Cigarette Smoking Practices, Smoking-Related Diseases, and the Costs of Tobacco-Related Disability Among Currently Living U.S. Veterans

Jeffrey E. Harris MD PhD

Report Commissioned by the
Department of Veterans Affairs
Assistant Secretary for Policy and Planning

Draft September 8, 1997
Revised September 15, 1997

Introduction

On January 13, 1993, the Veteran Administration's General Counsel issued a precedent opinion (VAOPGCREC 2-93) that an injury or disease resulting from tobacco use in the line of duty in active military, naval, or air service could serve as the basis for a service-connected claim for compensation. In this report, I estimate the potential financial impact of this precedent opinion on claims for disability compensation among currently living veterans. I focus sharply on the population of male veterans, aged 45 years or more, who have already developed tobacco-related diseases. I do not project claims for compensation among veterans who may develop such diseases in the future. Nor do I consider claims for survivor and burial benefits by spouses of deceased veterans. My analysis considers only cigarette smoking-related disease and disability; a more complete study would include the effects of smoking cigar and pipe tobacco, as well as the use of smokeless tobaccos.

The Costs of Compensation for Tobacco-Related Disabilities

Figure 1 sets forth the conceptual framework for computing the total costs of tobacco-related disabilities. In essence, the total cost is derived as the product of a series of numbers, each of which needs to be estimated from existing data sources.

I start with an estimate of the size of the veterans population, broken down by age and sex. I then identify those diseases specifically associated with smoking, such as lung cancer, chronic lung disease, and coronary heart disease.

Figure 1. Computation of the Costs of Tobacco-Related Compensation

Total Costs of Tobacco-Related Disability	=	Size of Living Veteran Population	x	Prevalence of Smoking-Related Disease	x	Fraction of Disease Attributable to Smoking	x	Proportion of Veterans Who Started Smoking During Service	x	Proportion of Veterans Who Will File Claims for Compensation	x	Compensation Costs per Claim
Data Sources:		Table 1		Table 2		Table 7		Tables 4, 6		Table 9		Table 8

For each such disease, I determine the prevalence rate (that is, the number of living cases with the disease per population). The product of the size of the veterans population and the prevalence rate yields the number of veterans with each disease. This result is then multiplied by fraction of the disease prevalence that is attributable to smoking. (For example, about 90% of lung cancers in men are caused by smoking). The result gives the number of veterans with specific diseases caused by smoking.

The next multiplication step in Figure 1 determines the number of veterans with diseases caused by their smoking who initiated cigarette use during military service. The penultimate step computes the number of such veterans who will file valid claims with the Veterans Administration. The last step in the Figure multiples the number of such claims by the estimated cost per claim.

Each step in the sequence described in Figure 1 represents a separate source of uncertainty. An informative analysis of the total costs of compensating tobacco-related disabilities needs to take all these sources of uncertainty into account.

Size of Living U.S. Veteran Population

Table 1 shows the projected veteran population of the U.S. and Puerto Rico as of July 1, 1997. Approximately 21% of 25.6 million veterans are under 45 years of age; the vast majority of these individuals served during the Persian Gulf War or Vietnam era. This report focuses on the remaining 20 million veterans, now aged 45 years or more, who are much more likely to develop smoking-related illness. Of this group of veterans over 45 years old, approximately 3% are women.

Table 1. Projected Veteran Population in the U.S. and Puerto Rico as of July 1, 1997

Age Group	Total	Male	Female
<45	5,460,329	4,855,431	604,898
45-64	10,941,509	10,650,236	291,273
65+	9,148,800	8,819,758	329,042
All Ages	25,550,638	24,325,425	1,225,213

Source: Computed from tabulations provided by Department of Veterans Affairs, Washington DC, September 4, 1997.
Author: Jeffrey E. Harris MD PhD, September 15, 1997

Prevalence of Smoking-Related Diseases

Table 2 lists twelve categories of disease that have been specifically attributed to cigarette use.[1] For each disease category, I have estimated the prevalence rate, that is, the number of cases of the disease per 1,000 living persons. For non-cancerous conditions, such as coronary heart disease, stroke, and emphysema, I used estimates of "chronic conditions" reported in the 1994 National Health Interview Survey.[2]

For each cancer, by contrast, I computed the prevalence rate only for persons whose cancers had been diagnosed within the past five years. To make this computation, I relied upon a standard formula in epidemiology, in which the prevalence rate equals the incidence rate (that is, the number of new cases per year) multiplied by the average duration of survival. The cancer incidence rates were taken from the 1990-1994 Survey of Epidemiology and End Results (SEER) by the National Cancer Institute.[3] The average duration of survival was computed as the sum of the annual survival rates for the first 5 years after diagnosis, based upon cancers diagnosed in 1988.[4]

Cigarette Smoking Practices Among U.S. Veterans

In order to determine the proportion of prevalent cases of disease that are specifically attributable to cigarette smoking, I need to estimate the number of past and present cigarette smokers in the veteran population. To this end, I analyzed two recent, large-scale surveys of the U.S. civilian population: the

---

[1] *Reducing the Health Consequences of Smoking: 25 Years of Progress. A report of the Surgeon General, 1989.* DHHS Publication No. (CDC) 89-8411. Rockville MD: Centers for Disease Control, Office on Smoking and Health, 1989.

[2] See "Table 58. Number of selected reported chronic conditions per 1,000 persons, by sex and age: United States, 1994," in National Center for Health Statistics. *Current Estimates From the National Health Interview Survey, 1994. Vital and Health Statistics*, Series 10, No. 193. 1995.

[3] National Cancer Institute. *SEER Public Use CD-ROM 1973-1994.* Tables VIII, XI, XII, XV, XIX, XXI, and XXVI.

[4] See SEER Public Use CD-ROM, *idem.*, Tables VIII-6, VIII-7, XI-6, XI-7, XII-6, XII-7, XV-6, XV-7, XIX-6, XIX-7, XXI-6, XXI-7, XXVI-6, and XXVI-7. To obtain absolute survival rates, I multiplied the relative survival rates reported by SEER by the absolute survival rates for each age and sex group based upon 1995 mortality statistics, as reported in Table 2 of Anderson RN, Konacheck KD, Murphy SL. *Report of Final Mortality Statistics, 1995. Monthly Vital Statistics Report.* 45(11, Suppl 2): June 12, 1997. + Let S_t denote the proportion surviving t years after diagnosis. Then the mean duration of survival is the summation $S_1 + S_2 + \cdots S_t + \cdots$ for t = 1 to ∞. To obtain the mean duration of survival in the first 5 years after diagnosis, the summation runs from t = 1 to t = 5.

Table 2. Estimated Prevalence Rates of Smoking-Related Diseases in the Veteran Population

Smoking-Related Diagnosis	ICD-9-CM Code[1]	Prevalence Rate per 1,000 Population: Males, Ages 45 or Older	Males, Ages 45-64	Males, Ages 65 or Older	Females, Ages 45 or Older	Females, Ages 45-64	Females, Ages 65 or Older
Cancers:							
Lip, Oral Cavity, Pharynx[2]	140-149	1.4			0.7		
Esophagus[2]	150	0.2			0.1		
Pancreas[2]	157	0.1			0.1		
Larynx[2]	161	1.0			0.2		
Lung[2]	162	2.9			1.9		
Bladder, Other Urinary[2]	188	4.4			1.2		
Kidney[2]	189	1.3			0.7		
Cardiovascular Diseases:							
Coronary Heart Disease[3]	410-414	131.7	81.9	191.8	80.6	32.5	123.3
Cerebrovascular Disease[3]	430-438	35.2	20.4	53.1	39.7	16.2	60.5
Other Circulatory Disease[3]	440-448	39.0	14.0	69.1	25.8	8.4	41.3
Respiratory Diseases:							
Chronic Bronchitis[3]	490,491,496	47.3	43.8	51.5	74.4	82.7	67.0
Emphysema[3]	492	36.4	10.3	67.9	20.2	9.5	29.6

Author: Jeffrey E. Harris MD PhD, September 15, 1997.

Sources: National Center for Health Statistics. *Current Estimates From the National Health Interview Survey, 1994. Vital and Health Statistics*, Series 10, No. 193. 1995. Table 58. Number of selected reported chronic conditions per 1,000 persons, by sex and age: United States, 1994 *SEER 1973-1994 Public Use CD-ROM.* National Cancer Institute, May 1997. Tables VIII, XI, XII, XV, XIX, XXI, and XXVI. Harris JE. Chapter 3, "Changes in Smoking-Attributable Mortality," in 1989 Surgeon General's Report on Smoking and Health; and Anderson RN, Konacheck KD, Murphy SL. *Report of Final Mortality Statistics, 1995. Monthly Vital Statistics Report.* 45(11, Suppl 2): June 12, 1997, Table 2. Number of deaths and death rates, by age, race, and sex: United States, 1995.

Notes to Table 2:

1. *International Classification of Diseases, 9th Revision, Clinical Modification*.
2. For each 5-year age interval from 45 years and up, the sex- and age-specific cancer incidence (for 1990-1994) was multiplied by the estimated mean number of years of survival in the first 5 years after diagnosis (based upon relative survival rates reported for cases diagnosed in 1988 and absolute mortality rates for 1995). The resulting age-specific prevalence rates were aggregated according the age-distribution of veterans given in Table 1.
3. See National Center for Health Statistics, *idem*, Table 58. The prevalence rates refer to the "number of chronic conditions per 1,000" for each diagnosis. The prevalence of "Other Circulatory Disease" corresponds that for "Hardening of the Arteries" in Table 58. See also: (Internet) http://www.cdc.gov/nchswww/datawh/statab/pubd/ce94t58.htm. Estimates for ages 45+ based on age distribution of veterans population (Table 1).

National Medical Expenditure Survey (NMES) of 1987;[5] and the Tobacco Use Supplements (TUS) to the Current Population Surveys of 1992-1993).[6] Both surveys included questions on veteran status and smoking practices, as well as demographic information such as age and sex.

Among 38,446 respondents to the 1987 NMES household survey, a total of 4,582 veterans aged 18 years or more were identified.[7] Among this group, 3,748 respondents were asked whether they had smoked at least 100 cigarettes in their lifetimes. Among this group, 3,585 men and women responded, while 163 (or 4 percent) gave no information. Among the former 3,585 respondents to the question about lifetime cigarette use, a total of 2,680 (75%) reported having smoked 100 cigarettes. These individuals were then asked the age at which they started smoking regularly, of whom 2,535 (95%) responded. All individuals who reported ever smoking 100 cigarettes were also asked whether they smoked now. Overall, among the 3,585 respondents to the question about lifetime cigarette use, 905 (25%) had never smoked 100 cigarettes; 1,221 (34%) currently smoked; 1,393 (39%) no longer smoked; and 66 (2%) had smoked 100 cigarettes but did not describe current smoking practices.

Table 3 shows the detailed breakdown of smoking status among NMES veterans by age and sex. All results on smoking prevalence were weighted to represent the U.S. civilian non-institutional population. The Table shows that, among veterans of both sexes and all ages, 34.8% were current smokers at the time of the survey, while 75.4% had ever smoked (that is, the sum of 34.8% current smokers, 38.9% former smokers, and 1.7% ever smokers of unknown current

---

[5] U.S. Department of Health and Human Services, Agency for Health Care Policy and Research. *National Medical Expenditure Survey, 1987: Household Survey, Health Status Questionnaire and Access to Care Supplement, Public Use Tape 9 (ICPSR No. 9674, Dec. 1991); and Household Survey, Population Characteristics and Person-Level Utilization, Rounds 1-4, Public Use Tape 13 (ICPSR No. 9695, Feb. 1992).* Ann Arbor, MI: Inter-university Consortium for Political and Social Research.

[6] Tobacco Use Supplements, Current Population Survey, Sept. 1992 (*ICPSR No. 6383*), Jan. 1993 (*ICPSR No. 6641*), and May 1993 (*ICPSR No. 6407*). Ann Arbor, MI: Inter-university Consortium for Political and Social Research.

[7] A total of 4,478 veterans were identified on the basis of a specific variable (LASTVET), constructed by the NMES, that indicated veterans status as of the last round of NMES participation in 1987. According to NMES documentation, veteran status "is defined in accord with the definition used by the Department of Veterans Affairs (persons with prior service in either the Armed Forces or a National Guard/military reserve unit). Active duty military personnel were not classified as veterans. All edited military status variables (e.g., ever served in Armed Forces, etc.) were coded to "no" for persons 17 and under." See *Documentation for Public Use Tape 13*, *op. cit.*, "1.3.1 Demographics." An additional 104 respondents were identified on the basis of an additional military service variable (PVIETX), corresponding to service in the post-Vietnam era.

Table 3. Cigarette Smoking Among 3,585 Men and Women Veterans Who Responded to the 1987 National Medical Expenditure Survey[1]

Sex	Age Group	Sample Size	Current Smoker[2] (%)	Former Smoker[2] (%)	Smoked, Current Status Indeterm.[2] (%)
Males[3]	18-44	1,118	44.5	24.5	2.0
	45-64	1,370	33.5	44.0	1.5
	65+	943	20.1	54.8	1.8
	All Ages	3,431	34.8	39.2	1.7
Females[3]	18-44	82	46.3	21.8	0.0
	45-64	30	30.6	40.4	0.0
	65+	42	11.5	48.0	2.1
	All Ages	154	35.5	31.5	0.4
Both Sexes[3]	18-44	1,200	44.7	24.4	1.9
	45-64	1,400	33.5	43.9	1.5
	65+	985	19.7	54.5	1.8
	All Ages	3,585	34.8	38.9	1.7

Author: Jeffrey E. Harris MD PhD, September 15, 1997

Source: National Medical Expenditure Survey, 1987:

Household Survey, Health Status Questionnaire and Access to Care Supplement, Public Use Tape 9; and

Household Survey, Population Characteristics and Person-Level Utilization, Rounds 1-4, Public Use Tape 13.

Notes to Table 3:

1. A total of 3,748 veterans were asked about lifetime cigarette use, of whom 163 persons (4%) gave no response.
2. Respondents were asked: "Have you smoked at least 100 cigarettes in your lifetime?" Those who answered were then asked "Do you smoke now?" Those answering "yes" were classified as current smokers; those answering "no" were classified as former smokers; and those with no response were classified as ever-smokers with indeterminate smoking status. All estimates weighted to U.S. non-institutional civilian population.
3. The approximate 95% confidence ranges of current smoking prevalence for males and for both sexes were: 18-44 years: ±2.9%; 45-64 years: ±2.5%; 65 years or more: ±2.6%; all ages: ±1.6%. The 95% confidence range for females of all ages was: ±7.6%. The estimates for females by age group are based upon fewer than 100 responses, but are shown for completeness.

smoking status). The Table also shows that current smoking prevalence varies inversely with current age. While younger veterans have a lower rate of lifetime cigarette use, more than three-fourths of those over 45 years of age smoked cigarettes.

These findings are roughly in accordance with those of a recently published analysis of the National Medical Expenditure Survey by McKinney et al.[8] as well as a recent analysis of smoking supplements to the National Health Interview Survey.[9] Over 70 percent of veterans, as compared to about half of the U.S. adult civilian population, have ever smoked cigarettes.[10]

Table 4 shows the breakdown of smoking practices in the NMES data by type or era of service. Although there were too few respondents who served in World War I to draw reliable conclusions, the results have been included for completeness. With the exception of WW I veterans and men currently active in the National Guard or Reserves, lifetime cigarette use has exceeded 70% in every era. The highest current smoking rates were observed among male veterans of the Vietnam Era (42%) and Post-Vietnam Era (45%), who were younger than other veterans.

The last column of Table 4 shows the proportion of lifetime cigarette smokers who reported starting to smoke at age 18 or older, that is, during the time when the respondent would be eligible for military service. Among male veterans of World War II, about 48% started to smoke at or after age 18. The proportion of men who began to smoke during military-eligible years declined with each successive era. These findings are consistent with other reports that a

[8] McKinney WP, McIntire DD, Carmody TJ, Joseph A. Comparing the smoking behavior of veterans and nonveterans. *Public Health Reports* 1997; 112:212-7. See also Joseph SC. Commentary on veterans and smoking. *Public Health Reports* 1997; 112:218. The prevalence of current smoking among active duty personnel has declined from 51% in 1980 to 33% in 1995. Office of the Inspector General, Department of Defense. *Economic impact of the use of tobacco in DoD.* Arlington VA: US Department of Defense; 1996 Dec 31. Report No. 97-060.

[9] Klevens RM, Giovino GA, Peddicord JP, et al. The association between veteran status and cigarette-smoking behaviors. *American Journal of Preventive Medicine* 1995; 1:245-50. These authors reported a current smoking prevalence of 34% and a lifetime smoking rate of 74% among veterans.

[10] Among the 3,585 respondents to the smoking questions, only 154 (4%) were female. The numbers of female respondents in specific age groups in the NMES were insufficient to draw reliable conclusions about age-specific smoking rates among women veterans.

Table 4. Cigarette Smoking Among 3,431 Male Veterans Who Responded to the 1987 National Medical Expenditure Survey: By Type or Era of Service[1]

Type or Era of Service	Sample Size[2]	Current Age[3] Mean	Current Age[3] SD	Ever Smoked[4] (%)	Smokes Now[5] (%)	Started Age 18+ [6] (%)
World War I	17	90.7	2.8	37.1	6.4	30.9
World War II	1,284	66.2	5.3	78.9	24.1	47.9
Korean Conflict	550	57.0	4.7	80.9	30.0	44.4
Vietnam Era	949	42.4	7.2	76.5	42.4	41.5
Post-Vietnam Era	414	33.6	9.5	70.5	44.8	37.7
Served in Other Periods	322	51.4	8.1	79.8	40.8	43.0
Ever Active, Natl Guard/Reserves	847	48.5	13.5	70.4	34.7	44.8
Now Active, Natl Guard/Reserves	292	44.8	13.5	64.9	35.1	47.1
All Male Respondents	3,431	51.3	13.9	75.7	34.8	44.1

Author: Jeffrey E. Harris MD PhD, September 15, 1997

Source: National Medical Expenditure Survey, 1987:
Household Survey, Health Status Questionnaire and Access to Care Supplement, Public Use Tape 9; and
Household Survey, Population Characteristics and Person-Level Utilization, Rounds 1-4, Public Use Tape 13.

Notes:

1. Except for sample sizes, all estimates weighted to U.S. noninstitutional civilian population.
2. Sample sizes do not sum to 3,885 because some veterans served in multiple eras.
3. Age as of last round of interviews in 1987.
4. Percentage of respondents who answered "yes" to "Have you smoked at least 100 cigarettes in your lifetime?" See Note 2, Table 1. The approximate 95% confidence ranges for current smoking prevalence were: WW I: ±2.3%; Korean Conflict: ±3.8%; Vietnam Era: ±3.1%; Post-Vietnam: ±4.8%; Other Periods: ±5.4%; Ever Active, Natl Guard/Reserves: ±3.2%; Now Active, Natl Guard/Reserves: ±5.5%; All Men: ±1.6%. Estimates for WW I based upon fewer than 100 responses, but included for completeness.
5. Percent of those ever smoking who responded "yes" to "Do you smoke now?" See Note 2, Table 1.
6. Percent of those ever smoking who started smoking at age 18 years or older. Respondents who did not supply starting age were excluded from the denominator.

significant proportion of male veterans start smoking while on active duty.[11]

Among the 3,431 male veterans who reported their smoking practices, 356 respondents (10%) reported a "service-related disability."[12] (An additional 4% were recorded as "unknown" service-related disability status.) Among those with a service-related disability, 77% ever smoked cigarettes; among those without a service-related disability, 75% ever smoked cigarettes (P = 0.3). Likewise, among those with a service-related disability, 37% currently smoked, as compared to 35% of those not reporting a disability (P = 0.8). These findings support the conclusion that, at least as of 1987, service-related disability rates were unrelated to smoking practices.

Table 5 shows the corresponding results for the Tobacco Use Supplements to the Current Population Survey. For the three successive rounds of the survey during September 1992 through May 1993, a total of 45,150 self-declared veterans were identified, of whom 39,945 (88%) gave information about smoking practices. These individuals (or a proxy respondent) were asked: "Has … smoked at least 100 cigarettes in his/her lifetime?" Those who answered "yes" were then asked: "Does … now smoke cigarettes every day, some days, or not at all?" Those answering "every day" or "some days" were classified as current smokers; those answering "not at all" were classified as former smokers; and those who did not respond were classified as indeterminate status.

The TUS-based results in Table 5 show lower smoking rates for veterans than those derived from the NMES. The differing results of the two surveys may be due to differences in their respective sampling schemes; methods of ascertaining smoking (personal interview versus telephone, self-response versus proxy response permitted); types of questions asked; and definitions of veterans status. Nonetheless, 72 percent of veterans aged 45 years or more reported ever smoking cigarettes– an estimate close to the 75 percent rate of lifetime smoking derived from the NMES.

Table 6 shows the profile of smoking history according to type or era of service, based upon the Tobacco Use Survey data. In contrast to the NMES data, over 60 percent of veterans began smoking at age 18 or older. The higher rate of

---

[11] Bray RM, Marsden ME, Peterson MR. Standardized comparisons of the use of alcohol, drugs, and cigarettes among military personnel and civilians. *American Journal of Public Health* 1991; 81:865-9. Feigelman W. Cigarette smoking among former military personnel: a neglected social issue. *Preventive Medicine* 1994; 23:235-41. Kroutil LA, Bray RM, Marsden ME. Cigarette smoking in the U.S. military: findings from the 1992 worldwide survey. *Preventive Medicine* 1994; 23:521-8.

[12] Service-related disability was measured by the variable SMPDISX in the NMES data base.

Table 5. Cigarette Smoking Among 39,945 Men and Women Who Responded To The Tobacco Use Supplements of the Current Population Surveys, 1992-1993

Sex	Age Group	Sample Size	Current Smoker[2] (%)	Former Smoker[2] (%)	Smoked, Current Status Indeterm.[2] (%)
Males[3]	18-44	9,472	39.97	22.87	0.13
	45-64	17,161	27.57	44.38	0.25
	65+	11,791	14.29	57.30	0.16
	All Ages	38,424	26.72	42.79	0.19
Females[3]	18-44	856	29.87	19.37	0.32
	45-64	276	28.59	28.43	0.04
	65+	389	16.44	42.44	0.00
	All Ages	1,521	26.48	26.49	0.19
Both Sexes[3]	18-44	10,328	39.16	22.58	0.14
	45-64	17,437	27.58	44.11	0.25
	65+	12,180	14.35	56.87	0.16
	All Ages	39,945	26.72	42.18	0.19

Author: Jeffrey E. Harris MD PhD, September 15, 1997
Source: Tobacco Use Supplements, Current Population Survey, Sept. 1992, Jan. 1993, and May 1993.

Notes to Table 5:

1. Among 43,464 males who identified themselves as veterans, 5,040 (11.6%) did not respond to questions about tobacco use. Among 1,686 females who identified themselves as veterans, 165 (9.79%) did not respond to questions about tobacco use.
2. Respondents (or proxy respondents) were asked: "Has … smoked at least 100 cigarettes in her/her enitre life?" Those who answered yes were then asked: "Does … now smoke cigarettes every day, some days, or not at all?" Those answering "every day" or "some days" were classified as current smokers. Those answering "not at all" were classified as former smokers, while those who did not respond were classified as indeterminate status. Among the 39,945 respondents, a total of 12,220 had not smoked at least 100 cigarettes in his/her entire life. Among the remaining 27,725 responses to the second question, a total of 4,807 (17.3%) were given by proxy.
3. The approximate 95% confidence ranges of current smoking prevalence for males and for both sexes were: 18-44 years: ±1.0%; 45-64 years: ±0.7%; 65 years or more: ±0.6%; all ages: ±0.4%. The approximate 95% confidence ranges of current smoking prevalence for females were: 18-44 years: ±3.1%; 45-64 years: ±5.3%; 65 years or more: ±3.7%; all ages: ±2.2%.

Table 6. Cigarette Smoking Among 38,424 Male Veterans Who Responded to the 1992-1993 Tobacco Use Supplements to the Current Population Survey: By Type or Era of Service[1]

Type or Era of Service	Sample Size	Current Age Mean	Current Age SD	Ever Smoked (%)	Smokes Now[2] (%)	Started Age 18+ [3] (%)
World War I	31	90.0	0.0	42.3	7.9	75.4
World War II	10,942	71.1	5.0	72.0	14.4	65.7
Korean Conflict	6,359	61.4	4.1	74.3	23.2	61.6
Vietnam Era	11,522	46.4	6.1	70.3	34.6	63.6
Other Service	9,570	43.0	13.2	70.5	33.3	66.1
All Male Respondents	38,424	55.1	14.3	69.7	26.7	64.5

Author: Jeffrey E. Harris MD PhD, September 15, 1997

Source: Tobacco Use Supplements to Current Population Survey, Sept. 1992, Jan. 1993, May, 1993.

Notes to Table 6:

1. Except for sample sizes, all estimates weighted to U.S. noninstitutional civilian population.
2. The approximate 95% confidence ranges for current smoking prevalence were:
   WW I: ±9.5%; WW II: ±0.7%; Korean Conflict: ±1.0%; Vietnam Era: ±0.9%; Other Service: ±0.9%;
   All Men: ±0.4%. Estimates for WW I based upon fewer than 100 responses, but included for completeness.
3. Based upon the question: "How old was … when he/she started smoking cigarettes fairly regularly?"
   Respondents who did not report age started smoking smoking were excluded.

smoking initiation during service-eligible years may have resulted from a difference in questionnaires. In the TUS, respondents were asked about the age at which they started smoking "fairly regularly."

Smoking-Attributable Fractions

Table 7 computes the "smoking-attributable fractions" for each of the disease categories listed in Table 2. The smoking-attributable fraction represents the proportion of cases for each diagnosis that can be specifically attributed to cigarette smoking.[13] It is computed from a well-established formula that takes into account the rate of smoking in the population, as well as the extent to which smokers have higher disease rates than nonsmokers.[14] Two separate computations are shown, based upon the NMES and TUS survey results reported in Tables 3 and 5, respectively. Since the estimates of smoking rates among female veterans were based on small sample sizes, Table 7 shows the results for male veterans only.

Because American veterans have smoked more than the general population (as documented in Tables 3 through 6), they can be expected to have a higher prevalence of smoking-related diseases. Thus, smoking accounted for 27-30% of all cases of cerebrovascular disease occurring in male veterans aged 65 years or more. Had veterans smoked at the same rate as all U.S. civilian males, then the corresponding smoking-attributable fractions would have been 24%.[15]

Costs per Claim

Table 8 shows the estimated annual disability costs per claim for each of the smoking-related diseases listed in Tables 2 and 7. The Department of Veterans Affairs (DVA) estimated monthly claims for two classes of veterans: those who were not currently compensated; and those who were already compensated for another service-related disability. To obtain an overall mean monthly cost per claim, I computed a weighted average of these cost estimates under the assumption that

---

[13] See Table 7 in Harris JE. "Changes in smoking-attributable mortality." Chapter 3 in *Reducing the Health Consequences of Smoking: 25 years of progress. A report of the Surgeon General, 1989.* Rockville MD: Centers for Disease Control, Office on Smoking and Health. DHHS Publication No. (CDC) 89-8411, 1989. These diagnoses are also listed, with minor modification, in *SAMMEC 3.0: Smoking-Attributable Mortality, Morbidity, and Economic Costs. Computer software and documentation.* Atlanta GA: Centers for Disease Control and Prevention, Office on Smoking and Health, August 1996; Sect. 2: Methodology and Conceptual Issues, Table 7A, p. 22.

[14] See Harris JE, *op. cit.*, "Mathematics of Attributable Risk" pages 123-124.

[15] See Harris JE, *op. cit.*, Table 11 on page 156.

Table 7. Computation of Smoking-Attributable Fractions for U.S. Male Veterans

Smoking-Related Diagnosis	ICD-9-CM Code[1]	Relative Risks (Males)[2] Current Smoker	Former Smoker	NMES-based Smoking-Attrib. Fraction[3]	TUS-based Smoking-Attrib. Fraction[3]
Neoplasms:					
Lip, Oral Cavity, Pharynx	140-149	27.48	8.80	92.5%	91.2%
Esophagus	150	7.60	5.83	81.0%	79.3%
Pancreas	157	2.14	1.12	30.8%	26.3%
Larynx	161	10.48	5.24	83.4%	81.3%
Lung	162	22.36	9.36	91.6%	90.3%
Bladder, Other Urinary	188	2.86	1.90	50.4%	46.9%
Kidney	189	2.95	1.95	51.6%	48.2%
Cardiovascular Diseases:					
Coronary Heart Disease, Ages 45-64	410-414	2.81	1.75	44.1%	40.8%
Coronary Heart Disease, Ages 65+	410-414	1.62	1.29	25.1%	22.5%
Cerebrovascular Disease, Ages 45-64	430-438	3.67	1.38	42.9%	37.5%
Cerebrovascular Disease, Ages 65+	430-438	1.94	1.27	30.4%	26.9%
Other Circulatory Disease	440-448	4.06	2.33	61.7%	58.1%
Respiratory Diseases:					
Chronic Bronchitis	490,491,496	9.65	8.75	86.1%	84.9%
Emphysema	492	9.65	8.75	86.1%	84.9%

Author: Jeffrey E. Harris MD PhD, September 15, 1997.

Sources: Harris JE, chapter 3 in 1989 Surgeon General's Report, Table 6, p. 150; National Medical Expenditure Survey (NMES), 1987, Public Use Tapes 9 and 13; and Tobacco Use Supplements (TUS) to the Current Population Survey, Sept. 1992, Jan. 1993, and May 1993.

Notes to Table 7:

1. *International Classification of Diseases, 9th Revision, Clinical Modification.*
2. Based on 1982-1986 follow-up of American Cancer Society 50-state Study (CPS-II). Relative risks were based upon 1,491,791 man-years of exposure among male subjects aged 35 years or more.
3. Based upon the formula: $S = \left((R_c - 1)P_c + (R_f - 1)P_f \right) / \left(R_c P_c + R_f P_f + 1 - P_c - P_f \right)$, where R_c and R_f are the respective risks for current and former smokers, and where P_c and P_f are the respective prevalences of current and former smoking. In the NMES-based computations, the respective values of P_c and P_f for each age group were: ages 45-64, 33.51% and 45.44%; ages 65+, 20.11% and 56.59%; ages 45+, 34.81% and 40.93%. In the TUS-based computations, the respective values were: ages 45-64, 27.57% and 44.63%; ages 65+, 14.29% and 57.46%; ages 45+, 26.72% and 42.98%.

8.75% of all potential smoking-related claims already received compensation. The estimates in Table 8 represent the annualized values of the mean monthly costs per claim.

Table 8. Estimated Annual Costs per Disability Claim According to Smoking-Related Diagnosis

Smoking-Related Diagnosis	ICD-9-CM Code[1]	Mean Claim Cost per Year[2]
Cancers:		
Lip, Oral Cavity, Pharynx	140-149	1,163
Esophagus	150	13,229
Pancreas	157	9,119
Larynx	161	13,229
Lung	162	13,229
Bladder, Other Urinary	188	2,093
Kidney	189	2,093
Cardiovascular Diseases:		
Coronary Heart Disease	410-414	7,414
Cerebrovascular Disease	430-438	5,249
Other Circulatory Disease[3]	440-448	11,498
Respiratory Diseases:		
Chronic Bronchitis[4]	490,491,496	7,414
Emphysema[4]	492	7,414

Author: Jeffrey E. Harris MD PhD, September 15, 1997.
Source: Cost estimates based upon C&P data by Dept. of Veterans Affairs, adjusted for COLA to 1998.
Notes to Table 8:
1. *International Classification of Diseases, 9th Revision, Clinical Modification*.
2. Weighted average of non-currently compensated and currently compensated monthly costs, scaled to annual basis. The relative weights were: 91.25% and 8.25% for non-compensated and compensated cases.
3. Based on diagnosis-specific estimates for "peripheral vascular disease (atherosclerosis)"
4. Based on diagnosis-specific estimates for "chronic obstructive lung disease"

Computing Total Costs of Smoking-Attributable Disability Claims

Table 9 illustrates the computation of total smoking-related disability claims costs for male veterans aged 45 years or more with coronary heart disease (CHD). Four alternative calculations are made: two in which only 20% of eligible veterans file claims (“low claim rate”); and two in which 80% file claims (“high claim rate”). For each “claim rate,” estimates of the smoking-attributable fractions and the proportion

who started smoking during military service are based alternatively on NMES or TUS survey data.

For each of the four alternative calculations, the sequence of multiplication steps described in Figure 1 is carried out for men aged 45-64 years and men aged 65 or more years, respectively. The total costs across all age groups are then computed. As noted in the lower panel to Table 9, the range of costs is from $0.5 to $2.8 billion; the average is approximately $1.5 billion.

The procedure described in Table 9 may result in an upper limit of costs that is, in fact, too low. If all eligible veterans filed claims, then the total costs based on TUS survey data would equal an estimated $3.5 billion. In addition, if all veterans who ever smoked filed claims, even if they started regular cigarette use prior to military service, then the total potential costs due to coronary disease alone would equal over $5.4 billion.

Table 10 shows the results of applying the same procedure as in Table 9 to each of the smoking-specific diagnoses. I make eight different calculations based on the following dimensions: low versus high claim rate; NMES- versus TUS-based calculations; and the use of “chronic bronchitis” versus “emphysema” as an indicator of the rate of chronic obstructive lung disease. (Since many patients with smoking-induced chronic lung disease have coexisting chronic bronchitis and emphysema, it would be more appropriate to include claims for one of these diagnoses, but not for both.)

Table 9. Computation of Total Claims Costs Among Male Veterans Aged 45 Years or Older Based upon Smoking-Induced Service-Related Disability from Coronary Heart Disease (CHD)

Alternative Scenario	Survey Data Used	Age Group	Veteran Population	Prevalence of CHD (per 1,000)	Smoking-Attributable Fraction (%)	Proportion Who Started Smoking During Service (%)	Proportion Filing Claims (%)	Annual Cost per Claim	Total Claims Costs ($millions)
Low	NMES	45-64	10,650,236	81.9	44.1%	44.1%	20%	7414	252
Claim		65+	8,819,758	191.8	25.1%	44.1%	20%	7414	278
Rate		All Ages							529
	TUS	45-64	10,650,236	81.9	40.8%	64.5%	20%	7414	340
		65+	8,819,758	191.8	22.5%	64.5%	20%	7414	364
		All Ages							704
High	NMES	45-64	10,650,236	81.9	44.1%	44.1%	80%	7414	1,006
Claim		65+	8,819,758	191.8	25.1%	44.1%	80%	7414	1,111
Rate		All Ages							2,117
	TUS	45-64	10,650,236	81.9	40.8%	64.5%	80%	7414	1,361
		65+	8,819,758	191.8	22.5%	64.5%	80%	7414	1,456
		All Ages							2,818

	Mean	Range of Estimates	
Total Claims Costs of	Value	Lower	Upper
Coronary Heart Disease ($millions)	1,542	529	2,818

Author: Jeffrey E. Harris MD PhD, September 15, 1997
Source: Tables 1 through 8.

Table 10. Computation of Total Claims Costs Among Male Veterans Aged 45 Years or Older Based upon Service-Related Disability from All Smoking-Specific Diagnoses[1]

	LOW CLAIM RATE				HIGH CLAIM RATE			
	NMES-Based		TUS-Based		NMES-Based		TUS-Based	
Smoking-Related Diagnosis	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Lip, Oral Cavity, Pharynx	3	3	4	4	11	11	15	15
Esophagus	4	4	6	6	16	16	23	23
Pancreas	1	1	1	1	3	3	4	4
Larynx	18	18	26	26	73	73	104	104
Lung	61	61	88	88	243	243	350	350
Bladder, Other Urinary	20	20	27	27	81	81	110	110
Kidney	6	6	8	8	23	23	32	32
Coronary Heart Disease	252	252	340	340	1,006	1,006	1,361	1,361
Coronary Heart Disease	278	278	364	364	1,111	1,111	1,456	1,456
Cerebrovascular Disease	43	43	55	55	173	173	221	221
Cerebrovascular Disease	66	66	85	85	264	264	341	341
Other Circulatory Disease	475	475	654	654	1,900	1,900	2,617	2,617
Chronic Bronchitis	519		748		2,074		2,991	
Emphysema		399		575		1,596		2,302
Total	1,744	1,625	2,407	2,234	6,977	6,500	9,627	8,937

Total Claims Cost ($millions)

Average	**5,006**
Low	**1,625**
High	**9,627**

Author: Jeffrey E. Harris MD PhD, September 15, 1997

Source: Tables 1 through 9.

Notes to Table 10:

1. Columns (1) and (2) use different prevalence rates for "Chronic Obstructive Lung Disease."

As shown in Table 10, the mid-point estimate of total disability claims costs is $5.0 billion, with a range of $1.6 to $9.6 billion. As already noted, such an estimate could be too low. If all eligible veterans filed claims (rather than the 20 to 80% assumed in Table 10), then total costs would equal $8.1 to $11.2 billion. In addition, if all veterans who ever smoked filed claims, even if they started regular cigarette use prior to military service, then the total potential costs due to all smoking-related diseases would equal $18.4 to $19.8 billion.

Table 10 also shows that cardiovascular and respiratory diseases contribute far and away the large majority of claims costs for smoking-related service disability. This conclusion, however, may hinge upon my inclusion of only those smoking-related cancers that were diagnosed in the past five years.

The procedure described in Figure 1 and illustrated in Table 9 can also be used to estimate the number of veterans who will file claims for compensation. To make such an estimate, all the steps in Figure 1 are carried out except the last multiplication. Based upon such a procedure, I obtain a mid-point estimate that 620,000 male veterans aged 45 years or more will file claims, with a range of 201,000 to 1,195,000. If all veterans who ever smoked filed claims, then the total potential population of claimants would range from 2,135,000 to 2,460,000. These estimates– as well as the cost estimates in Table 10– hinge on the assumption that veterans do not have multiple smoking-related illnesses. Since smokers with coronary heart disease or lung cancer often have coexistent chronic obstructive lung disease, such an assumption is plainly inaccurate. It is unclear, however, whether more realistic assumptions about coexistent smoking-related diagnoses would have a material impact on estimates of the number or costs of disability claims.

Summary

I analyzed the total costs of service-connected claims for disability due to cigarette smoking-related diseases among living male veterans aged 45 years and over. My analysis was confined to veterans who already had smoking-related illnesses and injury. I did not project future smoking-related disease rates. Nonetheless, my finding that veterans of both the Vietnam Era and the Gulf War currently have higher smoking rates than older veterans suggests that the costs of smoking-related disability will likely increase over next two decades.

As shown in Table 10, my mid-point estimate of total costs is $5.0 billion, with an uncertainty range from approximately $1.6 to $9.6 billion. Such an estimate represents the cumulative backlog of disability claims among living veterans who already have smoking-related diseases.

The main sources of uncertainty in my analysis were the proportion of currently ill veterans who will file claims, as well as the proportion of veterans who began smoking during military service. In the extreme case where all eligible veterans filed

claims, regardless of the age that they started to smoke, total potential costs could reach $20 billion.

Because of limitations of data, this first analysis did not include the costs to veterans under age 45 and to female veterans. While these categories will add to the total cost estimates, their marginal contributions are unlikely to be large. Likewise, I did not estimate the costs of claims for survivor and burial benefits by spouses of deceased veterans. In comparison to the backlog of claims for disability among living veterans with smoking-related diseases, these additional costs are also likely to be small.

To improve the accuracy of the assessment of the total costs of tobacco-related disability among veterans, it would be useful to refine the estimates of per-case disability costs, and to study the factors that influence eligible afflicted veterans to file service-related disability claims. Sensitivity analyses concerning the number of veterans with multiple, coexisting smoking-related diagnoses, as well as tests of alternative models of the prevalence of smoking-related cancers, would also be useful.

Acknowledgments

This report relied upon the inputs of many people in the Department of Veterans Affairs, including (but not limited to) Patricia J. O'Neil, George Sheldon, and John Hisnanick. However, the opinions expressed in this Report are the my sole responsibility. They do not necessarily represent the views of the above individuals, the Department of Veterans Affairs, or any other federal or non-federal organization.