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Tobacco use at Fort Riley: A study of the prevalence of tobacco use among active-duty
Soldiers assigned to Fort Riley, Kansas.

Samuel Ornelas, M.P.H., Paul D. Benne, M.D., M.P.H. & Richard R. Rosenkranz, Ph.D.

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Introduction

Tobacco use is the leading cause of disease death in the United States (US) with an estimated 443,000 deaths each year.¹ Smoked tobacco has been associated with an increased risk of stroke, heart disease, chronic obstructive pulmonary disease, and several other forms of cancer.² Smokeless tobacco has also been associated with an increased risk of oral cancer,³ pancreatic cancer,⁴ and cardiovascular disease.⁵ Cessation could prevent much of the morbidity and mortality associated with tobacco use. Smokers who quit can expect to live as many as ten years longer than those who continue to smoke.⁶ Unfortunately only about 5% of those who attempt to quit are successful in quitting for at least a year.⁷

The US military environment has been perceived as one in which tobacco use has been accepted and often encouraged.⁸ The high prevalence of tobacco use among military personnel, either prior to entering or after accession, has been documented in several studies.^{9,10,11,12,13,14,15} The US Department of Defense has taken measures to reduce tobacco use,¹⁶ which resulted in a substantial decline in smoked tobacco use from 51.0% in 1980 to 32.2% in 2005.¹⁰ However, the US military experienced an increase in smoked tobacco use from 29.9% to 32.2% from 1998 to 2005, respectively.⁹ The military smoking prevalence of 32.2% is approximately one-third greater than the civilian population prevalence of 20.6%.¹⁷ In addition, smokeless tobacco use is substantially high among military personnel. Over 17% of military personnel reported using smokeless tobacco⁹ compared with 3.3% of their civilian counterparts.¹⁸

The high rate of tobacco use among military personnel is of growing concern given its substantial burden on military health care and combat readiness.^{19,20} It has been estimated that military smoking-related health care costs are \$500 million per year and an associated lost productivity cost of nearly \$346 million per year.¹⁹ Relative to non-smokers, military personnel

who smoke are more likely to miss duty days because of illness¹⁹, are less productive¹⁹, perform worse on physical fitness tests²¹, experience more training injuries¹⁹, and are more likely to be discharged within the first year of service.²⁰

Tobacco use is particularly high among US Army personnel. In the study by Bray and colleagues, Army personnel reported the highest rate of smoking (38%) compared to other branches of the US Military (Navy 32%, Marine Corps 36%, and Air Force 23%) and only second to the Marine Corps in terms of reported smokeless tobacco use (19% and 22%, respectively).⁹ Even after controlling for differences in sociodemographic factors, the Army reported significantly higher rates of any smoking, heavy smoking and nicotine dependence than the other military services.⁹

Cultural factors may hinder anti-tobacco and cessation efforts. Recent studies suggest that certain aspects of the military culture may inadvertently promote tobacco use.^{10,22} Authors of one these studies found several reasons cited for smoking associated to the military culture (i.e., a large number of places to buy cigarettes on an installation, peers who smoke, and the belief that smoking is part of the military).¹⁰ Several studies^{10,22,24} also document cultural factors leading to smoking relapse and new initiation during deployment.

Tobacco use studies among military personnel at individual military installations are needed because the success of tobacco use control efforts is dependent upon reliable surveillance data to develop appropriate intervention strategies that will meet the needs of the military organization and personnel.⁹ Therefore, the purpose of the current study was to examine the use of smoked and smokeless tobacco and to assess interest in tobacco cessation among active-duty personnel (soldiers) at the Army's post at Fort Riley, Kansas. To the best of our knowledge, this is the largest comprehensive assessment of tobacco use among Fort Riley active-duty personnel.

Methods

Participants

According to the United States Army Strength Report and Personnel Roster from the Mission Support Element, G1 personnel of the 1st Infantry Division, the average number of assigned active-duty personnel at Fort Riley during the study period, and thus had the opportunity to participate in the current study, was 12,780 (based on average monthly counts). Total number of participants for the present study was 6,181.

A large portion (44%) of study participants was in a pre-deployment or post deployment status during the course of the study. Members of 2nd Brigade returned from a combat deployment in Iraq and members of Fourth Brigade deployed to Iraq during the course of this study. All other major units (defined in this study as Brigade) were in a non-deployment status during the course of the study.

Design and Procedures

The study was conducted over nine months, from June 2009 to February 2010. This study was a collaborative effort between personnel at the Fort Riley Department of Public Health and the Fort Riley Soldier Readiness Process (SRP) center. Participants were presented with a questionnaire during their deployment SRP, post-deployment health assessment, or periodic health assessment (PHA). All military personnel including activated reserve component personnel are required to process through the SRP. Processing through the SRP takes approximately one to four hours. Upon arrival at the SRP center, military personnel were briefed on procedures and given their individual SRP packet (folder containing personal medical documents and other forms) in which the tobacco use assessment questionnaire was included. Personnel were instructed to complete the documents including the tobacco use assessment

questionnaire while waiting to process from one SRP station to the next. Soldiers in a pre-deployment status, in general, completed the survey two to three months prior to actually deploying. Soldiers in a post deployment status, in general, completed the survey three weeks after returning to home station. Tobacco use assessment questionnaires were returned to staff at the last SRP station. Questionnaires were collected at the SRP center and analyzed at the Fort Riley Department of Public Health.

Questionnaire

Data were obtained using a 24-item questionnaire assessing a variety of health-related items covering four general domains including demographics, pneumonia-related items (Pneumococcal vaccine screen), tuberculosis-related items (TB skin testing), and items specific to females (e.g., Are you pregnant?; HPV vaccine/Gardasil vaccine). The original intent of this survey was to quantify those using tobacco in order to project need of recently recommended pneumococcal vaccine for smokers. In terms of demographics, participants were asked to provide name, social security number, age, and unit (i.e., brigade). Participants reported being in a specific battalion or brigade. Specific battalions were categorized under their respective brigade (e.g., 1-28th Infantry Battalion under 4th Brigade). Participants classified as “No unit” did not specify unit affiliation and were therefore analyzed separately. Tobacco use questions consisted of the following: Do you use tobacco (yes or no), smoke or chew (choose one, both or none), and are you interested in quitting (yes, no or not applicable)?

Data Analysis

Data analysis was carried out using SPSS statistical software version 16.0 (SPSS Inc., Chicago, IL, USA). Univariate analysis identified factors associated with participants’ use of any type of tobacco, smoked tobacco use only, and smokeless tobacco use only. Respondent level

factors that were significantly associated with any tobacco use, smoked tobacco use, and smokeless tobacco use in the univariate analysis ($p < 0.05$) were included in the multinomial logistic regression model. Separate models were built for any tobacco, smoked tobacco, smokeless tobacco use and interest in tobacco cessation. Adjusted odds ratios (AOR) with 95% confidence intervals, indicating significance at the 0.05 level, are reported.

Results

Table 1 presents the descriptive characteristics of 6,181 active-duty personnel who participated in the study. The majority of participants were male (91.2%); the average age was 26.8 years (SD, 6.8 years) with a range of 17 to 58 years. Participants were divided into age quintiles (17-21, 22-24, 25-27, 28-32, and 33-58 yrs). Participants were stratified according to brigade. Members of 2nd Brigade represented the largest sample of participants ($n=1428$). The 2nd Brigade contained the smallest percentage of female participants and Partner Units contained the largest, 4.7% and 15.6%, respectively. Partner units are any units that are not directly associated with the brigade level elements (e.g., 1st, 2nd, 4th, and Combat Aviation Brigade (CAB)). This group was chosen as the referent due to being found to have the lowest the rate of tobacco use by subgroup (see Table 2 and Table 3). Participants not reporting being a member of a brigade or battalion (categorized as “No unit”) represented slightly over 3% of the study sample.

Table 2 presents means and adjusted odds ratios for smoked and/or smokeless tobacco use. The adjusted estimates for any tobacco use, smoked tobacco use and smokeless tobacco use are shown in Table 2. Forty-nine percent of all study participants reported using any form of tobacco, 39% reported using smoked tobacco, and 19% of participants reported using smokeless tobacco.

Female participants were significantly less likely to report any (AOR=0.3, CI = 0.3-0.4), smoked (AOR=0.5, CI = 0.4-0.6) and smokeless tobacco use (AOR=0.1, CI = 0.07-0.2). More than half of all male participants reported using any form of tobacco compared to one-quarter of female participants. The most pronounced difference was seen in reported smokeless tobacco use; 2% of female participants reported using smokeless tobacco compared to 20% of male participants.

Younger participants reported the highest tobacco use, 55% among 17-21 year-olds. Adjusting for sex, the odds of reporting any tobacco use for the youngest age groups, 17-21 and 22-24, were increased (AOR = 2.1, CI = 1.8-2.5 and AOR = 2.0, CI = 1.7-2.3 respectively), compared to the eldest age group (33-58). In comparison, the odds of reporting smoked tobacco use for the 17-21 age group was increased (AOR = 2.5, CI = 2.1-3.0) compared to the eldest age group (referent). The pattern remained consistent with the odds of reporting smokeless tobacco use for the youngest age group being significantly higher (AOR = 1.7, CI = 1.4-2.1), when compared to the eldest group.

Estimates for any, smoked and smokeless tobacco use were highest among members of 4th Brigade (63%, 48%, and 33%, respectively). Members of Partner Units reported the lowest smoked tobacco use (33%) and any tobacco use (39%). Smokeless tobacco use was found to be lowest among members of Aviation Brigade (12%). Members of 4th Brigade were significantly more likely to report any tobacco use (AOR= 1.7, CI = 1.4-2.1), smoked tobacco use (AOR= 1.4, CI = 1.2-1.7) and significantly more likely to report smokeless tobacco use (AOR= 1.8, CI = 1.4-2.3) compared to the Partner Units (referent). Members of 2nd Brigade were also significantly more likely to report any tobacco use (AOR = 1.2, CI = 1.04-1.5) and smoked tobacco use

(AOR= 1.2, CI = 1.03-1.5) but were not significantly different in reporting the use of smokeless tobacco as compared to Partner Units.

Table 3 presents sociodemographic factors associated with reported interest in tobacco cessation. Of the 3,032 participants who reported using any form of tobacco, over 36% reported an interest in tobacco cessation. There was no significant difference in the reported interest to quit tobacco between male and female participants (AOR=1.0, CI = 0.7-1.5). The youngest age group (age 17-21) was significantly less likely (AOR=0.6, CI = 0.5-0.8) to report an interest in tobacco cessation than the eldest age group (33-58). All other age groups were not significantly more likely to report interest in tobacco cessation compared to the eldest age group (22-24 yrs, AOR= 0.9, CI= 0.7-1.1; 25-27 yrs, AOR= 1.0, CI= 0.8-1.3; 28-32 yrs, AOR= 1.2, CI= 0.9-1.6). A comparison between brigades with respect to interest in tobacco cessation indicates that members of all other brigades were significantly more likely to report interest in quitting tobacco use than Partner Units (1st Brigade, AOR= 1.9, CI= 1.4-2.5; 2nd Brigade, AOR= 2.1, CI= 1.6-2.8; Aviation Brigade, AOR= 1.4, CI= 1.02-1.9; and 4th Brigade, AOR= 1.6, CI = 1.2- 2.2). Operationally engaged Brigades (1st, 2nd, and 4th Brigades) reported a greater desire to quit tobacco use than Partner Units, with members of 2nd Brigade being most likely (AOR=2.1, CI= 1.6-2.8) to report a desire to quit than Partner Units.

Discussion

The present study is the largest comprehensive assessment of tobacco use among active-duty personnel at the US Army Post at Fort Riley. Data were collected on tobacco use patterns of 6,181 active-duty personnel in the setting of a Soldier Readiness Process center. The SRP center was an opportune location because of the requirement for the target population to process prior to and after a deployment, and during periodic examinations (PHA's) of which a representative

sample of our target population was to complete. The study time frame provided the opportunity to survey active-duty personnel prior to a combat deployment to Iraq (4th Brigade) and active-duty personnel returning from a combat deployment to Iraq (2nd Brigade).

In the present study, results indicate that tobacco use was common among active-duty personnel serving at Fort Riley. Approximately one in two participants reported using any form of tobacco product (smoked or smokeless). Overall, the prevalence of smoked and smokeless tobacco use tended to be higher than those found among civilian (ST use of 20.6%¹⁷; SLT use of 3.3%¹⁸) and other military populations (ST use of 32.2%; SLT use of 14.5%).⁹ However, the current findings are similar to Bray and colleagues' findings of 38% smoking prevalence and 19% smokeless tobacco prevalence among US Army personnel.⁹ A striking deviation from the expected was seen in two units closest to deployment with an increased prevalence of any tobacco use of 50 and 63%. Wilson found a similar prevalence (Any tobacco 64%, ST 52%, and SLT 36%) among a battalion of Marines deployed to al Anbar Province in Iraq.¹⁵ These findings suggest that the increase in tobacco use may occur prior to and persist throughout a deployment.

Consistent with other studies,^{9,11,17,18,25} male tobacco use was greater than female tobacco use. The current findings on the female-reported tobacco use may not be completely representative, given a relatively small sample size. However, Fort Riley is an Infantry Forces Command Post; females have traditionally been excluded from serving in the combat arms military occupational specialties, most notably in the infantry. Females are more likely to be serving in support elements (i.e., Partner Units). Therefore, the small percentage of female participants in the current study likely accurately represents the general active-duty population at Fort Riley. Results of this study were adjusted for sex.

After adjusting for sociodemographic factors, members of 4th and 2nd Brigades reported greater tobacco use than the other brigades. The data collected in the present study did not allow for the explanation of why members of these units reported higher rates of tobacco use. However, it is important to note that these groups were in closest proximity to a combat deployment, either pre-deployment or re-deployment. Some studies have shown that there is an increased use of tobacco products during a deployment particularly in areas where alcohol is prohibited, such as Iraq.^{14,15} Deployed personnel may experience high levels of stress, particularly those in combat situations. Combat related stressors, which may include the need for constant vigilance against enemy attack and difficulty in distinguishing insurgents from civilians.²⁶ In response to the negative impact of stress, some soldiers cite using tobacco as a management tool²³ with the assumption that tobacco reduces their perceived level of stress. It may also be that stress prior to a deployment, which includes separation from family and friends, loss of income and fear of deployment to a war zone²⁶, increases tobacco use and may explain the increased use among members of 4th Brigade. Other units in this study, who were in a more stable (not deploying) status, may not be experiencing the stressors associated with deployment.

Another interesting finding is that approximately one-third or more of tobacco users in each brigade reported an interest in tobacco cessation. This is an interesting finding, considering that among civilian smokers, an estimated 45% try to quit each year¹⁷, suggesting a certain level of resistance among military personnel to tobacco cessation. Peterson and colleagues highlight several barriers to participation in tobacco cessation programs among military personnel (duty requirements, time when programs are offered, and the requirement to attend multiple appointments in many programs).¹³ This may explain the phenomenon of high percentage use and low percentage interest in quitting. Moreover, the highest reported interest to quit came from

the operationally engaged brigades, particularly 2nd Brigade, who was recently re-deploying from a combat tour in Iraq.

The youngest age group (17-21) reported the least desire to quit (28%), yet had the highest reported tobacco use. This age group is typical for new or recent enlistees into the military. Bray and colleagues found that 39% of young adults age 18-25 who were current smokers initiated smoking after joining the military.⁹ Theoretically, this may represent a stage of life where social and role model influences lead to initiation or re-initiation of tobacco use.

The results of the present study should be interpreted with consideration of the following limitations. The data were obtained via self-report, which allows the potential for the underreporting of tobacco use; no biological verification was sought. However, Velicer and colleagues have shown self-report measures to be generally valid for assessing smoking status in most epidemiological studies.²⁷ The same social desirability bias may have led to over reporting of intention/desire to quit. In addition, the original intent of the survey used in this study was to quantify those using tobacco to project need of recently recommended pneumococcal vaccine for smokers and the survey was designed to define prevalence and was less adept at accounting for temporal (particularly long term) relationships. Also, several demographic characteristics such as rank, marital status, education level, and race or ethnicity were not assessed in the current study. Other studies have found that tobacco use differs by these demographic characteristics.^{9,10,11,12,17,18,25} Additionally, there is a potential for those participants who did not specify unit affiliation to be fundamentally different from those who responded with a unit affiliation. Furthermore, it is uncertain whether the data from this study will generalize to active-duty personnel assigned to other military installations. Another limitation was that the sample although large, was limited by the small female sample size. Although females constitute a

smaller percentage of the Army population, patterns of tobacco use generally differ by sex and should be further explored in future studies. Additionally, the wide response rate range (31.4% to 98.4%) among units may convey a potential sampling bias, however, sample size calculations were conducted confirming that a sufficient sample was represented from each unit. Lastly, the tobacco use measure used in this study was limited in that it assessed tobacco use as current users in a binary fashion (yes or no), limiting our assessment of tobacco use. Generally the criterion used to assess smoking in adults is someone who smoked at least 100 cigarettes in his or her lifetime and has smoked at least once in the past thirty days and the criterion for smokeless tobacco users to have used at least twenty times.⁹

Counterbalancing the limitations, the current study had several strengths. First, the sample was very large and represented active duty personnel serving on a large Army installation. Second, the questionnaire completion rate was quite high. Lastly, the study allowed for the capitalization on the opportunity to ask cohort members about tobacco use shortly after and before a combat deployment.

Military installations offer a potential site for interventions that discourage the use of tobacco. Current efforts are needed to broaden intervention beyond smoked tobacco to address smokeless tobacco. Data from this study can help military installations target personnel at greatest risk of using specific types of tobacco products. These efforts could include policy changes that discourage tobacco use, reinforcing the message that tobacco use is not the norm. One key component is to utilize the leadership influence by targeting commanders, particularly of units near deployment. Policies protecting non-smokers from passive smoke exposure are needed. It is also important to limit the visibility and accessibility of tobacco products in order to

discourage initiation, potentially helping those who are attempting to quit or keeping occasional tobacco users from becoming habitual tobacco users.

In summary, the results of the present study suggest that active-duty personnel serving at Fort Riley Army Post represent a high-risk population for tobacco use; approximately one in two participants indicated using any form of tobacco. This prevalence is much higher than initially expected. There is a high prevalence of tobacco use with a low interest in cessation; approximately one in three tobacco users reported an interest in quitting. The results provide important information for local health care providers that can be used to tailor current prevention and cessation programs. The findings also indicate a potential deploying and re-deploying effect, although further research is needed to elucidate this effect. Additional research is also needed to examine the difference of tobacco use found between units, to include tobacco use through an entire deployment cycle.

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Table 1. Descriptive characteristics of participants of a tobacco use study among active-duty personnel at Fort Riley Army post.

Factor	Value	SD^a		
Age (yrs)				
Mean	26.8	6.8		
Range	17-58			
	n	(%)		
Sex				
Male	5,635	91.2		
Female	546	8.8		
Age Group				
17-21	1,397	22.6		
22-24	1,523	24.7		
25-27	1,048	17.0		
28-32	976	15.8		
33-58	1,236	20.0		
	n	N (%)	% Male	% Female
Unit/Brigade				
1 st Brigade	1,406	3446(40.8)	91.6	8.4
2 nd Brigade ^R	1,428	4009(35.6)	95.3	4.7
Avn Brigade	881	2810(31.4)	86.8	13.2
4 th Brigade ^P	1,265	3653(34.6)	94.3	5.2
No Unit	208	NA(3.4)	88.9	11.1
Partner Units	993	1009(98.4)	84.4	15.6
Total Participants	6,181	14,927		

N= Maximum monthly unit strength during study period

^a Standard Deviation

^P Pre-deployment status

^R Post-deployment status

Table 2. Tobacco use at Fort Riley, Kansas (N = 6,181).

Factor	<u>Any Tobacco Use</u>		<u>Smoked Tobacco Use</u>		<u>Smokeless Tobacco Use</u>	
	Prevalence (%)	AOR ^a (95% CI ^b)	Prevalence (%)	AOR ^a (95% CI ^b)	Prevalence (%)	AOR ^a (95% CI ^b)
Sex						
Female	25	0.3 (0.3-0.4) ^c	25	0.5 (0.4-0.6) ^c	2	0.1 (.07-0.2) ^c
Male	51	Referent	41	Referent	20	Referent
Age						
17-21	55	2.1 (1.8-2.5) ^c	47	2.5 (2.1-3.0) ^c	22	1.7 (1.4-2.1) ^c
22-24	54	2.0 (1.7-2.3) ^c	43	2.2 (1.8-2.5) ^c	21	1.6 (1.3-2.0) ^c
25-27	52	1.8 (1.5-2.1) ^c	43	2.1 (1.7-2.5) ^c	19	1.4 (1.1-1.8) ^c
28-32	46	1.5 (1.3-1.8) ^c	35	1.6 (1.3-1.9) ^c	17	1.3 (1.1-1.7) ^c
33-58	36	Referent	26	Referent	13	Referent
Unit/Brigade						
1 st Brigade	46	1.1 (1.0-1.3)	37	1.1 (0.9-1.3)	16	1.0 (0.8-1.3)
2 nd Brigade ^R	50	1.2 (1.04-1.5) ^c	41	1.2 (1.03-1.5) ^c	17	1.0 (0.8-1.3)
Avn Brigade	44	1.2 (1.0-1.4)	37	1.2 (1.0-1.4)	12	0.9 (0.7-1.2)
4 th Brigade ^P	63	1.7 (1.4-2.1) ^c	48	1.4 (1.2-1.7) ^c	33	1.8 (1.4-2.3) ^c
No Unit	45	1.2 (0.9-1.7)	35	1.1 (0.8-1.3)	17	1.4 (0.9-2.0)
Partner-Units	39	Referent	33	Referent	13	Referent
Total Participants	49		39		19	

Mean prevalence of users of both ST and SLT was 9% (SD 0.284)

^a Odds ratios were adjusted for sex, age group, and unit/brigade.

^b 95% CI = 95% confidence interval of the adjusted odds ratio (AOR).

^c Estimate is significantly different from the reference group at the 95% confidence interval.

^P Pre-deployment status

^R Post-deployment status

Table 3. Interest in tobacco cessation among total tobacco users (N=3,032).

Factor	AOR^a (95% CI^b)	AT^d (%)	ST^e (%)	SLT^f (%)
Sex				
Male	1.0 (0.7-1.5)	36	40	28
Female	Referent	36	37	31
Age				
17-21	0.6 (0.5-0.8) ^c	28	30	27
22-24	0.9 (0.7-1.1)	36	40	23
25-27	1.0 (0.8-1.3)	39	43	33
28-32	1.2 (0.9-1.6)	44	48	37
33-58	Referent	39	45	28
Unit/Brigade				
1 st Brigade	1.9 (1.4-2.5) ^c	40	43	35
2 nd Brigade ^R	2.1 (1.6-2.8) ^c	43	46	36
Avn Brigade	1.4 (1.02-1.9) ^c	34	37	21
4 th Brigade ^P	1.6 (1.2-2.2) ^c	33	37	25
No Unit	1.7 (1.1-2.7) ^c	39	42	17
Partner Units	Referent	27	30	31
Total tobacco users		36	40	28

^a Odds ratios were adjusted for sex, age group, and unit/brigade.

^b 95% CI = 95% confidence interval of the adjusted odds ratio (AOR).

^c Estimate is significantly different from the reference group at the 95% confidence interval

^d Any tobacco use

^e Smoked tobacco use

^f Smokeless tobacco use

^P Pre-deployment status

^R Post-deployment status