

# Mortality Patterns among Vietnam Veterans

A 24-Year Retrospective Analysis

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*The mortality experience of 33,833 US Army and Marine Corps Vietnam veterans who died during 1965–1988 was compared with that of 36,797 deceased non-Vietnam veterans using proportionate mortality ratios (PMRs). Military service information was abstracted from military personnel records and cause of death information recorded from death certificates.*

*Army Vietnam veterans had statistically significant excesses of deaths from laryngeal cancer (PMR = 1.38) and lung cancer (PMR = 1.08). There was an excess of external causes (PMR = 1.03), including motor vehicle accidents (PMR = 1.03) and accidental poisonings (PMR = 1.17). In contrast to Army Vietnam veterans, the results for Marine Vietnam veterans varied according to the referent population used. When compared with non-Vietnam veterans, Marine Vietnam veterans had significantly elevated PMRs for lung cancer (PMR = 1.17) and skin cancer (PMR = 1.33). There was also a significant excess of external causes of death (PMR = 1.06), accidental poisonings (PMR = 1.19), and homicides (PMR = 1.16) compared with all non-Vietnam veterans.*

Numerous mortality studies have been conducted to evaluate the health concerns of veterans who served in Vietnam. Vietnam Veterans from New York, Wisconsin, West Virginia, and Massachusetts have shown an excess risk of death from external causes of death, including motor vehicle accidents, accidental poisonings, suicides, or homicides.<sup>1–4</sup> The Centers for Disease Control (CDC) also reported that external causes of death were elevated for Vietnam veterans.<sup>5</sup>

The Department of Veterans Affairs (VA) conducted a post-Vietnam service mortality study of approximately 50,000 Army and Marine veterans who died between 1965 through 1982.<sup>6</sup> Army Vietnam veterans had significant excesses of deaths for motor vehicle accidents, non-motor vehicle accidents, and accidental poisonings when compared with Army non-Vietnam veterans. Lung cancer and non-Hodgkin's lymphoma were significantly elevated among Marine Vietnam veterans when compared with Marine non-Vietnam veterans. The follow-up study conducted in 1990 included an additional 11,325 veterans who died during 1982 through 1984.<sup>7</sup> The follow-up study reported statistically significant excesses for lung and laryngeal cancer among Army Vietnam veterans when compared with all non-Vietnam veterans. The excess deaths for lung cancer and non-Hodgkin's lymphoma among Marine Vietnam veterans reported in the earlier study persisted when compared with Marine non-Vietnam veterans.

This second follow-up study included an additional 9040 veterans

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who were randomly selected from Vietnam-era veterans who died during 1984–1988. The persistence of excess deaths due to external causes among Vietnam veterans will be examined as well as the excesses of deaths for certain cancers among Army and Marine Vietnam veterans.

**Methods**

**Study Subjects**

Study subjects were selected from the VA Beneficiary Identification and Record Locator Subsystem (BIRLS). BIRLS is an automated information retrieval system used by the VA to identify and locate veteran records. Three subfiles of deceased Army and Marine male veterans who served in the military during the Vietnam-era were selected from BIRLS (Fig. 1). The first subfile of 186,000 included veterans whose date of death was between July 4, 1965 and June 30, 1982, and whose military service dates included some period of time between 1965 and 1973. When military service data (branch, service dates, etc.) were missing in BIRLS, veterans whose birth year was between 1935 and 1957 (inclusive) were selected because of the high likelihood that they served during the Vietnam-era. The second subfile included veterans whose date of death was between January 1, 1982 and December 31, 1984. The third subfile included veterans whose date of death was between July 1, 1984 and June 30, 1988.

A random sample of 75,617 veterans was selected from the first subfile of 186,000 (Fig. 1). All 15,038 veterans from the second subfile were included, and a random sample of 11,851 veterans was selected from the third subfile of 59,259 (Fig. 1). The 102,506 veterans from the three subfiles made up the total sample. The military personnel records of 100,153 (97.7%) veterans were obtained from the National Personnel Records Center (NPRC) in St. Louis, Missouri. The records of 2353 veter-

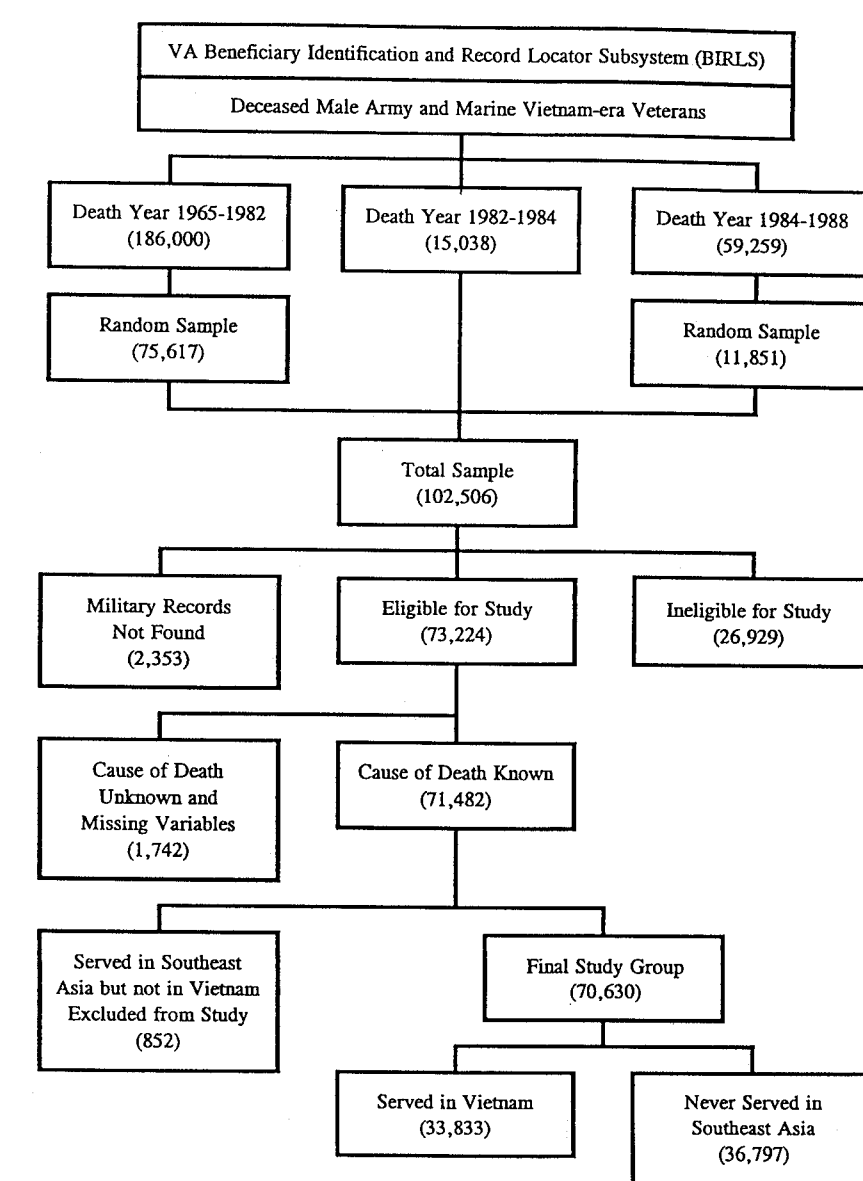


Fig. 1. Selection process of the three subfiles to produce the final study group.

ans could not be located at the NPRC or elsewhere. Of the 100,153 veterans with military records, 26,929 (26.9%) were excluded for the following reasons: duplicate names were on the file; service was in the Air Force, Navy, or Coast Guard; military service was not between 1965 and 1973; veteran was killed in Vietnam or missing in action; individual died in service before 1974; death was due to war-related injuries; the veteran was female; or wrong veteran was abstracted. Demographic and military information such as branch of service, length of

service, rank at discharge and military occupational specialty code (MOSC) was abstracted for the 73,224 eligible men. Additional information such as dates of service, principal duty, and unit addresses was abstracted for veterans who served in Vietnam, Thailand, Cambodia, or Laos.

Death certificates for all but 1742 (2.4%) of the 73,224 veterans with military records were obtained from sources including VA Regional Offices, Federal Records Centers, and state vital statistics offices. Underlying cause of death for each subject

**TABLE 1**  
Distribution of Deceased Vietnam-era Veterans by Demographic and Military Service Variables

	Army				Marine			
	Service in Vietnam				Service in Vietnam			
	Yes (n = 27,596)		No (n = 31,757)		Yes (n = 6237)		No (n = 5040)	
	n	%	n	%	n	%	n	%
Race								
White	21,620	78.3	25,352	79.8	5,219	83.7	4,133	82.0
Black	5,345	19.4	5,667	17.9	866	13.9	798	15.8
Other	631	2.3	738	2.3	152	2.4	109	2.2
Age at death								
≤24	1,250	4.6	2,840	8.9	345	5.5	855	17.0
25-34	11,763	42.6	13,910	43.8	3,168	50.8	2,875	57.0
35-44	7,766	28.1	7,861	24.8	1,670	26.8	834	16.6
≥45	6,817	24.7	7,146	22.5	1,054	16.9	476	9.4
Rank								
Enlisted	25,432	92.2	29,576	93.1	5,824	93.4	4,851	96.2
Warrant officer	640	2.3	323	1.0	65	1.0	18	.4
Officer	1,524	5.5	1,858	5.9	348	5.6	171	3.4
Length of service								
1 year or less	531	1.9	4,376	13.8	236	3.8	1,365	27.1
2-4 years	15,773	57.2	18,236	57.4	3,975	63.7	2,771	55.0
5-19 years	4,083	14.8	2,650	8.3	887	14.2	479	9.5
20 years or more	7,209	26.1	6,495	20.5	1,139	18.3	425	8.4

was coded by a qualified nosologist according to the rules in effect at the time of death, but using the rubrics of the International Classification of Diseases, 8th Revision (ICDA-8).<sup>8</sup> Military service status of the subjects was unknown to the nosologist.

Of the 71,482 men included in the analysis, 33,833 served in Vietnam, 36,797 never served in Southeast Asia, and 852 served in Thailand, Laos, or Cambodia. The 852 veterans who served in Southeast Asia but never in Vietnam were excluded from the analysis. The final study group of 70,630 veterans included 62,068 from the two earlier mortality studies.<sup>6,7</sup>

### Statistical Methods

As part of an internal comparison, cause-specific numbers of deaths observed among Vietnam veterans were compared with the corresponding expected numbers calculated by using the cause-specific proportions of deaths among the non-Vietnam veteran referent groups, adjusting for age at death, race, and calendar year of death. The proportional mortality ratios (PMRs) were calculated as the

ratio of observed to expected number of deaths.<sup>9</sup> A cause-specific PMR was considered statistically significant when the 95% confidence interval (CI) did not include 1.0. Separate analyses of Army and Marine Vietnam veterans were performed because of the possible variation in types of environmental exposure in Vietnam either by virtue of unit locations or types of duties performed. The Marine units were almost always located within the I Corps region (northernmost part) of South Vietnam. Two referent groups were used to calculate the PMRs: (1) branch specific (Army and Marine) non-Vietnam veterans; (2) all non-Vietnam veterans combined. The first referent group was used to calculate PMRs separately for Army and Marine Vietnam veterans using their corresponding non-Vietnam counterparts to determine the expected number of deaths. The small number of deaths among the Marine non-Vietnam veterans may cause unstable proportions of deaths especially for rare causes of death. Therefore, a second set of PMRs for Army and Marine Vietnam veterans was

calculated using all non-Vietnam veterans combined as a referent group.

For external comparisons, the third referent group of US males was used to compare the mortality experience of each veteran group. The US male population alone would not be an appropriate referent group because of the healthy selection bias inherent in the military service enlistment process.

## Results

### Demographic and Military Characteristics

The distributions of subjects by race and age at death were comparable by branch of service and Vietnam service status (Table 1) with a few exceptions. Marine non-Vietnam veterans had a higher percentage of deaths before age 25 (17%) than Marine Vietnam veterans (5.5%). Rank distribution was similar by branch of service and Vietnam service status. Approximately 3% of Vietnam veterans served 1 year or less compared with approximately 20% for the non-Vietnam veterans.

TABLE 2

Mortality Patterns by Major and Cancer Causes among Vietnam Veterans, 1965-1988

Underlying Cause (8th Revision, ICDA)	Army			Marine		
	Observed	PMR <sup>a</sup>	PMR <sup>b</sup>	Observed	PMR <sup>c</sup>	PMR <sup>b</sup>
All causes	27,596	1.00	1.00	6,237	1.00	1.00
Infectious diseases (000-136)	223	.94	.96	39	.98	.79
Cancer (140-174, 185-209)	3,954	.99	1.00	822	1.20*	1.04
Pancreas (157)	147	1.00	1.02	34	1.47*	1.28
Larynx (161)	50	1.47*	1.38*	4	.47	.65
Lung (162)	1,139	1.06*	1.08*	215	1.48*	1.17*
Connective tissue (171)	47	1.03	.97	12	.72	1.08
Skin (172-173)	234	1.00	1.00	73	1.28*	1.33*
Prostate (185)	58	.92	.87	9	.79	.90
Testis (186-187)	114	1.16	1.12	28	.79	1.07
Non-Hodgkin's lymphoma (200 & 202)	171	.88	.91	46	1.68*	1.10
Hodgkin's disease (201)	125	1.01	1.10	25	1.85*	.89
Multiple myeloma (203)	36	.86	.87	4	.56	.51
Circulatory diseases (390-458)	5,756	.97	.97	1,048	.92*	.92*
Respiratory diseases (460-519)	648	.94	.96	111	1.11	.83*
Digestive diseases (520-577)	1,494	.99	.99	269	.90	.87*
All external causes (800-999)	13,589	1.04*	1.03*	3,575	1.02	1.06*
Motor vehicle (810-827)	4,618	1.03*	1.03*	1,195	1.02	1.02
Poisoning (850-877)	603	1.18*	1.17*	159	1.11	1.19*
Suicide (950-959)	2,673	.97	.96	740	1.01	1.02
Homicide (960-978)	2,265	1.05*	1.02	617	1.01	1.16*

<sup>a</sup> Expected numbers based on 31,757 deaths among Army non-Vietnam Veterans.<sup>b</sup> Expected numbers based on 36,797 deaths among non-Vietnam Veterans.<sup>c</sup> Expected numbers based on 5040 deaths among Marine non-Vietnam Veterans.

\* Statistically significant with the 95% confidence interval not including 1.0.

### Internal Comparison to Non-Vietnam Veterans

Table 2 shows mortality patterns for selected major causes of death including cancers and external causes. Among Army Vietnam veterans, cancer mortality patterns were similar regardless of whether the referent group included all non-Vietnam veterans or only Army non-Vietnam veterans. There was a significant excess of laryngeal cancer among Army Vietnam veterans when compared with Army non-Vietnam veterans (PMR<sup>a</sup> = 1.47, CI = 1.09-1.94) and all non-Vietnam veterans (PMR<sup>b</sup> = 1.38, CI = 1.03-1.83). A slightly increased frequency of lung cancer deaths was statistically significant with either referent group. Fewer deaths from non-Hodgkin's lymphoma and multiple myeloma were observed than expected based on either comparison group.

There was a statistically significant excess of deaths for all external

causes among Army Vietnam veterans regardless of whether expected numbers were based on Army non-Vietnam veterans or all non-Vietnam veterans. Of the external causes, the PMRs for motor vehicle accidents and accidental poisonings were significantly elevated. The excess of homicide deaths was significant when compared with Army non-Vietnam veterans (PMR<sup>a</sup> = 1.05, CI = 1.01-1.09) but not when compared with all non-Vietnam veterans. None of the other major causes of death or site specific cancers were significantly elevated.

In contrast to Army Vietnam veterans, the results for Marine Vietnam veterans varied according to the referent population used (Table 2). Marine Vietnam veterans had a significant excess of cancer deaths (PMR<sup>c</sup> = 1.20, CI = 1.12-1.28) when compared with Marine non-Vietnam veterans. There were significantly elevated frequencies of deaths due to cancers of the pancreas (PMR<sup>c</sup> =

1.47, CI = 1.02-2.05), lung (PMR<sup>c</sup> = 1.48, CI = 1.29-1.69), skin (PMR<sup>c</sup> = 1.28, CI = 1.00-1.61), non-Hodgkin's lymphoma (PMR<sup>c</sup> = 1.68, CI = 1.23-2.24), and Hodgkin's disease (PMR<sup>c</sup> = 1.85, CI = 1.20-2.73) among Marine Vietnam veterans. The PMRs for external causes did not deviate significantly from 1.0. There was a significant deficit of deaths due to circulatory disease (PMR<sup>c</sup> = 0.92, CI = 0.87-0.98). When all non-Vietnam veterans were used as a comparison group, Marine Vietnam veterans had significant excesses for lung cancer (PMR<sup>b</sup> = 1.17, CI = 1.02-1.34) and skin cancer (PMR<sup>b</sup> = 1.33, CI = 1.04-1.67). Furthermore, Marine Vietnam veterans had a statistically significant excess of deaths from external causes (PMR<sup>b</sup> = 1.06, CI = 1.03-1.10), accidental poisonings (PMR<sup>b</sup> = 1.19, CI = 1.01-1.39) and homicides (PMR<sup>b</sup> = 1.16, CI = 1.07-1.26). Proportionate mortality ratios for deaths due to circulatory,

TABLE 3

Mortality Patterns by Major and Cancer Causes among Vietnam-era Veterans, 1965-1988 Compared with US Men

Underlying Cause (8th Revision, ICDA)	Army				Marine			
	Vietnam		Non-Vietnam		Vietnam		Non-Vietnam	
	Obs	PMR	Obs	PMR	Obs	PMR	Obs	PMR
Infective diseases (000-136)	223	.63*	270	.69*	39	.50*	29	.49*
Cancer (140-174, 185-209)	3,954	1.04*	4,358	1.05*	822	1.07	431	.87*
Pancreas (157)	147	1.03	170	1.11	34	1.30	13	.95
Larynx (161)	50	1.32	34	.88	4	.67	4	1.38
Lung (162)	1,139	1.12*	1,141	1.06*	215	1.21*	77	.86
Connective tissue (171)	47	1.18	53	1.13	12	1.25	11	1.45
Skin (172-173)	234	1.05	235	.98	73	1.34*	36	.98
Prostate (185)	58	1.08	103	1.22*	9	1.17	6	1.30
Testis (186-187)	114	1.09	119	.96	28	1.02	26	1.06
Lymphosarcoma and reticulosarcoma (200 & 202.2)	169	.93	221	1.08	45	1.06	15	.48*
Hodgkin's disease (201)	125	.93	137	.89	25	.73	15	.54*
Multiple myeloma (203)	36	.92	45	1.07	4	.58	4	1.12
Circulatory diseases (390-458)	5,756	.97*	6,292	.98*	1,048	.91*	628	.95
Respiratory diseases (460-519)	648	.81*	823	.87*	111	.68*	70	.60*
Digestive diseases (520-577)	1,494	.96	1,579	1.00	269	.83*	183	.92
All external causes (800-999)	13,584	1.10*	16,115	1.07*	3,575	1.14*	3,396	1.13*
Motor vehicle (810-827)	4,618	1.16*	5,557	1.11*	1,195	1.16*	1,164	1.10*
Poisoning (850-877)	603	1.16*	671	.94	159	1.19*	133	1.00
Suicide (950-959)	2,673	1.09*	3,381	1.15*	740	1.16*	692	1.20*
Homicide (960-978)	2,265	.92*	2,705	1.34*	617	1.06*	627	1.12*

\* Statistically significant with the 95% confidence interval not including 1.0.

respiratory, and digestive diseases were significantly lower among Marine Vietnam veterans than all non-Vietnam veterans.

### External Comparison to the US Population

To evaluate the presumed "healthy veteran effect" for natural causes of death, the mortality experience of each veteran group was compared with that of the US male population. As expected, all four groups of veterans had a substantially lower mortality for major natural cause of death categories such as infectious, circulatory, respiratory, and digestive diseases than the general US population (Table 3). However, PMRs for all cancers and lung cancer were higher among the veteran

groups with the exception of the Marine non-Vietnam veteran group.

The PMRs for external causes showed excess deaths due to motor vehicle accidents and suicide in all four veteran groups when compared to the US population. The PMR for accidental poisoning was significantly elevated for Vietnam veterans but not for non-Vietnam veterans, whereas PMRs for homicide were significantly elevated for all veteran groups except the Army Vietnam veterans.

### Consideration of Time since Vietnam Service

Table 4 showed mortality patterns for cancer and external causes by years since leaving Vietnam. Several significantly elevated PMRs for can-

cer among Army and Marine Vietnam veterans displayed patterns of a possible latency effect in that PMRs corresponding to later years were greater than PMRs for earlier years. Examples include laryngeal and testicular cancer in Army veterans, and overall cancers, skin cancer, non-Hodgkin's lymphoma, and Hodgkin's disease in Marine veterans. The significantly elevated PMRs for external causes of death among Army veterans were observed primarily during the first two earlier latency categories, within 15 years of Vietnam service.

### Discussion

The significant excess of external causes of death seen in the present study among Army and Marine Viet-

**TABLE 4**  
Cancer Mortality among Vietnam Veterans by Latency

Cancer Site (8th Revision, ICDA)	Army				Marine			
	Overall <sup>a</sup> PMR	PMR <sup>a</sup> by Latency <sup>b</sup> (years)			Overall <sup>c</sup> PMR	PMR <sup>c</sup> by Latency <sup>b</sup> (years)		
		0-10	11-15	≥16		0-10	11-15	≥16
Cancer (140-174, 185-209)	.99	.97	.98	1.05	1.20*	1.12	1.23*	1.23*
Pancreas (157)	1.00	.89	1.01	1.14	1.47*	3.88*	1.40	.92
Larynx (161)	1.47*	1.44	1.44	1.58	.47	.00	.48	.57
Lung (162)	1.06*	1.06	1.05	1.09	1.48*	1.96*	1.47*	1.21
Connective tissue (171)	1.03	1.55	.74	.81	.72	.34	1.13	1.15
Skin (172-173)	1.00	.97	1.00	1.09	1.28*	1.37	1.04	1.62*
Prostate (185)	.92	.98	.77	1.12	.79	1.13	1.26	.54
Testis (186-187)	1.16	.92	1.86*	.88	.79	.75	1.02	.00
Non-Hodgkin's lymphoma (200 & 202)	.88	.79	.88	1.13	1.68*	1.57	1.74*	1.82
Hodgkin's disease (201)	1.01	.93	1.09	1.12	1.85*	1.18	3.46*	.00
Multiple myeloma (203)	.86	.59	.90	1.34	.56	.39	.50	.79
All external causes (800-999)	1.04*	1.04*	1.03*	1.06	1.02	1.00	1.03	1.04
Motor vehicle (810-827)	1.03*	1.05*	.99	1.04	1.02	1.07	.97	.93
Poisoning (850-877)	1.18*	1.11*	1.27*	1.30	1.11	1.17	1.03	1.22
Suicide (950-959)	.97	.95	.99	.99	1.01	.88	1.14*	1.12
Homicide (960-978)	1.05*	1.03	1.08*	1.10	1.01	.98	1.10	.93

<sup>a</sup> Expected numbers based on 31,757 deaths among Army non-Vietnam veterans.

<sup>b</sup> Duration from last year in Vietnam to death year.

<sup>c</sup> Expected numbers based on 5040 deaths among Marine non-Vietnam veterans.

\* Statistically significant with the 95% confidence interval not including 1.0.

nam veterans compared with all non-Vietnam veterans was consistent with other studies of Vietnam-era veterans.<sup>1-7</sup> Army Vietnam veterans had statistically significant PMRs for motor vehicle accidents and accidental poisoning compared with either referent group. Homicide was statistically significant when Army non-Vietnam veterans were used as the referent group. Vietnam Marines had a statistically significant elevated PMR for homicides not seen in the previous VA analysis and accidental poisoning reached statistical significance.<sup>7</sup> Past studies have reported excess risk for suicide among Vietnam veterans compared with non-Vietnam veterans,<sup>2,4</sup> but no increased relative frequency of suicides was seen among Vietnam veterans in the present study.

There was a significantly elevated PMR for cancer of the larynx among Army Vietnam veterans. Of the 50 deaths due to cancer of the larynx among Army Vietnam veterans, 27 occurred among the 19,708 veterans who died during 1965-1982, 18 oc-

curred among the 4437 veterans who died during 1982-1984, and 5 occurred among 3451 veterans who died during 1984-1988. In addition, the PMR for lung cancer was slightly elevated and statistically significant among Army Vietnam veterans when expected numbers were based on either veteran referent group. A study from New York<sup>1</sup> reported a statistically significant excess risk for lung cancer among Vietnam veterans. No other Vietnam veteran studies have reported excess risk of laryngeal cancer.

Information on the smoking and drinking habits of Vietnam and non-Vietnam study subjects was not available from the personnel records. Therefore, the magnitude that smoking and drinking contributed to the excess frequency for laryngeal cancer was not determined. In addition, the extent that smoking added to the excess frequency for lung cancer is unknown. However, other studies have shown that Vietnam veterans did not appear to smoke and drink with greater frequency than non-

Vietnam veterans.<sup>10-11</sup> Furthermore, there were no excesses of deaths for other smoking-related causes such as emphysema or heart disease among Army or Marine Vietnam veterans.

Marine Vietnam veterans had significantly elevated PMRs for pancreatic cancer, lung cancer, skin cancer, non-Hodgkin's lymphoma and Hodgkin's disease when expected numbers were based on Marine non-Vietnam veterans. In comparison with all non-Vietnam veterans, there were significant excesses for lung cancer and skin cancer among Marine Vietnam veterans. The excess deaths due to pancreatic cancer and skin cancer were not reported in the previous VA studies. The relatively small numbers of Marine non-Vietnam veteran deaths available for a comparison group, coupled with a substantially different age at death distribution than that for Marine Vietnam veterans, may have resulted in unstable proportions of deaths by age at death and calendar period, particularly for rare causes of death. Because the healthy selection bias is

probably the same for both Army and Marine veterans, the comparisons based on the more stable proportions for all non-Vietnam veterans combined may be more appropriate than those based on the branch-specific non-Vietnam groups.

There seemed to be a latency effect for testicular cancer among Army Vietnam veterans with a significant PMR in the 11–15 years category (PMR = 1.86, CI = 1.36–2.47). The Army Vietnam veterans had a median age of death of 36 in that category. Testicular cancer is the second most common cancer among white males between the ages of 35 and 39.<sup>12</sup> Among Marine Vietnam veterans, there seemed to be a latency effect for non-Hodgkin's lymphoma with a significant PMR of 1.74 (CI = 1.07–2.65) and for Hodgkin's disease with a significant PMR of 3.46 (CI = 1.93–5.70) in the 11–15 years category.

The limitations of PMR studies should be considered when drawing conclusions from the analyses in this study. First, actual mortality rates are not determined in PMR studies but only proportions of cause-specific death. Second, if the study population has a very low overall mortality rate compared with the referent group, then risk will be overestimated for some causes (this study attempted to overcome this "healthy veteran effect" by using a veteran comparison group). A CDC study of Army Vietnam veterans showed that the mortality rate of Vietnam veterans was 17% higher than the rate among the non-Vietnam veterans.<sup>5</sup> Therefore, PMRs for certain cancers reported in this study could have been biased toward underestimating the risks. Third, the number of deaths for rare causes were probably small even with a large comparison popu-

lation. Consequently, the proportions generated could be unstable. Fourth, because multiple comparisons were made, some statistically significant results would be expected owing to chance alone. Finally, specific etiologic and environmental factors that influence mortality rates could not be determined in this study.

Despite the limitations, this study provides valuable information because it is the largest mortality study of Vietnam veterans ever reported. The inclusion in the analysis of a comparably large non-Vietnam population whose characteristics were well-defined and similar to the study group is a major strength of this study. The high acquisition rate of military records and death certificates was also a strong point of this study. Military personnel records were retrieved and reviewed for approximately 98% of the potential study subjects to determine eligibility. In addition, death certificates were gathered for 97.6% of the eligible veterans with military records.

In summary, in comparison with non-Vietnam veterans, Army Vietnam veterans had a significant excess of deaths due to all external causes. Statistically significant excess of cancers of the larynx and lung were also observed, but the magnitude of the PMR for lung cancer was not very large. Marine Vietnam veterans had a significantly elevated PMR for lung cancer and skin cancer. There was also a significant excess of external causes, accidental poisonings, and homicides compared with all non-Vietnam veterans.

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