

U. S. ARMY CHEMICAL CORPS VIETNAM VETERANS HEALTH STUDY: PRELIMINARY RESULTS

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Introduction

After years of concern among veterans regarding the possible long-term health consequence of exposure to phenoxyherbicides used in Vietnam and to their contaminant dioxin (2, 3, 7, 8-terachlorodibenzo-p-dioxin), Public Law 102-4 was enacted in 1991. The law mandated the Secretary of Veterans Affairs (VA) to support the National Academy of Sciences (NAS) in conducting a comprehensive review of the scientific and medical literature regarding the health effects of exposure to Agent Orange and other herbicides used in Vietnam. Furthermore, NAS was required to make recommendations for additional studies to resolve areas of continuing scientific uncertainty relative to herbicide exposure.

In its 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 The committee decided that the Ranch Hand Study with the 1,261 men at the start of the study was limited by the small size of the cohort, and that a study of members of the Army Chemical Corps who may also have been highly exposed to herbicides in Vietnam would substantially increase the size of the highly exposed population of Vietnam veterans and would yield greater statistical power to detect less common health outcomes. 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 level and intensity of their herbicide exposure may have been similar to those of the Ranch Hand cohort involved with the fixed wing aircraft spraying. The primary objectives of this study are 1) to compare the prevalence of various health outcomes including cancer of Army Chemical Corps personnel who served in Vietnam to those of military peers who did not serve in Vietnam, 2) to compare the prevalence of selected birth outcomes and birth defects among the children of these two veteran groups, and 3) to assess the Agent Orange exposure likelihood in these groups of veterans through the measurement of serum TCDD levels. This report describes preliminary results from the first 565 veterans (284 Vietnam and 281 non-Vietnam veteran controls) selected for a feasibility study.

Materials and Methods

Selection of Study Subject:

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)

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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 were selected for the feasibility study.

Data Collection:

Information on exposure variables were 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. For a number of selected health outcomes, medical and hospital records were obtained to further document the reported health outcomes. The computer assisted telephone interview (CATI) system was used for the interviews because of its efficiency. Dioxin levels in serum were measured on a random sample of 50 Vietnam and 50 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. The blood specimens were shipped to the CDC laboratory by overnight delivery service in accordance with the CDC protocol. The CDC lab analyzed blood specimens for 2, 3, 7, 8-TCDD and 4 other dioxin congeners using the analytical protocol published elsewhere.²

Statistical Analysis:

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.³ After log transformation of serum TCDD levels, Student's t-test was used to compare mean dioxin concentrations between two veterans groups. Pearson correlation coefficient was calculated between log transformed TCDD level and self-reported frequency of herbicides spraying.⁴

Results and Discussion

Of the original 565 veterans selected for the feasibility study, 59 (10.4%) were never located, 34 were located but deceased and 40 refused to participate. Overall, 405 veterans completed a full telephone interview and an additional 27 veterans completed an abbreviated short written questionnaire. Among both Vietnam and non-Vietnam veterans, demographic and military characteristics of interviewed veterans were not significantly different from their respective groups of eligible veterans.

Serum dioxin levels:

Among the 95 veterans whose blood specimens were analyzed for dioxin, self-reported history of spraying herbicides in Vietnam was significantly associated with blood TCDD concentrations. Furthermore, among the subgroup of 22 Vietnam veterans who reported spraying herbicides, there was a statistically significant relationship between the frequency of herbicide spraying in Vietnam and current serum TCDD concentrations ($\beta=0.46, p<0.03$).

Based on these results, veterans were further divided into those who had a history of herbicide spraying and those who did not.

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TABLE 1. Mean 2,3,7,8-TCDD concentration (standard deviation) in ppt by Vietnam service and self-reported history of spraying herbicide

Categories	Vietnam Sprayers (N=22)	Vietnam non-Sprayers (N=24)	Non-Vietnam non-Sprayers (N=41)
Mean	6.33	3.68	3.62
Standard Deviation	12.33	7.44	8.78

* ppt: TCDD level in parts per trillion adjusted for lipid.

† two non-Vietnam veterans reported a history of herbicide spraying and 6 veterans did not know whether they sprayed herbicide or not.

Selected Health Outcomes:

Table 2 describes distribution of selected medical conditions for Vietnam and non-Vietnam veterans. In general, the risk of adverse health outcomes was highest among Vietnam veterans with a history of herbicide spraying. In comparison to non-Vietnam non-sprayers (N=170), Vietnam sprayers (N=107) had a significantly higher risk of chloracne, other skin problems, anemia, hepatitis, and ulcers. Other medical conditions including cancers and diabetes were elevated among Vietnam sprayers but were not statistically significant.

TABLE 2. Percent distribution of selected medical condition for Vietnam and non-Vietnam veterans by self-reported history of spraying herbicide

Medical Conditions	Vietnam Sprayers (N=107)	Vietnam non-Sprayers (N=100)	Non-Vietnam non-Sprayers (N=170)	Adjusted OR (95%CI)*
Anemia	9.4	6.0	2.4	4.45 (1.24-15.90)
Cancer	10.3	8.0	5.3	1.20 (0.42-3.43)
Chloracne	9.4	3.0	0	—
Diabetes	12.2	7.0	7.7	1.39 (0.57-3.44)
Hepatitis	16.8	8.0	5.9	4.48 (1.83-10.96)
Stomach Ulcers	19.6	18.0	10.6	2.69 (1.26-5.72)

* OR (95% CI): Odds ratio (95% confidence interval) comparing Vietnam sprayers to non-Vietnam non-sprayers.

Selected Birth outcomes

To satisfy the basic statistical requirement of independence of observation, an index child was identified for each veteran. If the Vietnam service or exposure to herbicide did have any reproductive effect, it would more likely be manifest in the first child following the exposure (Vietnam service). For the Vietnam veteran, an index child was defined as the first singleton child who was fathered by the veteran and whose delivery date was at least one year subsequent to the date the veteran entered Vietnam. For non-Vietnam veteran, it was a child born after July 4, 1966

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or one year after the date the Veteran entered military service, whichever was later. There were statistically non-significant higher rates of reported birth defects (18.8% vs. 7.7%) and still births (3.1% vs. 1.4%) among index children fathered by Vietnam sprayers than among those fathered by non-Vietnam, non-sprayers.

In summary, direct evaluation of the effects of phenoxyherbicide exposure among U.S. Vietnam veterans was limited by the inability to identify a large number of veterans with reasonable certainty of exposure. Up until now, the Air Force Ranch Hand cohort was the only Vietnam veteran group which showed significantly elevated body burden, although their mean serum TCDD level is still an order of magnitude lower than that observed in industrial workers.⁵ This feasibility study, for the first time, identified the second group of a large number of Vietnam veterans with elevated serum TCDD levels even 2 or 3 decades after the exposure. Without prior knowledge of their serum TCDD levels, a subgroup of veterans with higher TCDD levels tended to report more adverse health outcomes. Furthermore, serum TCDD levels were significantly associated with self-reported history of herbicide spraying in Vietnam. The main study on approximately 5,000 Vietnam era veterans with an additional 900 blood specimen analyses for TCDD is ongoing.

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