



# **NAVAL POSTGRADUATE SCHOOL**

**MONTEREY, CALIFORNIA**

## **THESIS**

**THE IMPACT OF LOCAL SMOKING CULTURE ON  
THE SMOKING BEHAVIOR OF U.S. SOLDIERS**

by

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March 2018

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**THE IMPACT OF LOCAL SMOKING CULTURE ON THE SMOKING  
BEHAVIOR OF U.S. SOLDIERS**

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Submitted in partial fulfillment of the  
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## **ABSTRACT**

Military members seemingly have a greater propensity for smoking than civilians. This observation has motivated many researchers to explore the military's historic relationship with tobacco and to examine the ways in which military culture promotes tobacco usage. The U.S. Army offers a unique opportunity to conduct natural experiments that measure cultural effects on smoking behavior because its soldiers are randomly assigned to their duty locations. My research exploits the variation in smoking behavior throughout the United States by using state level smoking prevalence rates as a proxy measure for local smoking culture. I employ fixed effects models to compare the self-reported smoking behavior of individual U.S. Army soldiers to the smoking culture of their assigned state to address two primary questions: 1) Is there significant evidence that a soldier's smoking behavior changes when he or she moves to a state with a different smoking culture? And 2) Is the same state level variation in smoking prevalence observed in the general population also observed in the Army population? My research provides initial evidence that local smoking culture influences soldiers' decisions about smoking, and I recommend ways the U.S. Department of Defense can leverage cultural effects to reduce smoking prevalence in the military.

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## **LIST OF ACRONYMS AND ABBREVIATIONS**

BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
DoD	Department of Defense
MOS	military occupational specialty
PDE	Person-Event Data Environment
PHA	Periodic Health Assessment

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## I. INTRODUCTION

Historically, tobacco usage has been considered an inherent element of the military culture. What is more, the tobacco industry has aggressively targeted the military population making them a well established and reliable customer base. Since 1975, the U.S. Department of Defense has taken substantial measures to change the smoking culture and reduce the number of smokers in the military to improve personnel readiness, reduce healthcare costs, and increase work productivity. These measures include banning smoking during recruit training, restricting tobacco usage to designated areas, and providing counseling and medications to aid smoking cessation. Most recently, the Department of Defense amended its Armed Services Exchange Policy, mandating that military commissaries and exchanges raise the prices on tobacco products to match the price levels charged by local civilian retailers.

Despite these efforts, the Centers for Disease Control and Prevention (CDC) report that smoking is much more prevalent among services members and veterans than in it is in the civilian population. Those service members previously deployed to combat environments display even higher smoking prevalence rates (Centers for Disease Control and Prevention, 2018). With each passing year, the Department of Defense's interest in a smoke-free military grows as smoking has been directly linked to poor health and increases in absenteeism among service members and veterans.

The U.S. Army offers a unique opportunity to conduct natural experiments that measure cultural effects on smoking behavior because it assigns (and usually reassigns) soldiers to their duty locations. My research exploits the variation in smoking behavior throughout the United States and uses state level smoking prevalence rates, obtained from the CDC and military health assessment surveys, as a proxy measure for local smoking culture. I compare the self-reported smoking behavior of individual U.S. Army soldiers to the smoking culture of their assigned state to address two primary questions: 1) Is there significant evidence that a soldier's smoking behavior (smoking status and smoking intensity) changes when the local smoking culture changes? And 2) Is the same state level variation in smoking prevalence observed in the general population also observed in

the Army population? Additionally, I evaluate how a soldier's smoking behavior changes in response to specific stress events over time.

Critics have implied that the military's efforts to curb tobacco use among its personnel are only half-hearted and do not go beyond reducing exposure to second-hand smoke. Although the impact of smoking on military readiness is overwhelmingly negative, the Department of Defense has not issued a policy banning tobacco use (Secretary of Defense, 2016). Service members and civilians alike may rebel against such a policy, possibly leading to poor recruitment and retention. As the military's manpower and personnel offices aim to implement more effective smoking prevention and cessation policies, it is critical to understand the pathways to smoking and to analyze the degree to which the military environment affects those pathways. Furthermore, it is also important to identify factors that lead to success in smoking cessation. Notably, the military proves to be a unique social environment. Prior studies, by Liu, Zhao, Chen, Falk, and Albarracín, (2017) and by Piko, Luszczynska, Gibbons, and Tekozel (2005), have concluded that there are significant social and cultural implications for smoking initiation and smoking cessation. The Department of Defense constantly seeks avenues to influence the behavior of service members without negatively impacting troop morale and public perception of the organization. The armed forces may be able to find such an avenue to smoking prevention and cessation by leveraging social and cultural influences to shape the smoking behavior of individual service members.

Traditional smoking cessation efforts focused on long-term and moderate to high intensity smokers (those who smoke more than 10 cigarettes per day), but they often do not address the social context of smoking. However, Schane, Glantz, and Ling (2009) showed that the number of low-level consumption smokers is dramatically increasing, and they determined that social smoking is a stable consumption pattern. These non-daily "social smokers" smoke primarily in social settings. Schane, Glantz, and Ling also found that social smokers often do not view themselves as smokers so they are frequently misclassified as non-smokers. Furthermore, their study discovered that social smokers believe they are not susceptible to nicotine addiction or negative health consequences as a result of their smoking even though medical research contradicts these beliefs. Those

who engage in social smoking view the activity as having the benefit of easing stress and social tensions and facilitating relationships. Traditional smoking cessation efforts are not effective for social smokers because they do not aim to negate these perceived benefits (Schane, Glantz, & Ling, 2009).

A survey of active duty personnel, published by Barlas, Higgins, Pflieger, and Diecker (2013), revealed that many service members exhibit a kind of transient smoking behavior and primarily smoke while they are with their peers. For example, it is not uncommon for a service member to engage in smoking while at work but stop smoking while at home. Similarly, many service members only smoke while on detachment or deployment. In addition to the phenomenon of social smoking, researchers have determined that a positive attitude towards smoking and the numbers of friends and family members who smoke are positively correlated to the likelihood that an individual will begin smoking (Cengelli, O'Loughlin, Lauzon, & Cornuz, 2012). The same factors are negatively correlated with smoking cessation. These factors highlight the importance of the social context on an individual's choices about smoking.

Economists are increasingly interested in quantifying the phenomenon of social contagion and identifying the mechanisms by which it occurs. The *Oxford Dictionary of Psychology* (2014) defines social contagion as “the spread of ideas, attitudes, or behavior patterns in a group through imitation and conformity.” Peer effects and cultural effects are of interest to policy makers because not only have they been shown to be powerful on their own, but they can also act as social multipliers to behavioral policies. For example, if alcohol is an ordinary good, a higher tax on alcohol will directly discourage individuals from drinking. Peer effects multiply the impact of the alcohol tax because individuals will not only drink less because it is more costly to them, they will also drink less because their peers are now drinking less (Nakajima, 2007). Like peer effects, cultural influences can drive an individual's choices and leave them inclined to behave in a particular way. Liu, Zhao, Chen, Falk, and Albarracín (2017), compare culture to “mental software that affects our ways of perceiving the world and other people” (p. 1084). Therefore, culture will affect the way individuals respond to the behaviors of those around them.

My research expands upon existing knowledge about peer group behavior by exploring culture as a moderating factor of peer influence. From the soldier's perspective, the Army randomly assigns him to his state (smoking culture); he or she does not get to choose the state where he or she is stationed, thereby, mitigating potential biases due to self-selection of individuals into states with a particular smoking culture. Additionally, I employ fixed effects models, holding constant factors such as psychological attributes and exposure to stress events; therefore, the models will better isolate and estimate the true cultural effect by comparing an individual to himself or herself as the state smoking culture changes.

Despite the many empirical challenges presented by measuring peer effects, there is an abundance of prior research supporting the impact of peer effects on individual behaviors. My research supports the idea that changing cultural influences lead to changes in behavior at the individual level. Specifically, I find that a soldier is more likely to be a smoker as the mean state level smoking prevalence rate increases. Males and enlisted service members are more responsive than females and officers to changes in smoking culture, but my results show that those under 25 years of age are most responsive to changes in the military smoking prevalence rate. These findings can guide efforts to reshape the military's smoking cessation programs and tobacco control policies and reduce the prevalence of smoking within the military, especially among the social smokers.

## II. BACKGROUND AND RELATED WORK

### A. OVERVIEW

Widespread tobacco usage among U.S. military service members is an enduring problem for the Department of Defense. The number of smokers in the civilian population of the United States has decreased considerably, with the smoking prevalence rate declining by more than half since 1965 (Hoffman, 2011). Despite the trends among the general population, military personnel continue to smoke at significantly higher rates than their civilian counterparts. The 2011 Department of Defense Health Related Behaviors Survey of Active Duty Military Personnel reported that 25.2 percent of military members between the ages of 18 and 20 years old identified themselves as regular smokers while only 14.7 percent of the same age group in the civilian population smoked cigarettes. The survey findings were especially alarming for the U.S. Army and U.S. Marine Corps; more than 30 percent of young soldiers and Marines admitted that they were active smokers.

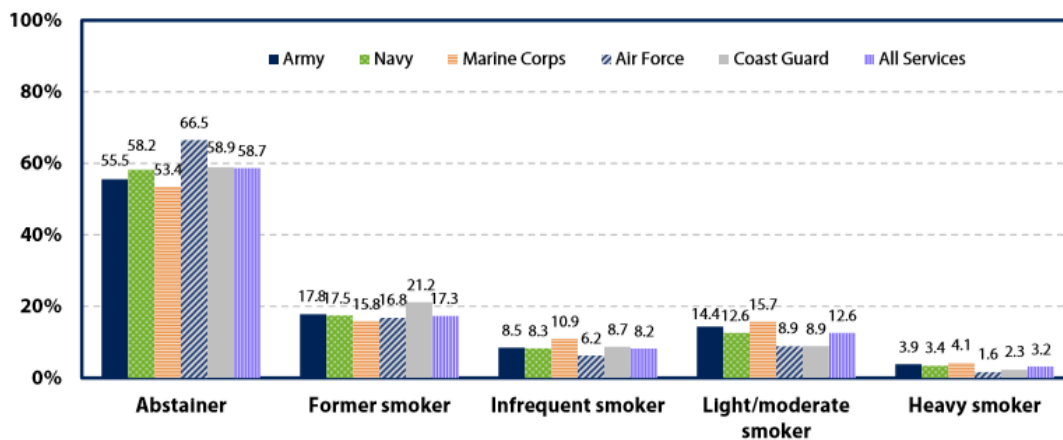


Figure 1. Cigarette Smoking Behavior by Service. Source: Barlas et al. (2013).

The CDC identify tobacco usage as the leading cause of preventable death and disease in the United States, stating that it kills almost a half a million Americans and that smoking-related illnesses cost Americans \$170 billion each year (Centers for Disease

Control and Prevention, 2017c). The Department of Defense has determined that smoking behavior has an equally adverse impact on its military forces. In April 2016, the Secretary of Defense published a memorandum citing tremendous healthcare costs, about \$1.6 billion annually, and the inarguably negative impacts on personnel health, readiness, and productivity resulting from tobacco use among service members. The memorandum also highlighted the military's longstanding problem with smoking initiation, stating that 38 percent of military smokers begin smoking following entry-level training at the time of their first assignments (Secretary of Defense, 2016). Military members seemingly display a higher propensity to engage in smoking when compared to civilians. This observation has motivated many researchers to explore the military's historic relationship with tobacco and to examine the ways in which military culture may promote tobacco usage.

Although the short-term consequences of smoking among military members receive more attention, a few researchers have been able to quantify the long-term impact of smoking on veterans. Bedard and Deschnes (2006) determined that veterans of World War II and the Korean War experienced higher rates of premature death partly because of "the military facilitating the adoption of risky behaviors/habits early in the life of young soldiers" (p. 177). Moreover, Bedard and Deschnes identify a causal relationship between military-induced smoking and higher mortality rates among veterans. They ultimately found that, among veterans born between 1920 and 1939, smoking caused 64 to 79 percent of heart disease and 35 to 58 percent of lung cancer resulting in premature death (2006, p. 178).

## **B. SMOKING CULTURE IN THE MILITARY: PAST AND PRESENT**

The link between soldiers and cigarettes has historic roots in pointed tactics employed by the tobacco industry; these efforts were only made more impactful by the support and power of the U.S. Congress. Cigarette consumption increased dramatically among soldiers during World War I when the military provided cigarettes to servicemen as a part of their compensation. Soldiers relied on cigarettes for pleasure, comfort and entertainment, so much so that the commander of the American Expeditionary Force,



General John Pershing, famously implied that tobacco and bullets were equally necessary to win the war (Nelson & Pederson, 2007).

With the rise of cigarette smoking throughout the armed forces, society began to attribute the qualities of the soldiers to the act of smoking itself: strong, masculine, and patriotic. Interestingly, a popular sentiment at the time was that cigarettes helped soldiers (and ultimately the war effort). Some argued that smoking reduced a soldiers' need to partake in other vices viewed as more consequential, namely alcohol and sex (Goodman, 2005). Numerous studies to date have countered this idea by showing a positive correlation between smoking and other risky behaviors (e.g., alcohol abuse and unprotected sex) (Nelson & Pederson, 2007). *Tobacco in History and Culture: An Encyclopedia* describes the smoking culture in the United States during the First World War:

The war elevated the image of cigarettes, turning them into icons of manliness and virtue. Congress ordered the War Department to include cigarettes in the rations issued to soldiers overseas and to make them available at low prices to soldiers at home and abroad. Americans from all walks of life supported private "Smokes for Soldiers" campaigns to augment these supplies. Many groups that had once been hostile to cigarettes—including the YMCA and the Salvation Army—helped provide them to servicemen. (Goodman, 2005, p. 50)

Internal documents from Phillip Morris and R.J. Reynolds tobacco companies reveal how the industry continued to capitalize on the nation's wars through targeted advertising and outreach to service members. Events during the Gulf War, in particular, provide telltale examples of how the tobacco industry circumvented the military's attempts to implement tobacco control regulations. Several organizations initiated campaigns in late 1990 to provide troops care packages that included food and toiletry items. Tobacco companies eagerly donated free cigarettes for inclusion in the care packages as well. At the time, the distribution of free cigarettes to service members was against Department of Defense policy. However, congressional members from North Carolina and other tobacco producing states made urgent appeals to the Secretary of Defense and the Armed Services Committee. Many pointed out the irony of discouraging smoking to protect a soldiers' long-term health while asking them to face the more

immediate and grave dangers of warfare. Despite the military's policy, the Defense Logistics Agency shipped over 50,000 free cartons of cigarettes at the taxpayers' expense. Tobacco companies also donated branded paraphernalia (e.g., playing cards, hats, etc.) and special edition magazines to troops overseas. Furthermore, these companies created an image of themselves as patriots and philanthropists in the eyes of smokers and non-smokers alike by providing cards with voice messages to troops and their families and by hosting events to welcome returning soldiers home. The idea of denying men and women who risk their lives for their nation the comfort of cigarettes was met with contempt and smoking was regarded as normative behavior within the Department of Defense (Smith & Malone, 2009). Over time, service members came to view cigarette smoking as a valid reason to take frequent breaks during the workday, and leadership would often use smoke breaks as a reward for good performance, fueling the desire for soldiers and sailors to continue smoking (Conway, 1998).

In 2009, Nelson, Pederson, and Lewis analyzed tobacco use among U.S. Army personnel. They found that soldiers "believed the Army played a role in handing down tobacco-use traditions, and it created an environment that was tobacco friendly. If soldiers wanted to quit tobacco, many did not believe the Army environment was conducive to abstinence [from smoking]" (Nelson, Pederson, & Lewis, 2009, p. 164). More recently, the 2011 Department of Defense Health-Related Behaviors Survey of Active Duty Military Personnel analyzed the military's culture of substance use with respect to alcohol, cigarettes, smokeless tobacco, Marijuana and prescription drug misuse. The survey used two measures to determine the culture of substance use, depicted in Figure 2. The first measure, referred to as social network facilitation, reflects the percentage of personnel who reported that their peers used the respective substance in their presence. The second measure, leadership deterrence, stems from the percentage of participants who believed senior personnel at their duty stations discouraged use of the respective substance (Barlas, Higgins, Pflieger, & Diecker, 2013, p. 179). The indicators of smoking culture varied with the respondent's smoking intensity level. In other words, heavy smokers reported the highest levels of social network facilitation and the lowest levels of leadership deterrence for cigarette use. Conversely, participants with no history

of cigarette smoking reported strong leadership deterrence and the lowest levels of social network facilitation for all substances except prescription drugs (Barlas, Higgins, Pflieger, & Diecker, p. 181). On the whole, the survey results signaled that military culture is very conducive to the use of tobacco products and alcohol, but prescription drug misuse and marijuana use are not well tolerated.

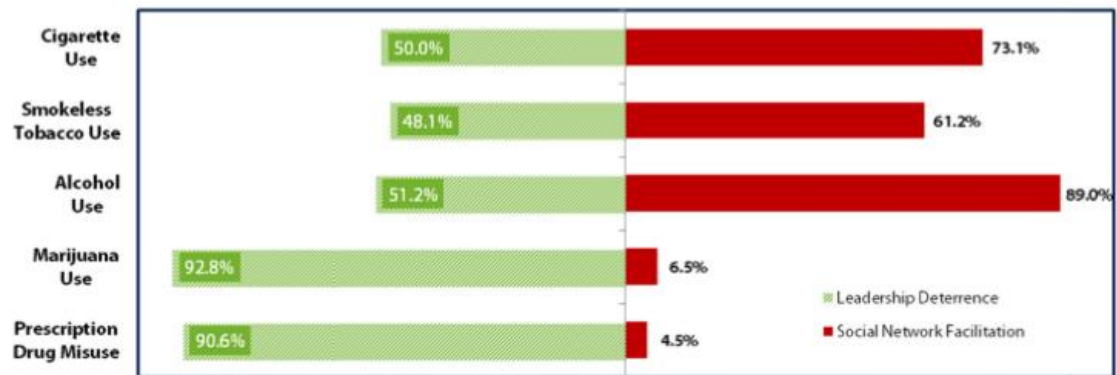


Figure 2. Department of Defense Culture of Substance Use.  
Source: Barlas et al. (2013).

## C. PREDICTORS OF SMOKING BEHAVIOR

Peer group behavior, individual personality traits, and cultural influences are among the most frequently cited predictors of an individual's smoking decisions. Many studies have identified genetic predispositions and mental health disorders as principal pathways to smoking. However, my research focuses on the social and cultural pathways to smoking and does not examine biological factors or mental health disorders beyond addiction and acute stress.

### 1. Peer Effects

Doctors and economists have been extensively exploring the medical, biological, psychological and social aspects of cigarette smoking for decades. With respect to smoking initiation, one finding continually emerges and creates consensus among researchers: the individual's decision to start smoking is highly correlated with the smoking behavior of his or her peers. A recent study by Liu, Zhao, Chen, Falk, and

Albarracín (2017), determined that, “having peers who smoke is associated with about twice the odds of adolescents beginning and continuing to smoke,” and the degree of interpersonal closeness with one’s peers (i.e., close friends vs. peers) was found to be significantly and positively correlated with the size of the peer effect (p. 1082). The influence of peers’ behavior may be more pronounced in military environments. In 1998, Haddock and colleagues studied a population of U.S. Air Force recruits and concluded that “as the percentage of friends who smoked increased, basic trainees [who never smoked] were nearly 2.7 times more likely to smoke one year after basic military training” (as cited by Nelson & Pederson, 2007, p. 785).

Manski (1993) identifies three possible explanations for why individuals in a group may choose the same behaviors. First, there may be an endogenous effect (peer effect). In the case of smoking behavior in the U.S. Army, the endogenous effect occurs when the individual soldier’s smoking behavior tends to vary with average smoking behavior of his or her unit/peer group, all else equal. Exogenous effects, or the tendency the individual’s behavior to vary with exogenous characteristics of the group, may also result in similar behaviors among individuals in a group. For example, an individual soldier’s choices about smoking may vary with the average education level of his or her unit. Lastly, Manski argues that correlated effects are relevant when individuals in a group make similar decisions as a result of being part of the same institution or because they have similar experiences or characteristics. For example, there are correlated effects if soldiers in a particular unit do not to smoke because the occupational specialty of that unit necessitates high levels of fitness (Manski, 1993).

It is extremely difficult to isolate endogenous effects; omitted variables often bias estimations of peer effects. Furthermore, Manski highlights the empirical challenges of distinguishing the effects of the individual on the group from the effects of the group on the individual (Manski, 1993). Accurate estimates of peer effects critically depend on the appropriate selection of the peer group. Studies will often define a peer group based on individual’s classroom, school, neighborhood or work section. However, collective lifestyle patterns, observed at the county, state, or country level, offer an understanding of the broader cultural implications and social contexts of smoking. Cultural influences that

capture both exogenous and correlated effects (as defined by Manski) deeply affect everyone. Therefore, cultural influences do impact individual behavior. A deeper understanding of local cultural influence on smoking behavior may help the Department of Defense to achieve its goal of reducing tobacco use within the military.

## **2. Cultural Influence**

The use of cultural influence as a predictor of individual behavior allows researchers to account for many of the factors that moderate the impact of peer effects. Liu, Zhao, Chen, Falk, and Albarracín, (2017) analyzed various peer effect studies conducted across 16 countries in Europe, Asia, Africa, and North America. One of the study's primary goals was to examine how peer effects on smoking initiation and continuation vary across cultures. The authors opted to use Hofstede National Culture Dimension Index scores for collectivism<sup>1</sup> as proxies for national culture, and they hypothesized that peer effects would be greater, on average, in countries with high collectivism scores, offering the supportive rationale that follows:

The magnitude of social influence should be greater in societies that value interdependent relationships and place group goals ahead of personal goals. In this regard, the collectivism-individualism orientation is a highly relevant culture dimension. Individualistic groups view the self as a unique entity and value independence, whereas collectivistic groups view the self as embedded within a group and give precedence to harmony within groups. Findings from cross-cultural studies of social conformity indicate that individualistic societies prioritize personal decisions independent of normative factors, whereas collectivist societies tend to reward conformity more. (p. 1084)

The study also examined the moderating role of inter-personal closeness, which is a measure that likely has cultural implications as well. Meta-analysis determined that both interpersonal closeness and collectivism positively moderated peer influences with high statistical significance (Liu, Zhao, Chen, Falk, & Albarracín, 2017).

The findings of a more limited study of adolescents in four countries, Hungary, Poland, Turkey, and the United States, found that “perceived peer’s smoking was the

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<sup>1</sup> Hofstede collectivism scores measure the degree to which individuals in a given country prefer a tightly knit social framework and feel they are inextricable from the group.

most important predictor of adolescent smoking” within each of the four countries (Piko, Luszczynska, Gibbons, & Tekozel, 2005, p. 397). Notably, the magnitude of the peer influence varied substantially across the four countries, further suggesting that cultural level dynamics play a role in peer group influence.

I argue that such evidence has strong implications for the military population because the military environment embraces the philosophical ideal that the unit, the service, and the nation are more important than the individual; by design, the individual needs to value the lives of others over his or her own life. Moreover, military service fosters interpersonal personal closeness through indoctrination and shared hardships.

### **3. U.S. States: Local Smoking Cultures**

Data obtained from the CDC through the Behavioral Risk Factor Surveillance System (BRFSS) survey shows smoking prevalence varies greatly across the United States, ranging from nine percent in Utah to nearly 26 percent in Kentucky. In general, smoking prevalence tends to be lower in the West and Northeast and higher in the Midwest and the South. There are two very notable factors that contribute to the geographical differences in cigarette consumption rates: (i) the strength of the tobacco control measures implemented within each state, and (ii) the role of tobacco production in each state’s economy. Qualitative analysis implies a negative relationship between these two factors, and taken together, these factors are a reflection of the state’s smoking culture (Jemal et al., 2011).

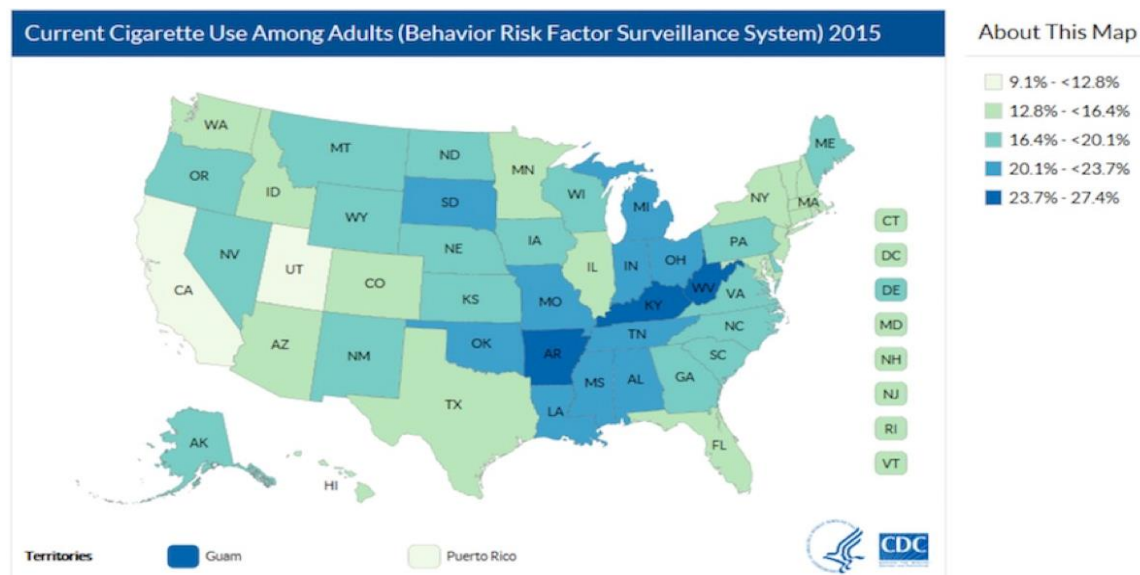


Figure 3. Smoking Prevalence Map in the United States.  
Source: Centers for Disease Control and Prevention (2017a).

Jemal et al., (2011) analyzed changes in state level smoking prevalence rates between 1992 and 2007. Their study made use of two indices that characterize tobacco control measures: the Initial Outcome Index (a measure of a state’s laws and policies regarding tobacco control) and the Strength of Tobacco Control Index (a measure of resources and efforts devoted to reducing tobacco use). The authors compared these measures with the relative percent changes in the number of smokers in each state. The study found that in states with stringent tobacco control policies, larger decreases in the number of smokers per capita occurred. Additionally, the authors observed, “it is interesting that the observed relative percentage reduction in smoking prevalence was more closely correlated with tobacco control measures, particularly the IOI, than with the initial smoking prevalence in the state” (Jemal et al., 2011, p. 8). This finding implies that the Department of Defense can augment its tobacco prevention and cessation policies and overcome its current culture, which normalizes tobacco use, by implementing stronger tobacco control measures.

It is logical to conclude that states that earn relatively large revenues from tobacco farming would not have the incentive to develop and implement strong tobacco control

policies. In fact, tobacco producers are known to petition Congress when laws discouraging or preventing tobacco use are proposed. North Carolina is the country's largest producer of tobacco and nearly one out five of its residents currently smoke (Wilson, 2014). Kentucky, the state with the nation's highest percentage of smokers, is home to about one-half of the tobacco farms in the United States.

**Tobacco Production By State**

Rank	State	in 1,000 pounds
1	North Carolina	453,860
2	Kentucky	214,280
3	Georgia	214,280
4	Virginia	57,651
5	Tennessee	52,155
6	South Carolina	33,180
7	Pennsylvania	22,250
8	Ohio	4,300

Figure 4. States Producing the Most Tobacco. Source: World Atlas (2017).

#### **4. Personality Traits and Beliefs**

Individual's intentions, beliefs and attitudes with respect to smoking are consistently identified as significant predictors of smoking status in adolescents and young adults. For example, individuals are more likely to smoke if they believe they will not suffer any resulting health consequences or if they are not well educated about the health consequences of smoking. Individual psychosocial characteristics have also been shown to be valid predictors of smoking initiation. General assertiveness and an ability to resist peer pressure, often referred to as resistivity or drug refusal skills, are negatively correlated with smoking initiation (Epstein, Williams, Botvin, Diaz, & Ifill-Williams, 1999). In addition to the personal attributes already mentioned, high levels of academic achievement and life satisfaction, and a future-oriented mindset were found to have to be



negatively related with smoking behavior in multiple countries (Piko, Luszczynska, Gibbons, & Tekozel, 2005).

Not surprisingly, many of the factors determined to be predictors of smoking initiation and continuation are also good predictors of successful smoking cessation. A longitudinal study of smoking cessation in young adults pinpointed the most robust predictors of success in smoking cessation. These factors included: not having friends who are smokers; not intending to smoke in the future; having unfavorable beliefs about smoking; and being older at the time of first cigarette use (Cengelli, O'Loughlin, Lauzon, & Cornuz, 2012).

## **5. Smoking and Stress in the Military**

Some researchers argue that the unique stressors experienced by military personnel leave them more predisposed to smoking, and the standard approaches to tobacco cessation and prevention may not be suitable for service members because they do not address the stresses encountered during deployment and combat (Nelson & Pederson, 2007). Huntzinger (2002) noted that, “interventions designed for the general population may not be effective with the military population, because many military member’s job demands may be life threatening, and using tobacco is one readily available way to deal with environmentally-induced stress” (as cited by Nelson & Pederson, 2007, p. 788). Indeed, military service members overwhelmingly report that they smoke to alleviate stress and to relax or calm down. Although military members identify stress reduction as their primary reason for smoking, more than half of the same individuals also report smoking to alleviate their boredom or to help them remain awake (Barlas, Higgins, Pflieger, & Diecker, 2013).

Several studies of military personnel suggest that there is a positive correlation between combat stress and smoking intensity (Fu et al., 2007), but the findings in studies relating stress and smoking in the civilian population are more varied. One study examined the relationship between both objective and subjective measures of stress and changes in cigarette consumption over the course of one year in a group of 18 to 25 year olds. The study did not find evidence of correlation between either the experience of

acute stress or self-reported daily stressors and the number of cigarettes the participants smoked at the start of the experiment, nor did it find a relationship between changes in stress levels and changes observed in the participant's cigarette consumption one year later (Conrad, Wardle, King, & DeWit, 2013). Smokers generally report higher levels of stress than non-smokers, and doctors have debated whether or not the physical act of smoking can actually reduce stress levels. Wetter and colleagues found that an individual's belief that smoking relieves stress is a better predictor of increases in cigarette consumption than the actual experience of a stress event (as cited by Conrad, Wardle, King, & DeWit, 2013).

### **III. DATA AND METHODOLOGY**

#### **A. DATA OVERVIEW**

I conducted this research using panel data at the individual level that accessed via the Department of the Army's Person-Event Database (PDE). More specifically, I analyzed the Periodic Health Assessment (PHA) survey responses provided by soldiers between the years of 2010 and 2014. The U.S. military requires service members to complete Periodic Health Assessments annually. The questionnaire evaluates and identifies mental, physical, and behavioral health concerns, including the frequency and intensity of cigarette use and addiction level. I define soldiers who smoke more than 10 cigarettes per day to be moderate to heavy smokers. I merged individual survey responses with demographic data from the Defense Manpower Data Center using unique identifiers. This dataset contains approximately 607,000 person-month observations, representing 422,834 unique soldiers, since one individual may provide multiple observations of the course of the time period. Unfortunately, PDE does not contain data on the other branches of military service.

Additionally, I obtained smoking prevalence data published by the Centers for Disease Control for each of the 50 states, Washington, DC, Puerto Rico, and Guam. The smoking prevalence data originates from the 2016 Behavioral Risk Factors Surveillance System, a telephone survey conducted from 2010 to 2016. I calculated the average state level smoking prevalence from 2010 to 2014 to indicate the percentage of the general population who are current smokers; current smokers are defined as having smoked 100 or more cigarettes in their lifetime and also having smoked within the previous 30 days (Centers for Disease Control and Prevention, 2017b).

#### **B. VARIABLE DESCRIPTIONS**

In this section, I provide detailed descriptions of the variables used in my analysis. I generated binary variables to describe smoking behavior, smoking prevalence, gender, age, rank group, and occupational specialty. Additionally, I created variables to indicate whether a soldier had been recently exposed to stress events. I subsequently

included these variables in fixed effects regressions to determine smoking outcomes at the individual level.

I focus on two outcome variables to examine both smoking status and smoking intensity. Smoker is a binary variable equal to one when the respondent indicates he or she has smoked cigarettes on at least one day during the previous 30 days. I define smoking intensity based on the number of cigarettes consumed each day. Among the soldiers who identified themselves as smokers, the majority of them are light smokers. Light smokers consume 10 or fewer cigarettes per day. Moderate smokers consume 11 to 20 cigarettes each day, while heavy smokers report smoking more than 20 cigarettes per day. Nine percent of sample participants are moderate to heavy smokers.

To examine how a soldier's smoking behavior changes when he or she moves to a state with different smoking culture than his previous stationed state, I employ two measures of smoking prevalence as my key independent variables. First, I use mean state level smoking prevalence rates among all adults, collected by the Centers for Disease Control between the years of 2010 and 2014, as a measure of each state's smoking culture. I generate a second variable, a state level military smoking prevalence rate calculated from Periodic Health Assessment survey responses in this sample, to approximate a soldier's local smoking culture.

Furthermore, I examine differences in smoking outcomes based on gender, rank, and age. Variables for male and female indicate the survey respondent's gender. Likewise, rank variables indicate whether the respondent is an enlisted or an officer. I categorize respondents into two groups based on their age at the time of the survey: younger than 25 years of age and 25 years of age and older. 18 to 24 years of age is a critical age range for two reasons. First, this age group represents the majority of the Army population and the majority of new recruits. Secondly, most smokers will begin smoking by the age of 18, and younger people tend to be more responsive to the social influences they experience (Liu, Zhao, Chen, Falk, & Alabarracin, 2017). The sample population is 84 percent male with the average age being 29.8 years old. Junior enlisted and senior enlisted soldiers provided more than 80 percent of survey responses.

Soldiers with combat occupational specialties, trained to engage in tactical land combat, are shown to experience the stressors and mental health disorders linked with smoking at higher rates than those who do not participate in tactical combat (Fu et al., 2007). I use a binary indicator equal to one for those personnel designated as combat soldiers in order to examine these unique occupational specialties and deepen this analysis.

Lastly, I identify divorce and demotion as stress events that may affect a soldier's smoking behavior. I tested binary variables that equal to one when the soldier experienced a divorce or demotion in the year prior to completing the health assessment survey. My sample contains approximately 4,500 observations of recent divorce and 237 recent demotions. Table 1 contains summary statistics for the overall sample population, as well as for smokers and non-smokers. 25 percent of respondents were smokers and nine percent were moderate to heavy smokers.

Table 1. Summary Statistics

	<u>All</u>	<u>Non-smokers</u>	<u>Smokers</u>
<b>Smoking Status</b>			
Smoker	24.9%	0.0%	100.0%
Moderate Smoker	7.8%	0.0%	31.4%
Heavy Smoker	1.1%	0.0%	4.4%
<b>Gender</b>			
Male	84.3%	82.5%	89.7%
Female	15.7%	17.5%	10.3%
<b>Age</b>			
Under 25 years old	33.4%	31.0%	40.5%
25 years and older	66.6%	69.0%	59.5%
<b>Rank Group</b>			
Enlisted	81.4%	76.5%	96.5%
Officer	18.6%	23.5%	3.5%
<b>Combat Duty</b>			
Combat MOS	26.3%	25.4%	29.3%
<b>Stress Event</b>			
Recent divorce	0.75%	0.76%	0.73%
Recent demotion	0.04%	0.04%	0.03%
<b>Observations</b>	607,259	456,347	150,912

As discussed in the literature review portion of this paper, there is a high degree of variation in the state level smoking prevalence of the general population. Table 2 shows that there is also state level variation in the mean reported smoking prevalence of Army soldiers. It is important to consider that U.S. Army units vary in size and are strategically (not uniformly) located throughout the United States. This fact likely accounts for some of the variation observed.

I also note that smoking prevalence between military and civilian population is quite different for some states. For example, based on the state level distribution, California ranks in the bottom quartile based on civilian smoking prevalence but in the top quartile based on the military smoking prevalence. On the other hand, the military smoking prevalence rate in Pennsylvania is only 12.8 percent, but the civilian smoking prevalence rate is relatively high at 21.2 percent. The low correlation between the two prevalence rates may be due to measurement error resulting from differences in the duration of residency and geography.

As I stated earlier, the Army assigns soldiers to their locations. Considering the periodicity of the health assessment survey (annually) and the average length of a military tour (two to three years), it is likely that a soldier in a given state has not resided in the state for as long as his or her civilian counterparts. Therefore, soldiers may not have had sufficient time to react to the state's smoking culture. Furthermore, soldiers are primarily assigned to the military bases within a given state. So the military smoking prevalence rate only accounts for portions of the state, whereas the civilian smoking prevalence rate is an average for an entire state. I continue the discussion of these two factors in the subsequent sections of this paper.

Table 2. Variation in Smoking Prevalence Rates by State

<u>State</u>	<u>Observations</u>	<u>Military Smoking Rate</u>	<u>State Smoking Rate</u>
TX	117405	27.6%	17.0%
GA	65091	24.2%	19.5%
NC	60587	20.5%	20.5%
WA	45884	25.6%	16.5%
KY	45862	26.5%	27.5%
CO	43937	28.0%	17.4%
HI	31718	23.8%	14.7%
VA	29099	19.0%	19.6%
KS	27028	28.6%	19.9%
NY	25373	27.0%	16.3%
OK	16624	28.2%	23.6%
LA	14607	30.3%	24.5%
AK	14136	26.7%	21.5%
MO	13887	25.9%	22.9%
CA	11730	26.8%	12.9%
MD	10867	14.5%	16.6%
SC	7510	18.0%	22.3%
AZ	6280	19.5%	17.3%
DC	4798	10.8%	18.9%
FL	3542	18.0%	17.9%
AL	3524	16.5%	22.7%
PA	1108	12.8%	21.2%

### C. THE IMPACT OF LOCAL CULTURE ON U.S. ARMY SOLDIERS

For the purposes of this study, the state level smoking prevalence rate is a proxy for local smoking culture. This study benefits from the fact that Army soldiers are randomly assigned to their state location, and therefore, randomly assigned to a smoking culture. Additionally, this study exploits that fact that the Army generally relocates soldiers every two to three years based on its own priorities, exposing them to exogenous variation in smoking culture. Individual fixed effects models show the changes in each soldiers smoking behavior as he or she encounters different smoking cultures. One study took a similar approach in seeking to measure the impact of local health cultures on the fitness levels of U.S. Army personnel. Datar and Nicosia (2018) found a significant correlation between higher county-level obesity rates and increases in the Body Mass Indexes of soldiers and their families. The degree of correlation increased as the duration

of the duty assignment increased. This finding is intuitive as longer time periods spent in a local culture allow the soldiers to normalize what they observe (i.e., obesity) in that culture. Sociology finds that individuals will adapt their behaviors (i.e., eating and exercise habits) to their normalized views. A similar phenomenon likely exists with respect to smoking.

#### **D. METHODOLOGY AND FRAMEWORK**

With two outcome variables (smoker and moderate/heavy smoker) and two key independent variables (state smoking rate and PHA smoking rate) defined, I apply four variations of a basic fixed effects model. To isolate the change in smoking behavior that results from changing states, I employ fixed effects for both the respondent and the observation year. The individual fixed effects remove differences in smoking behavior that result from unobserved individual characteristics, such as genetic predisposition to smoking. Year dummies capture macro trend in smoking prevalence over time. Each model provides an analysis of the sample population at the individual level. Additionally, I examine the outcomes of the four models for eight subsets of the population: males, females, enlisted, officers, younger than 25, 25 and older, combat occupations, and other occupations. The general fixed effects model follows:

$$y_{it} = \beta_0 + \beta x1_{it} + \beta x2_{it} + \beta x3_{it} + a_i + \epsilon_{it}$$

$$y_{it} = \text{smoking behavior}$$

$$x1_{it} = \text{smoking prevalence rate}$$

$$x2_{it} = \text{recent divorce indicator}$$

$$x3_{it} = \text{recent demotion indicator}$$

$$a_i = \text{time-invariant variable}$$

$$\epsilon_{it} = \text{error term}$$



## **IV. RESULTS AND ANALYSIS**

I organize my regression results and analysis into two sections. First, I analyze the impact of state smoking culture on the soldier's smoking behavior, and I study variations in smoking status and smoking intensity across each of the population subgroups. Next, I repeat this analysis using the calculated PHA smoking prevalence rate, a proxy for state level military smoking culture.

### **A. THE IMPACT OF STATE SMOKING CULTURE**

Regression results provided in Table 3 summarize the relationship between state smoking prevalence rate and the soldier's decisions about smoking. For the overall population, my results show a positive correlation, at the 10 percent level of significance, between the state smoking prevalence rate and the likelihood a soldier is a smoker. If a soldier moved from a non-smoking state (zero percent smoking prevalence) to a smoking state with 100 percent smoking prevalence, his likelihood of becoming a smoker goes up by 5 percentage points. The correlation between state smoking culture and smoking behavior is most significant in the male and enlisted populations. On average, the likelihood that a male soldier or an enlisted soldier becomes a smoker when he moves from a state with no smokers to a state with 100 percent smoking prevalence increases by approximately eight percentage points.

With respect to smoking intensity, I find very statistically significant correlations between state smoking rate and the outcome of moderate to heavy smoker for the overall population. On average, the likelihood that a soldier is a moderate to heavy smoker increases by 10 percentage points if he or she moves from a non-smoking state to a state comprised only of smokers. I find significant positive correlation between the state smoking rate and moderate to heavy smoking in most of the population subgroups, including males, enlisted, 25 and older, and in all occupational specialties.

On the other hand, I observe no statistically significant correlation among females or officers for either the smoking status or smoking intensity outcome. The disproportionate number of males and the high numbers of enlisted personnel in the

military may explain some of these results. A female in the military is likely to experience a “male-dominated culture,” and she is likely to have many males in her peer group. This finding is relevant because Nakajima (2007) showed that social influences on smoking decisions are stronger within genders than across genders.

Although, I did not specifically test education levels in my analysis, it is likely that the officer variable captures the effect of education on smoking decisions. As a general rule, commissioned officers must have an undergraduate level degree. Piko, Luszczynska, Gibbons, and Tekozel (2005) determined that those who obtained higher levels of academic achievement are not only less likely to smoke, but they are less likely to choose friends who smoke. The CDC reports that 20 percent of people with only a high school diploma smoke while only 8 percent of people with four-year degrees smoke (Centers for Disease Control and Prevention, 2018). Furthermore, my analysis of the health survey responses in this study determined that lower percentages of females and officers are smokers; therefore, the influences on their smoking decisions may come from their largely non-smoking peer groups vice the state or local smoking culture as defined in this study.

Interestingly, I find significant evidence that experiencing a recent divorce is negatively correlated with smoking behavior. The relationship is especially strong when examining the number of cigarettes smoked (smoking intensity). A soldier who gets divorced during the year prior to completing the health survey is less likely, by approximately one percentage point, to be a moderate or heavy smoker. One possible reason for the negative correlation may be that a recent divorce often coincides with a decrease in stress. Relationships on the brink of divorce are often unpleasant and leaving the relationship may actually reduce a soldier’s stress level. Finally, I find marginally significant evidence in the overall population that experiencing a recent demotion increases the likelihood that a soldier is a smoker.

## **B. THE IMPACT OF STATE LEVEL MILITARY SMOKING CULTURE**

By and large, I find the state level smoking prevalence rate among the military population only (calculated from the PHA responses in my sample) is more precisely estimated and therefore reaches higher statistical significance than state level civilian

smoking prevalence as calculated by the CDC. This may be because the military smoking prevalence rate better approximates a soldier's local smoking culture because soldiers are not equally distributed throughout each state. Instead, they are stationed in clusters at specific locations (near military installations). Also, many soldiers live in barracks so their interactions are more with their peers and not necessarily with the civilian population. The magnitude of the estimate is actually similar to those reported in Table 3, but the standard errors are much smaller. Take the whole sample estimate as an example. The coefficient 0.06 indicates a soldier is more likely to smoke, by six percentage points, when he or she moves from a non-smoking state to a state with a smoking rate of 100 percent. The six percentage point increase resulting from the change is the military smoking prevalence rate is very similar to the five percentage point change observed with the same change in civilian smoking prevalence, but it is much more statistically significant. Table 4 depicts my regression results showing the relationship between military smoking prevalence and smoking outcomes.

As with the state smoking prevalence, I find a positive and significant correlation between the PHA smoking rate and smoking status for both the male and enlisted subgroups. I discovered the strongest relationship in those under 25 years of age. On average, the likelihood that a soldier who is younger than 25 is a smoker increases by a staggering 22 percentage points if they moved from a non-smoking military setting to one with 100% smokers. This finding suggests that placing young adults in low smoking environments may be an effective way to prevent smoking initiation and reduce smoking prevalence among 18 to 24 year olds. Research conducted by Liu, Zhao, Chen, Falk, and Albarracín (2017) emphasizes the importance of reducing smoking among young adults by citing that 90 percent of adult smokers establish the habit by the age of 18. They also state those who begin smoking earlier in life have worse health outcomes and are more likely to be nicotine dependent than those who do not begin smoking until later in life (Liu, Zhao, Chen, Falk, and Albarracín 2017). Once again, no significant relationship between smoking behavior and smoking prevalence is observed among females and officers. Although, the PHA smoking prevalence rate is a better predictor of smoking status than the state smoking prevalence rate, I do not find that it predicts smoking intensity.

<u>Smoker</u>									
	All	Males	Females	Enlisted	Officer	25 and older	Under 25	Combat MOS	Other MOS
<b>State smoking rate</b>	0.05007 *	0.07559 **	-0.07593	0.08474 **	-0.02645	0.05149 *	0.01385	0.11198 *	0.02925
	(0.02866)	(0.03207)	(0.06270)	(0.03713)	(0.02865)	(0.02896)	(0.08950)	(0.06528)	(0.03211)
<b>Recently divorced</b>	-0.00927 *	-0.00771	-0.01214	-0.00942	-0.00564	-0.00400	-0.00901	-0.00444	-0.01070 **
	(0.00497)	(0.00771)	(0.00789)	(0.00591)	(0.00671)	(0.00501)	(0.01652)	(0.01266)	(0.00537)
<b>Recently demoted</b>	0.07754 *	0.06339	0.18850	0.09448 *	0.00479	0.14163	0.17304 *	-0.09607	0.12202 **
	(0.04504)	(0.04884)	(0.11934)	(0.05447)	(0.06637)	(0.05495)	(0.09000)	(0.11129)	(0.04960)
<u>Moderate/heavy smoker</u>									
	All	Males	Females	Enlisted	Officer	25 and older	Under 25	Combat MOS	Other MOS
<b>State smoking rate</b>	0.10491 ***	0.12197 ***	0.01702	0.15098 ***	-0.00602	0.10115 ***	0.12239 *	0.17911 ***	0.08912 ***
	(0.02202)	(0.02520)	(0.04055)	(0.02894)	(0.01614)	(0.02309)	(0.06459)	(0.05167)	(0.02438)
<b>Recently divorced</b>	-0.01224 ***	-0.01277 ***	-0.01234 **	-0.01316 ***	-0.00654 *	-0.00406	-0.04575 ***	-0.01679	-0.01192 ***
	(0.00382)	(0.00484)	(0.00510)	(0.00461)	(0.00378)	(0.00399)	(0.01192)	(0.01002)	(0.00408)
<b>Recently demoted</b>	0.01661	0.01867	0.00154	0.02005	0.00188	-0.03129	0.04472	-0.10472	0.04602
	(0.03459)	(0.03838)	(0.07718)	(0.04247)	(0.03738)	(0.04380)	(0.06495)	0.08809	(0.03766)
<b>Observations</b>	607,259	511,902	95,357	494,580	112,679	404,553	202,706	159,687	447,572

\*\*\*p value < 0.01    \*\*p value < 0.05    \*p value < 0.10

1. smoking outcomes using CDC state smoking prevalence rate    2. fixed effects for respondent and year

Table 3. Outcomes for State Smoking Prevalence Rate

<u>Smoker</u>									
	All	Males	Females	Enlisted	Officer	25 and older	Under 25	Combat MOS	Other MOS
<b>PHA smoking rate</b>	0.06310 *** (0.02387)	0.06692 ** (0.02725)	0.04909 (0.04769)	0.08946 *** (0.03288)	0.01464 (0.02109)	0.03960 * (0.02342)	0.22194 *** (0.08528)	0.07292 (0.06273)	0.05780 ** (0.02574)
<b>Recently divorced</b>	-0.00927 * (0.00497)	-0.00776 (0.00616)	-0.01225 (0.00789)	-0.00944 (0.00591)	-0.00568 (0.00671)	-0.00401 (0.00501)	-0.00879 (0.01652)	-0.00449 (0.01266)	-0.01070 (0.00537)
<b>Recently demoted</b>	0.07800 * (0.04504)	0.06384 (0.04884)	0.18865 (0.11934)	0.09498 * (0.05447)	0.00505 (0.06637)	0.01443 (0.05495)	0.17369 * (0.08999)	-0.09326 (0.11129)	0.12217 ** (0.04960)
<u>Moderate/heavy smoker</u>									
	All	Males	Females	Enlisted	Officer	25 and older	Under 25	Combat MOS	Other MOS
<b>PHA smoking rate</b>	0.01399 (0.01833)	0.00565 (0.02142)	0.04358 (0.03084)	0.01349 (0.02563)	0.01237 (0.01188)	0.00739 (0.01867)	0.03199 (0.06156)	-0.00432 (0.04966)	0.01453 (0.01955)
<b>Recently divorced</b>	-0.01215 *** (0.00382)	-0.01273 *** (0.00484)	-0.01228 ** (0.00510)	-0.01305 *** (0.00461)	-0.00655 * (0.00378)	-0.00399 (0.00399)	-0.04557 *** (0.01192)	-0.01670 * (0.01002)	-0.01184 *** (0.00408)
<b>Recently demoted</b>	0.01684 (0.03346)	0.01883 (0.00384)	0.00205 (0.07718)	0.02034 (0.04247)	0.00211 (0.03738)	-0.03107 (0.04380)	0.04513 (0.06495)	-0.10246 (0.08810)	0.04619 (0.03767)
<b>Observations</b>	607,259	511,902	95,357	494,580	112,679	404,553	202,706	159,687	447,572

\*\*\*p value < 0.01    \*\*p value < 0.05    \*p value < 0.10

1. smoking outcomes using PHA smoking prevalence rate    2. fixed effects for respondent and year

Table 4. Outcomes for PHA Smoking Prevalence Rate

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## CONCLUSIONS AND RECOMMENDATIONS

My research provides initial evidence that soldiers do change their own smoking behaviors in response to changes in smoking culture. I find that a soldier is more likely to be a smoker, and smoke more heavily, as the mean state level smoking prevalence rate increases. The cultural influence is stronger among males and enlisted service members, but my results show that those under 25 years of age are most responsive to changes in the military smoking prevalence rate. The impact of smoking culture on soldiers with different education levels is a subject that requires more analysis.

I observe a high degree of variation in the state level military smoking prevalence rates derived from the PHA survey responses. Many states have smoking prevalence rates that are substantially different from the state level military smoking prevalence rate (e.g., California, Texas, Colorado), which may suggest that the military has a unique smoking culture that shapes the smoking behavior of soldiers, but the differences are more likely attributable to measurement error. Large variations in smoking prevalence rates are observable within a single state. For this reason, I recommend that future iterations of this study employ county level smoking prevalence and installation-level smoking prevalence to better quantify and determine the significance of the relationship between smoking culture and individual smoking decisions. County level smoking prevalence rates are a better proxy of a soldier's local smoking culture because they represent the smoking culture in closest proximity to the soldier's duty location.

Additionally, I determined that stress events impact smoking behavior. Most notably, I find that a recently divorced soldier is likely to smoke fewer cigarettes each day. I did not find strong evidence regarding the impact of a recent demotion on smoking behavior; this may be because there are so few instances of demotion in my sample. I only examine smoking outcomes for these two stress events, but I recommend that future studies expand upon my study of stress and smoking by including a larger variety of stress events, including current deployments, death in the family, and recent birth of a child.

In this study, I give consideration to the ways in which military environments may further intensify the effects of previously researched phenomena, including peer effects, cultural influence, and social networks, on an individual's choices regarding smoking initiation and smoking cessation. In the earlier chapters on this paper, I discuss the military's history of promoting and normalizing tobacco usage among soldiers. I also discuss the idea the cultural effects within the military are likely magnified because military environments foster collectivism and interpersonal closeness. If the DoD is to achieve its goal of reducing smoking in the military, it must change its smoking culture through stronger tobacco control policies.

Last year, the DoD took a major step in discouraging smoking by banning the sale of discounted cigarettes on bases. An additional measure that may prove effective is to raise the legal age for the purchase and use of tobacco to 21 at all military installations. This effort would not only reduce the likelihood that a soldier will ever become nicotine-dependent; it also has the potential to generate social multiplier effects and dramatically reduce smoking prevalence (U.S. Department of Health and Human Services, 2018). Furthermore, I recommend the DoD implement strategic messaging campaigns aimed at reducing social smoking. These campaigns should emphasize the negative health consequences from that result from non-daily smoking and depict smoking as non-normative in the military. Lastly, I recommend that designated smoking areas on DoD installations be made less appealing by removing any seating and shelters that encourage service members to gather with the intention of smoking. These recommendations can generate and leverage the cultural effects examined throughout this paper and decrease the popularity of smoking in the military.



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