Nicotine & Tobacco Research, 2015, 586–591
doi:10.1093/ntr/ntu187
Original investigation
Advance Access publication September 19, 2014

OXFORD

Original investigation

Health Care Expenditures Attributable to Smoking in Military Veterans

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Abstract

Introduction: The health effects of cigarette smoking have been estimated to account for between 6%–8% of U.S. health care expenditures. We estimated Veterans Health Administration (VHA) health care costs attributable to cigarette smoking.

Methods: VHA survey and administrative data provided the number of Veteran enrollees, current and former smoking prevalence, and the cost of 4 types of care for groups defined by age, gender, and region. Cost and smoking status could not be linked at the enrollee level, so we used smoking attributable fractions estimated in sample of U.S. residents where the linkage could be made.

Results: The 7.7 million Veterans enrolled in VHA received $40.2 billion in VHA provided health services in 2010. We estimated that $2.7 billion in VHA costs were attributable to the health effects of smoking. This was 7.6% of the $35.3 billion spent on the types of care for which smoking-attributable fractions could be determined. The fraction of inpatient costs that was attributable to smoking (11.4%) was greater than the fraction of ambulatory care cost attributable to smoking (5.3%). More cost was attributable to current smokers ($1.7 billion) than to former smokers ($983 million).

Conclusions: The fraction of VHA costs attributable to smoking is similar to that of other health care systems. Smoking among Veterans is slowly decreasing, but prevalence remains high in Veterans with psychiatric and substance use disorders, and in younger and female Veterans. VHA has adopted a number of smoking cessation programs that have the potential for reducing future smoking-attributable costs.

Introduction

The health effects of cigarette smoking have been estimated to account for 6%–8% of U.S. health care expenditures.[1,2] More recent estimates are based on econometric models that compare the actual health care costs of smokers and former smokers to the hypothetical costs of nonsmokers with the same demographic characteristics of smokers.[3,4] Our objective was to determine the annual health care expenditures attributable to cigarette smoking incurred by Veterans of U.S. military service enrolled to receive health services from the VHA. Such costs could be expected to be significant, given the high rate of tobacco use associated with military service.

Recent surveys have found that 30% of active duty U.S. service members are current smokers.[5] Use of tobacco in the military has been linked to combat stress and boredom, the acceptability of tobacco use, and the availability of low cost tobacco at military installations.[6] Among members of the U.S. military services, tobacco use is more prevalent in those who are male, White, or have alcohol

problems. Smoking prevalence is higher in combat deployed military,[5,7] in those with Post-Traumatic Stress Disorder,[8] and in those deployed to Iraq or Afghanistan,[7,9] especially among those with psychiatric illness.[10,11] The association between military service and elevated smoking prevalence has also been found in other countries,[12–16] where smoking has been linked to combat exposure[14] and overseas deployment.[13]

Military service is associated with a lifelong increase in tobacco use.[17] Veterans are more likely than non-Veterans to be a current smoker or to have ever smoked.[18,19] According to an analysis of data from the Behavioral Risk Factor Surveillance System from 2003–2007, the age-adjusted smoking prevalence was 27% in Veterans and 21% in non-Veterans.[20] Approximately 20% of U.S. Veterans use VHA services.[21] Smoking is especially prevalent among VHA patients, who have been estimated to have 1.52 times the odds of being a current smoker than other Veterans.[19]

The most recent method of estimating smoking-attributable health care costs considers not only the cost of smoking-related diseases, but also the effect of smoking on general health. Smoking is associated with poor health even among those who do not have a specific smoking-related disease. Those with poor health incur more health care costs. Failure to account for this additional health effect of smoking understates effect of smoking on health care expenditures.[2] This paper employs an econometric method that includes this additional effect to estimate the smoking-attributable cost of VHA services.

Methods

The effect of smoking status on health care cost has been estimated from a nationally representative sample of U.S. residents.[22] In previous work, parameters from that model were combined with California survey data on smoking prevalence and data on health care expenditures to estimate the smoking attributable health care costs of Black[23] and Hispanic residents of California.[24] This paper extends this method to estimate the smoking attributable cost of Veterans enrolled to receive care from VHA.

The previously developed model determined the relative risks (RR) of incurring four types of health care expenditures for smokers (current or former) relative to never smokers for subgroups stratified by age group, gender, and census region of residence (Northeast, Midwest, South, West). This model was estimated from data that did not include Veterans status. We assumed that these relative risks are the same for Veterans as for other U.S. residents who share the same smoking status, age, gender, and region.

The analysis used data on sub-groups of VA enrolled Veterans defined by age, gender, and region. These data include status as current or former smoker, and four types of health care expenditures. We applied the RR estimates from the national model to these smoking status and expending data regarding Veterans enrolled in VHA.

Although VHA assesses the smoking status of nearly all Veteran patients and records findings in their electronic medical record, the result of many of these assessments are recorded as text in a progress note, and not in the health factors database.[25] As a result, VHA does not yet have a national database of Veteran smoking status that can be linked to health care cost for a more direct estimation of smoking attributable cost.

Model of Smoking-Attributable Health Care Expenditures

The econometric model for health care cost of smoking consisted of 10 equations. These equations estimated the impact of smoking on the propensity of ever having a smoking-related disease, the propensity of having poor health, the propensity of having positive annual expenditures (four separate equations for hospitalization, ambulatory care, prescription drugs, and home health care), and logarithmic level of annual expenditures among individuals with positive expenditures (four separate equations for inpatient care, ambulatory care, prescription drugs, and home health care).[23,24,26] The 10-equation model was estimated separately for each of the six subgroups defined by gender and age (18–34, 35–64, 65+) among adults aged 18 and older. Data were from the 2002–2008 Medical Expenditures Panel Survey (MEPS) linked with the National Health Interview Survey (NHIS). The MEPS is a nationally representative survey of the non-institutionalized U.S. population, containing respondent-level information on health status, medical conditions, age, gender, region of residence, and the annual expenditures of all types of health care services except for nursing home care. The NHIS Sample Adult file includes smoking history and current smoking status. The MEPS survey uses the NHIS as its sampling frame. Each year a new MEPS panel is established, drawing from the previous year's NHIS households so that the MEPS data can be linked to the NHIS Sample Adult files. We pooled the 2002–2008 MEPS data to increase the sample size and linked them with the corresponding NHIS observations. The nominal values of annual health care expenditures were adjusted into 2008 dollars using the annual deflator from Consumer Price Index for Medical Care.[27] After excluding those with missing values for smoking status, education, marital status, and health status, the final study sample contained data on 57,692 adults.

The smoking-attributable health care expenditures were estimated using a prevalence-based annual cost approach and an excess cost methodology. After estimating the 10-equation model, the estimated coefficients were used to generate two sets of predicted healthcare expenditures for each current smoker and former smoker: one for a factual case and one for a counterfactual case of a hypothetical "nonsmoking smoker"—that is, for someone who has all the same characteristics as the smoker except that they are assumed to be a never-smoker. The difference between the factual and the counterfactual predictions among all smokers is the excess cost of smoking. This excess cost divided by total predicted healthcare expenditures among all individuals (including smokers and never smokers) is the smoking-attributable fraction (SAF). The ratio of mean predicted expenditures between smokers and never smokers is the RR of healthcare expenditures. The SAF is the percentage of costs that can be attributed to smoking. The SAF for the type of healthcare expenditure j can be decomposed into two components: one for current smokers (SAF_c), and one for former smokers (SAF_f). These SAF can be expressed terms of the RR and the prevalence of current smokers (P_c), former smokers (P_f), and never smokers (P_n) as follows[23,24]:

$$SAF_j = SAF_{j,c} + SAF_{j,f} \quad (1)$$

$$SAF_{j,c} = \frac{(P_c)(RR_{j,c} - RR_{j,c\to n})}{(P_n) + (P_c)(RR_{j,c}) + (P_f)(RR_{j,f})} \quad (2)$$

$$SAF_{j,f} = \frac{(P_f)(RR_{j,f} - RR_{j,f\to n})}{(P_n) + (P_c)(RR_{j,c}) + (P_f)(RR_{j,f})} \quad (3)$$

The relative risk of healthcare expenditure type j for current smokers ($RR_{j,c}$), is defined as the ratio of the mean predicted expenditures

for current smokers to the mean predicted expenditures for never smokers. The analogous relative risk for former smokers ($RR_{j,f}$) is the ratio of their mean expenditure to that of never smokers. The relative risk of healthcare expenditure type *j* for hypothetical "nonsmoking current" smokers ($RR_{j,c\to n}$) is defined as the ratio of the mean predicted expenditure for individuals with the same characteristics as current smokers under the assumption they never-smoked, to the mean predicted expenditure for never smokers. The relative risk for hypothetical "nonsmoking former smokers" ($RR_{j,f\to n}$) is found in an analogous fashion, using the mean predicted expenditure for individuals with the same characteristics as former smokers under the assumption they never-smoked.

Smoking Status

Smoking prevalence in Veterans enrolled to receive services from the U.S. Veterans Health Administration was obtained from a national probability sample surveyed in 2010.[28] Current smokers were defined as those who have smoked at least 100 cigarettes in their lifetime and now smoke daily or some days. Former smokers were defined as those who have smoked at least 100 cigarettes in their lifetime but do not smoke now. We used responses to questions about smoking status, gender, age, and the state where respondent resided. We used the average sample probability weights for each group to estimate the proportion of enrollees who were current smokers and former smokers by age category, gender, and region of the country. The small sample size for women Veterans required us to assume that the age distribution of female smokers and former smokers was the same in every region. We tested the statistical significance of differences in smoking prevalence in groups defined by age, gender and region using chi-square tests that considered correlation by sampling strata and respondent-level survey weights.

Combining Smoking Status and the Model

Applying the RRs estimated from the econometric models and smoking prevalence data of Veterans enrolled in VHA to Equations 2 and 3, we estimated the SAFs among the VHA enrollees. Different SAFs were estimated for each subgroup stratified by gender, age, and region category by type of healthcare cost, with separate SAFs for current and former smoking.

Health Care Cost

VHA health care costs were obtained from the person-level cost data set created by the Health Economics Resource Center for the 2010 federal fiscal year (the year ending September 30, 2010), which provides the total cost of hospital stays[29] outpatient visits[30] prescriptions dispensed by the VA pharmacy.[31] This data set has one record for each user of VHA care. We linked these cost data to utilization records that contain each user's gender, age, and the state where they resided when they first received care during the year. States were recoded as one of the four U.S. census regions (Northeast, South, Midwest, or West). Age category was assigned according to patient age at the middle of the year. Observations included the annual cost of five types of inpatient care, 13 types of outpatient care, and medications. Costs were assigned to the four categories as used by the MEPS: inpatient care, ambulatory care, home health care, and prescription medications. A fifth category was used to tabulate a residual category of cost that appear in VHA data but are not included in the cost of smoking econometric model, including nursing home care and dental services. Total VHA health care expenditures for the four MEPS cost categories were determined for groups defined by gender, age category, and region. We applied the set of SAFs to VHA health care expenditures in each category to estimate smoking-attributable VHA heath care expenditures.

Results

Smoking Prevalence

The 2010 survey characterized 7.7 million Veterans enrolled to receive health services form the Veterans Health Administration.[28] Enrollees were largely male (94.0%). Nearly half (45.0%) were over 65 years of age; 48.2% were between 35 and 64 years of age and the remaining 6.8% were under 35. Veteran enrollees were more likely to be living in the South (41.2%) than in the Midwest (21.9%), West (20.7%) or Northeast (16.1%) census region. The survey determined that 19.6% (standard error of estimate ±0.3%) of enrollees were current smokers and 48.1% (standard error of estimate ±0.4%) were former smokers.

Table 1 provides smoking prevalence of Veteran enrollees by gender, age group, and census region. Veterans older than 65 years were less likely to be a current smoker and more likely to be a former smoker than Veterans under 65 (both comparisons statistically

Table 1. Prevalence of Current Smoking and Former Smoking Among Persons Enrolled in the VHA Health Care System, by Gender, Age and Region, 2010

	Current smoker		Former smoker	
	Prevalence (%)	95% confidence interval	Prevalence (%)	95% confidence interval
Gender				
Male	19.4	(18.7%–20.0%)	49.5	(48.7%–50.2%)
Female	23.2	(23.0%–23.4%)	27.1	(26.9%–27.3%)
Age Category				
18–34 years	25.7	(25.5%–25.8%)	25.8	(25.6%–26.0%)
35–64 years	28.3	(27.7%–28.9%)	38.7	(38.1%–39.3%)
65 years and older	9.3	(9.0%–9.6%)	61.6	(60.9%–62.2%)
Region				
Midwest	21.6	(21.2%–21.9%)	49.5	(49.1%–49.8%)
Northeast	16.6	(16.4%–16.9%)	51.4	(51.1%–51.8%)
South	20.5	(20.0%–21.0%)	46.6	(46.0%–47.2%)
West	17.9	(17.7%–18.2%)	47.1	(46.8%–47.5%)
All	19.6	(18.9%–20.2%)	48.1	(47.3%–48.9%)

significant with $p < .001$). Veterans aged 35–64 years of age were more likely to be former smokers than Veterans under 35 years of age ($p < .001$), but the difference in the percentage that were current smokers was not statistically significant ($p = .06$).

Male Veterans were less likely to be a current smoker and more likely to be a former smoker than female Veterans (both comparison statistically significant with $p < .001$). This difference reflects the older age of male Veterans. A multivariate logistic regression that controlled for age found no significance difference between genders in current smoking prevalence. The Odds Ratio of being a current smoker for male relative to female Veterans was 1.08 (95% confidence interval = 0.89–1.31). An age-adjusted analysis found that male Veterans were significantly more likely than female Veterans to be a former smoker (Odds Ratio 1.93, 95% confidence interval = 1.66–2.27).

Veterans from the South and Midwest census regions were more likely to be current smokers than Veterans from the Northeast and West regions. Veterans from the Northeast were more likely to be former smokers than Veterans from the South or West.

Health Care Cost

There were 5.6 million users of VHA health care in 2010, and they used $40.2 billion in health care services, including $35.3 billion in the four categories of care considered in the cost of smoking econometric model. Ambulatory care services accounted for $18.8 billion of these costs, more than half (53%) of the total. VHA spent $10.8 billion (31%) on inpatient care, $5.4 billion (15%) on medications, and $0.3 billion (1%) on home health services. Veterans between 35 and 64 years of age accounted for $19.5 billion (55% of the total cost), and those aged 65 and old accounted for $14.2 billion (40%). Women Veterans incurred 6% of these VHA health care costs.

Smoking-Attributable Health Care Cost

Table 2 provides information on the VHA health care costs that were attributable to smoking, with sub-totals by type of care, census region, gender, and age category. We estimated that $2.7 billion of 2010 VHA health care cost (7.6%) was attributable to smoking. A much greater fraction of inpatient cost (11.4%) was attributable to smoking than of ambulatory care cost (5.3%).

Table 3 presents smoking-attributable health care costs for subgroups of patients defined by smoking status, region, gender, and age category. Out of the total health care cost attributable to smoking, much greater costs were attributable to those who are current smokers ($1.7 billion) compared to former smokers ($983 million). This is true for every subgroup except smokers over 65 years of age, for whom smoking-attributable costs were greater for former smokers.

Table 2. Health Care Costs Attributable to Cigarette Smoking in the Veterans Health Administration, in Millions of Dollars, 2010

	Health care cost	Smoking-attributable cost	Smoking-attributable fraction (%)
Types of care			
Ambulatory	18,803	999	5.3
Home Health	282	36	12.8
Inpatient	10,822	1,237	11.4
Prescription Drugs	5,370	407	7.6
Region			
Northeast	5,135	376	7.3
Midwest	7,550	608	8.1
South	15,036	1,154	7.7
West	6,949	495	7.1
Outside Continental U.S.	607	46	7.6
Gender			
Women	2,192	132	6.0
Men	33,085	2,548	7.7
Age			
18–34 years	1,557	106	6.8
35–64 years	19,502	1,583	8.1
65+ years	14,218	991	7.0
Total	35,277	2,680	7.6

Table 3. Smoking-Attributable Health Care Cost by Smoking Status, in Millions of Dollars, 2010

	Current smokers	Former smokers	Total
Regions			
Northeast	216	160	376
Midwest	398	211	608
South	752	402	1,154
West	306	190	495
Outside Continental U.S.	25	21	46
Gender			
Women	101	31	132
Men	1,596	953	2,548
Age			
18–34 years	77	30	106
35–64 years	1,277	306	1,583
65+ years	343	648	991
Total	1,697	983	2,680

Discussion

Smoking was responsible for at least $2.7 billion of the health care cost incurred by the 7.7 million Veterans enrolled in VHA in 2010. This represented 7.6% of the VHA expenditures on health services for which the cost of smoking could be attributed. This estimate represents the excess health care cost of Veterans who had ever smoked compared to what they would have incurred if they had never smoked.

Compared to non-Veterans, Veterans are more likely to be a current smoker and they are more likely to be an ever-smoker. Even so, we found that smoking-attributable costs in VHA were not very much greater than the estimates for other populations in other health care systems, in which 6%–8% of health care costs are attributable to smoking.[2] Although the age-adjusted prevalence of smoking is greater in Veterans, the actual prevalence of current smoking is quite similar to that of the general population. The 19.6% current smoking prevalence in Veteran enrollees in 2010 was similar to the 19.3% smoking prevalence in the U.S. population.[32] The unadjusted (actual) prevalence of current smoking reflects the high proportion of VHA enrollees who were over age 65 (45%) and the low prevalence of current smoking in this age group (9.3%).

This study has some limitations. We assumed that the relative risk of health care expenditures for smokers relative to never smokers is

the same for Veterans as for other U.S. residents who share the same smoking status, age, gender, and region. We needed to make this assumption because we could not link VHA data on smoking status with health care cost, and hence could not directly quantify the relationship between smoking and cost. The relative risk was determined using an econometric model developed in nationally representative sample of the U.S. non-institutionalized adult population. We combined the smoking prevalence rates of Veterans enrolled in VHA with the relative risk estimates from individuals with the same demographics to derive the smoking-attributable VHA heath care costs. We did not estimate the smoking-attributable cost for nursing home services or services purchased by VHA as these costs could not be matched to the categories used in the econometric model of smoking-attributable health care expenditures. Some of these costs were undoubtedly attributable to smoking so our estimates represent the lower bound of total smoking related cost.

Smoking prevalence in Veterans has been slowly decreasing.[20] This likely reflects the trend of diminishing use of tobacco in the U.S. general population as well as VHA smoking cessation efforts. VHA restricted smoking in its facilities and stopped selling cigarettes in hospital canteens in 1991,[19] but as late as 2002, smoking cessation pharmacotherapies were still severely underutilized.[33] VHA adopted a number of smoking cessation programs in the last decade.[33–38] Key milestones were the elimination of two important barriers to smoking cessation treatment: the requirement that patients attend a smoking cessation clinic before receiving nicotine replacement therapy (eliminated in 2003) and the copayment for smoking cessation clinic visits (eliminated in 2006).[37] Other VHA smoking cessation initiatives include adding tobacco screening and counseling rates as indicators of clinician and manager performance, providing telephone counseling, nurse administered interventions for hospitalized smokers, smoking cessation services to employees, and integrating smoking cessation services with treatment for Post-Traumatic Stress Disorder.[35,36] The VHA Public Health Strategic Health Care Group trained preceptors to champion tobacco cessation efforts throughout the agency, and developed clinical reminders for the VHA electronic health record.[37] These reminders prompt clinicians to screen smokers and recent quitters, conduct brief intervention, offer pharmacotherapy, and make referrals to cessation programs.

Several studies have documented the increased uptake of cessation services by VHA patients. The number of patients receiving NRT increased by 9% per year between 1999 and 2002[33] and by 15% per year between 2004 and 2008.[38] VHA provided an estimated $30 million worth of NRT and bupropion for smoking cessation in 2008.[38] A patient survey conducted in 2007 found that 80% of current smokers received brief physician advice to quit smoking, and 60% reported receiving a physician recommendation for cessation medications and quit methods.[35,36]

Several challenges remain. Smoking prevalence remains high in VHA patients with psychiatric and substance abuse diagnoses,[35,36] a group that is especially difficult to treat. Veterans returning from Iraq and Afghanistan include many current smokers,[7,9] especially among those returning with Post-Traumatic Stress Disorder.[10] Smoking prevalence is also high in women Veterans.[39]

Resources spent on smoking cessation programs may reduce future smoking-attributable costs in VHA. The most important argument for these programs, however, is their impact on health. Smoking cessation treatment remains one of the most cost-effective health care interventions.[40]

Funding

This work was supported by funding from the Public Health Strategic Health Care Group and the Health Services Research and Development Service of the U.S. Department of Veterans Affairs, projects ECN 99-017 and RRP 11-266.

Declaration of Interests

None declared.

Acknowledgments

We appreciate the assistance of M. Schwaber of the Office of Policy and Planning of the Veterans Health Administration, and S. Chen of the Health Economics Resource Center.

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