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HEALTH STATUS OF U. S. ARMY CHEMICAL CORPS VIETNAM-ERA VETERANS RELATIVE TO CURRENT SERUM DIOXIN CONCENTRATIONS

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Introduction

In 1991, after years of concern among veterans regarding the possible long-term health consequences of exposure to phenoxyherbicides used in Vietnam and to their contaminant dioxin (2, 3, 7, 8-tetrachlorodibenzo-p-dioxin), Public Law 102-4 was enacted. In response to that law, the National Academy of Sciences (NAS) released the report: "Veterans and Agent Orange. Health effects of herbicides used in Vietnam." In this 1994 report, the NAS committee recommended continued follow-up of the Air Force Ranch Hand cohort and its comparison group and a health study of members of the Army Chemical Corps who served in Vietnam and an appropriate comparison group.¹ Members of the Army Chemical Corps were responsible for the storage, preparation and spraying of herbicides around the perimeters of base camps and aerial spraying from helicopters in Vietnam. The concentration and intensity of their herbicide exposure was thought to be similar to those of the Ranch Hand cohort involved with the fixed wing aircraft spraying.² The U.S. Department of Veterans Affairs decided to undertake a health interview study of Army Chemical Corps personnel. This report describes preliminary study results for selected health outcomes among the 2,927 veterans who completed the telephone interview and 385 serum assessments completed by the Centers for Disease Control and Prevention (CDC).

Materials and Methods

Army Chemical Corps Vietnam veterans, for the purpose of this study, were defined as men who were on active duty in the US Army for a minimum of 18 months and whose permanent tour of duty included service in Vietnam with a military occupation specialty code (MOSC) reflecting chemical operation duties during the period from July 4, 1965 to March 28, 1973, a period during which there was a significant U.S. military combat involvement in Vietnam. The non-Vietnam veteran controls consisted of men who have similar characteristics as the Vietnam group with respect to branch of service, length of service, time period of service and military occupation except for their permanent tour of duty which did not include service in Vietnam. A total of 2,872 eligible Vietnam veterans and 2,737 eligible non-Vietnam veterans were identified from 22 Army Chemical Units assigned to Vietnam, from the automated personnel data files maintained by the Defense Manpower Data Center, and from the student class rosters of the Army Chemical School at Fort McClellan in Alabama. Of these eligible veterans, a random sample of 284 Vietnam veterans and 281 non-Vietnam veterans was selected for the feasibility study completed in 1998.

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Veterans from the original cohorts who were not known to be deceased as of December 1998 were eligible for the main study. This included 2,247 Vietnam and 2,242 non-Vietnam veterans.

Information on exposure variables was collected from telephone interviews and supplemented with and validated by military personnel records to the extent feasible. Data on health outcome variables were also collected by telephone interviews. The computer assisted telephone interview (CATI) system was used for the interviews because of its efficiency. For a number of selected health outcomes, medical and hospital records are being collected to further document the reported health outcomes. Dioxin concentrations in serum are being assessed on 800 Vietnam veterans and 100 non-Vietnam veterans, who participated in the telephone interview. Blood specimens were collected at individuals' homes by trained medical technicians using a collection device and storage containers provided by the participating CDC laboratory. Serum specimens were shipped to the CDC laboratory by overnight delivery service in accordance with the CDC protocol. The CDC lab is analyzing the serum specimens for 2, 3, 7, 8-TCDD and 5 other dioxin congeners using the analytical protocol published elsewhere.³ To date, CDC has completed assessments on 332 Vietnam veterans and 53 non-Vietnam veterans. As a measure of association for dichotomous outcomes, the odds ratio (OR) and 95% confidence interval (CI) were calculated using a multivariate logistic regression model with adjustment for covariates.⁴

Results and Discussion

Of the 4,119 veterans whose current residences could be determined for the main study, 1,499 Vietnam veterans and 1,428 non-Vietnam veterans completed the telephone interview resulting in an interview rate of 72.9 % and 69.2 %, respectively. Among both the Vietnam and non-Vietnam veterans, demographic and military characteristics of interviewed veterans were not significantly different from their respective groups of eligible veterans. However, there were differences between the Vietnam and non-Vietnam cohorts who completed the interview with respect to certain military and demographic characteristics. Compared to the non-Vietnam veteran participants, Vietnam veterans who completed the health interview were more likely to be enlisted personnel and were more likely to have remained in the service for a longer period of time. The Vietnam veterans had a greater percent of veterans who were nonwhite and were less likely to have a college degree. In addition, Vietnam veterans were slightly older at the time of interview (median age at interview was 53 years for the Vietnam veterans and 51 years for the non-Vietnam veterans). Because of these differences, adjustment for these covariates was made in the multivariate analyses.

Table 1 presents the prevalence of selected self-reported medical conditions for Vietnam veterans compared to non-Vietnam veterans without regard to any specific exposures. The odds ratios for each of the selected conditions showed an elevated risk of the selected condition among Vietnam veterans over their non-Vietnam counterparts. After adjustment for covariates, statistically significant elevated risks were observed for hepatitis and all cancers among Vietnam veterans compared to non-Vietnam veterans. In addition, Vietnam veterans were much more likely to report that they were in poor health and that their medical problems limited the kind and amount of work they did.

TABLE 1. Prevalence of Selected Health Conditions Among U.S. Army Chemical Corps Veterans by Vietnam Service Status

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Conditions	Vietnam (N=1499)		Non-Vietnam (N=1428)		Odds Ratio	
	Number	%	Number	%	Crude	Adj. (95%CI)*
Diabetes	226	15.08	136	9.52	1.58	1.11 (0.86-1.43)
Hepatitis	101	6.74	65	4.55	1.48	1.86 (1.30-2.65)
Heart Conditions	243	16.21	158	11.06	1.47	1.10 (0.87-1.39)
Current Poor Health	189	12.61	91	6.37	1.98	1.66 (1.25-2.20)
Limited in Kind & Amt. Of Work	245	16.34	135	9.45	1.73	1.49 (1.17-1.90)
Hypertension with Med.	496	33.09	355	24.86	1.33	1.03 (0.86-1.24)
All Cancer†	108	7.20	53	3.71	1.94	1.46 (1.01-2.11)

* Adjusted odds ratio and 95% confidence intervals were derived from a logistic regression model with adjustment for age, race, education, body mass index, and rank and time in service.

† Cancer category excludes non-melanoma skin cancers.

A comparison of the health status of Vietnam veterans to their non-Vietnam counterparts does not take into account the variety and level of exposure to specific toxic agents such as phenoxyherbicides that any specific Vietnam veteran might have experienced. In addition, those comparisons are subject to biases from the perception by many veterans who served in Vietnam that they had in fact received hazardous exposures that had affected their current medical condition. To address these problems, serum dioxin assessments were conducted on approximately a 20 % sample of the entire Army Chemical Corps study population. The main study phase was designed to collect 800 serum samples from Vietnam veterans and 100 samples from non-Vietnam veterans that had completed the telephone interview. This report includes the analysis of the results on the first 385 samples provided to us by CDC.

Of the 385 dioxin assessments, 332 were among Vietnam veterans and 53 were among non-Vietnam veterans. The mean 2,3,7,8 TCDD concentration in parts-per-trillion (ppt) on a lipid adjusted basis was 3.63 ppt among the Vietnam veterans compared to a mean value of 2.20 ppt among the non-Vietnam veterans. A t-test of the means showed that the difference in the means was statistically significant at the .05 level. Further examination of the dioxin concentrations among only Vietnam veterans showed a gradient of concentrations that was divided into a low and a high group. The low group had a mean dioxin concentration of 1.79 ppt with a standard deviation of 0.59 and a range of 0.55 to 3.00 ppt, and the high group had a mean dioxin concentration of 7.49 ppt with a standard deviation of 10.83 and a range of 3.15 to 85.80 ppt. These two groupings provided the basis of all additional comparisons examining the risk of selected medical conditions. Grouping the Vietnam veterans by TCDD concentration allowed for the assessment of the risk of certain diseases relative to a specific exposure.

Table 2 shows the prevalence of selected health conditions among Vietnam veterans by high and low serum TCDD concentrations. After adjustment for specific covariates, the odds ratio for diabetes in the high TCDD group compared to the low group was statistically significant (adjusted OR=2.64, 95 % confidence interval = 1.39-5.01). None of the other 6 conditions examined were significantly different from unity except for cancer which showed a significant deficit among the high TCDD concentration Vietnam veterans compared to the low TCDD concentration Vietnam

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veterans. Elevated odds ratios observed in the earlier comparisons between the Vietnam veterans and the non-Vietnam veterans do not appear to be associated with dioxin exposures.

TABLE 2. Prevalence of Selected Health Conditions Among U.S. Army Chemical Corps Vietnam Veterans by Serum TCDD Concentration

Conditions	Serum TCDD, ppt				Odds Ratio		
	Low (N=225) 1.79 ppt ± 0.59		High (N=107) 7.49 ppt ± 10.83		Crude	Adj.	(95%CI)*
	Number	%	Number	%			
Diabetes	24	10.67	27	25.23	2.36	2.64	(1.39-5.01)
Hepatitis	12	5.33	9	8.41	1.58	1.66	(0.65-4.24)
Heart Conditions	37	16.44	21	19.63	1.19	1.19	(0.64-2.23)
Current Poor Health	26	11.56	15	14.02	1.21	1.30	(0.64-2.64)
Limited in Kind & Amt. Of Work	43	19.11	19	17.76	0.93	0.91	(0.49-1.68)
Hypertension with Med.	68	30.22	34	31.78	1.05	0.96	(0.57-1.64)
All Cancer†	21	9.33	3	2.80	0.03	0.22	(0.06-0.80)

* Adjusted odds ratio and 95% confidence intervals were derived from a logistic regression model with adjustment for age, race, education, body mass index, and rank and time in service.

† Cancer category excludes non-melanoma skin cancers.

The observations found are consistent with those showing an excess of diabetes among certain subgroups of Air Force Ranch Hand personnel.⁵ Small numbers may have precluded us from observing other associations between TCDD concentration and disease. The additional serum assessments being conducted by CDC, and the medical record verification efforts that are underway should allow for a thorough evaluation of the risk of disease associated with Agent Orange exposures realized by U.S. Army Chemical Corps personnel who served in Vietnam. An accurate surrogate indicator of a high phenoxyherbicide exposure is being sought that can be applied to all the veterans completing the health interview.

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