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Current Trends

Postservice Mortality Among Vietnam Veterans

The CDC has recently completed the first phase of the Vietnam Experience Study (VES), a comprehensive study of the health of Vietnam veterans. The VES is a historical cohort study in which the health of 9,324 Vietnam veterans is compared with that of 8,989 non-Vietnam veterans who served in Korea, Germany, or the United States during the Vietnam era. Eligibility for the study was limited to male U.S. Army veterans who first entered military service between 1965 and 1971, who served a single term of enlistment, and who were discharged alive in the enlisted pay grades E-1 through E-5. Participants were randomly selected from computerized lists of accession numbers taken from the military personnel files of Army veterans who were discharged during the relevant time period.

The VES has three components: an assessment of mortality; health interviews of living veterans; and a clinical, psychological, and laboratory evaluation of a random sample of those persons who completed the health interview. The mortality component is the portion of the VES that has recently been completed; a summary of this phase follows (1).

Several methods were used to determine the number of deaths occurring among Vietnam veterans after discharge from active duty and before January 1, 1984. The result was nearly complete ascertainment of the vital status for both cohorts. In addition to an analysis based on the cause of death as specified on each death certificate, a medical review panel independently assigned an underlying cause of death using information from supplemental sources. These sources included personal physicians as well as hospital records, autopsy reports, and coroner and law enforcement files. Causes of death were coded according to the Ninth Revision of the International Classification of Diseases (2).

The study indicated that veterans of service in Vietnam experienced a 17% higher rate of postservice mortality than veterans who served in Korea, Germany, or the United States. The most noteworthy pattern of overall mortality was the changing difference between Vietnam and non-Vietnam veterans over time. During the first 5 years after discharge, Vietnam veterans had a mortality rate 1.5 times higher than non-Vietnam veterans (Table 1). During the succeeding years, there was essentially no difference between the two groups. This pattern was generally consistent across most demographic and military subgroups of veterans. When the data were stratified by type of military unit and military occupational specialty, the relative risk of postdischarge mortality for those less likely to have been in combat was similar to the risk for those who were more likely to have been in combat.

External causes, which include both intentional and unintentional injuries, accounted for most of the increased mortality in the early postservice period. Fatal injuries from motor vehicle crashes (MVC) were approximately two times more likely among Vietnam veterans than non-Vietnam veterans during this time (Table 2). A more detailed examination of MVC deaths

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did not indicate any particular factor that could explain the overall excess among Vietnam veterans. Data on the involvement of alcohol (available for 62% of MVC deaths) indicated that drinking did not account for this excess. Furthermore, the increased death rate was evident regardless of the time of day of the crash or the number of vehicles involved. Suicide and homicide showed similar increases in the early follow-up period, with both rate ratios being at or below 1.0 thereafter (Table 2).

Mortality from unintentional poisonings was elevated among Vietnam veterans throughout the follow-up period, although the number of such deaths was small (rate ratio [RR] = 2.5, 95% confidence interval [CI] = 0.88-6.92). Most of these involved the use of illicit drugs. When all drug-related deaths identified by the medical review panel were analyzed together (Table 2), the rate ratio between Vietnam and non-Vietnam veterans appeared to increase with the number of years since discharge. Furthermore, this excess was found almost exclusively among draftees; those assigned to tactical military occupational specialties; and those serving in Vietnam during 1968 or 1969, the years of heaviest combat activity.

TABLE 1. Number of deaths, person-years, and crude death rates/1,000 person-years among Vietnam and non-Vietnam veterans and rate ratios, by time since discharge - United States, 1965-1983

Years since discharge	No. deaths	Vietnam		Non-Vietnam			Rate ratio	95% CI*
		Person-years	Rate/1,000	No. deaths	Person-years	Rate/1,000		
≤5	110	46,350	2.37	73	44,747	1.63	1.45	(1.08-1.96)
6-10	72	45,855	1.57	74	44,233	1.67	0.94	(0.68-1.30)
≥11	64	35,692	1.79	53	32,350	1.64	1.09	(0.76-1.57)
All years	246	127,897	1.92	200	121,329	1.65	1.17	(0.97-1.41)

*Confidence interval.

TABLE 2. Numbers of deaths from specific causes among Vietnam and non-Vietnam veterans and unadjusted rate ratios, by time since discharge - United States, 1965-1983

Cause (Ninth Revision ICD*)	No. deaths	≤5 years		Time since discharge ≥6 years		No. deaths	All years Rate ratio (95% CI†)
		Rate ratio (95% CI†)	No. deaths	Rate ratio (95% CI†)			
Motor vehicle injuries (E810-E825)	66	1.93 (1.16-3.22)	67	1.16 (0.72-1.87)	133	1.48 (1.04-2.09)	
Other unintentional injuries§	23	1.05 (0.46-2.39)	39	0.89 (0.48-1.67)	62	0.95 (0.58-1.56)	
Suicide (E950-E959)	25	1.72 (0.76-3.88)	32	0.64 (0.32-1.30)	57	0.98 (0.59-1.65)	
Homicide (E960-E969)	18	1.52 (0.59-3.91)	33	0.78 (0.39-1.55)	51	0.99 (0.57-1.71)	
Drug-related¶	18	1.21 (0.48-3.06)	22	2.01 (0.82-4.94)	40	1.58 (0.83-3.00)	

*International Classification of Diseases.

†Confidence interval.

§Includes deaths from unintentional injuries, exclusive of deaths from motor vehicle crashes and unintentional poisonings.

¶Defined by medical review panel. Includes deaths due to drug dependence and abuse, unintentional poisonings by drugs, suicide by drugs and poisonings by drugs, intentionality undetermined.

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Circulatory system diseases were the only natural causes of death for which the mortality rate among Vietnam veterans differed from that among non-Vietnam veterans. As compared with non-Vietnam veterans, Vietnam veterans had a notable deficit in such deaths (RR = 0.5, 95% CI = 0.25-0.99).

For all causes of death except suicide, statistical adjustment for potential confounders such as age at discharge, race, military occupational specialty, and pay grade at discharge had little effect on the results. For suicide, adjustment increased the RR in the early post-service period from 1.7 to 2.5 (death certificate data).

Reported by Agent Orange Projects, Div of Chronic Disease Control, Center for Environmental Health, CDC.

Editorial Note: The intent of this study was to assess the effect of military service in Vietnam on subsequent mortality. The "Vietnam Experience" includes a wide variety of factors that could influence health. These include psychological stresses associated with war, infectious diseases prevalent in Vietnam, and exposure to the herbicide Agent Orange.

Previous studies of Vietnam veterans reveal a similar excess of mortality from external causes among Australian Vietnam veterans (3). Deaths from suicide, homicide, and unintentional poisoning occurred more frequently among Australian veterans who had served in Vietnam than among other Australian Vietnam-era veterans. Mortality associated with MVCs was not elevated overall, but data suggested an excess in the youngest age group.

Findings on mortality from external causes from four other proportional mortality studies of U.S. Vietnam veterans are not consistent with this CDC study (4-7). These four studies showed no significant increases in deaths from MVCs (5), suicide and homicide, or unintentional poisonings (4) among U.S. Vietnam veterans.

Whereas the CDC study revealed a continuing excess of drug-related deaths among U.S. Vietnam veterans, the only substance-related excess among Australian Vietnam veterans involved deaths from alcohol-related natural causes (1). These discordant findings may reflect differences in in-service use of drugs and alcohol. While the use of illicit drugs by American troops in Vietnam was reported to be heavy (8,9), drug use among Australian soldiers was reported to be uncommon. However, alcohol use was reported to be heavy among Australian soldiers (3).

The lower mortality from circulatory diseases among Vietnam veterans is unexpected and may be a by-product of the selection process for assignment to Vietnam, which may have included consideration of cardiovascular fitness established during basic or advanced training. An opposite result was found in the Australian study, where mortality due to circulatory diseases was 90% higher among Vietnam veterans than among non-Vietnam veterans (3). Various indexes of cardiovascular morbidity measured in the other components of the VES may help to further explain these mortality findings.

The CDC findings for external-cause mortality are similar to previous observations of post-service mortality in U.S. Army veterans serving in combat areas during World War II and the Korean War (10). In contrast, broader cross sections of World War II veterans, which included both men who had served in war zones and men who had not, did not show either a difference or a deficit in postdischarge traumatic deaths (10,11), as did non-Vietnam veterans in the CDC study. These findings suggest that the postservice excess of traumatic deaths among Vietnam veterans may not be unique to the Vietnam experience, but rather, may be a consequence of the unusual stresses endured while stationed in a combat zone. The pattern of drug-related deaths, however, may be more specifically linked to combat intensity rather than to the result of an across-the-board effect of the war experience.

The mortality assessment of Vietnam veterans presented here is an incomplete evaluation of the health experience of this group. Additional data on the present and past health status

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of living Vietnam veterans will be forthcoming from the health interview and laboratory and psychological evaluation components of the VES. Because this group of veterans has not yet reached the age at which chronic diseases have an important impact on mortality, continued monitoring of mortality among VES participants may provide additional insights.

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Epidemiologic Notes and Reports

Toxic Shock Syndrome Following Influenza — Oregon; Update on Influenza Activity — United States

Oregon. A case of toxic shock syndrome (TSS) following influenza has been reported to CDC. On December 11, 1986, a 13-year-old white female with fever, hypotension, and acute respiratory failure was seen at an Oregon hospital. Pertinent findings on physical examination included a temperature of 39 C (102 F); blood pressure of 60/0; evidence of upper airway obstruction; and conjunctival, palatal, and lingual hyperemia. A chest radiograph at the time of admission showed a bilateral increase in lung markings consistent with a diagnosis of early adult respiratory distress syndrome.

During the 24 hours following admission, the patient developed a diffuse, erythematous, sunburn-like rash and watery diarrhea. She required both intravenous fluids and vasopressors for treatment of severe hypotension. A diagnosis of toxic shock syndrome was considered and was supported by laboratory findings of thrombocytopenia ($70,000/\text{mm}^3$), renal insufficiency (creatinine level = 2.8 mg/dL, urea nitrogen level = 40 mg/dL), hypocalcemia (Ca = 5.9 mg/dL), and elevated levels of creatine kinase (12,000 U/L) and aspartate aminotransferase (367 U/L). *Staphylococcus aureus* was isolated from two tracheal aspirates obtained on the day of admission. Other studies, including vaginal cultures, blood cultures, and urine antigen testing, were negative for pathogenic organisms.