HEALTH STATUS OF VIETNAM VETERANS

VOLUME II
TELEPHONE INTERVIEW

The Centers for Disease Control
Vietnam Experience Study
January 1989

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Centers for Disease Control
Center for Environmental Health and Injury Control
Atlanta, Georgia 30333

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ACKNOWLEDGMENTS

This report was prepared by Coleen A. Boyle, Pierre Decoufle, W. Dana Flanders, Patricia Holmgreen, Thomas R. O'Brien, and Nancy E. Stroup.

The Vietnam Experience Study Telephone Interview Research Subgroup consisted of Coleen A. Boyle, Eugenia E. Calle, Karen S. Colberg, Pierre Decoufle (subgroup leader), Owen J. Devine, W. Dana Flanders, Melinda L. Flock, Jerry G. Gentry, Patricia Holmgreen, John M. Karon, Maurice E. LeVois, Thomas R. O'Brien, Joseph B. Smith, and Nancy E. Stroup.

Other members of the Vietnam Experience Study staff are Charles L. Adams, Joseph L. Annest, Drue H. Barrett, Andrew L. Baughman, Edward A. Brann, Elizabeth A. Cochran, Frank DeStefano, Robert C. Diefenbach, Barbara Dougherty, Sandra S. Emrich, Anthony S. Fowler, Robert R. German, Martha I. Hunter, M. Riduan Joesoef, Muin J. Khoury, Marcie-jo Kresnow, Heather D. McAdoo, Brenda R. Mitchell, Robin D. Morris, Linda A. Moyer, Mark J. Scally, Scott F. Wetterhall, and Robert M. Worth.

A number of current and former members of the Centers for Disease Control (CDC) staff also made important contributions: Robert J. Delaney, John J. Drescher, J. David Erickson, John J. Gallagher, Marilyn L. Kirk, Michael E. Krafrissen, Peter M. Layde, Peter J. McCumiskey, Daniel L. McGee, Terryl J. Meranda, Daniel A. Pollock, Melvin W. Ralston, Philip H. Rhodes, Richard K. Rudy, Paul D. Simpson, and Dennis M. Smith.

Consultants who made special contributions to the telephone interview component of the Vietnam Experience Study are Charles F. Cannell, Naomi H. Golding, and Richard L. Hough.

Many other individuals and organizations have provided invaluable assistance to the study. These include the Agent Orange Working Group and its Science Panel; Congressional Office of Technology Assessment; Army Reserve Personnel Center and U.S. Army and Joint Services Environmental Support Group, Department of Defense; Equifax, Inc.; General Services Administration; Internal Revenue Service; Lovelace Medical Foundation; National Personnel Records Center, National Archives and Records Administration; National Center for Health Statistics; Institute of Medicine, National Academy of Sciences; Research Triangle Institute; Social Security Administration; Veterans Administration; other members of the CDC; and outside consultants who contributed their unique expertise.

Invaluable secretarial support for this report was provided by Sandra K. Tully.

Leaders of veterans' service organizations provided important advice and support to the study, and participation by Vietnam-era veterans made the study possible.

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SUMMARY

In this volume of the monograph *Health Status of Vietnam Veterans*, we describe the methods and results of a telephone health survey of male Vietnam-era Army veterans. The survey is part of the Vietnam Experience Study (VES) conducted by the Centers for Disease Control (CDC) to determine if men who served in Vietnam have been at increased risk of incurring various types of health problems compared with men who served elsewhere. The telephone interview component of the VES provides estimates of the magnitude and extent of self-reported general and specific health problems of Vietnam veterans compared with other veterans.

Veterans were randomly selected from almost 5 million records of persons who had served in the U.S. Army during the Vietnam era. To be included in the study, a man had to (1) have joined the U.S. Army as a draftee or volunteer between January 1, 1965 and December 31, 1971, (2) have served only one term of enlistment, and (3) have had a pay grade no higher than E-5 at separation from active duty. Altogether 17,867 veterans, (9,078 Vietnam and 8,789 non-Vietnam) not known to have died during active duty or between discharge and December 31, 1983 (the closing date of the mortality phase of the VES), constituted the study sample.

Veterans were traced by using mailings, telephone directory assistance, credit bureau searches, driver's license and motor vehicle registration records, city directories, local records, and personal field visits. Altogether, 93.5% of Vietnam veterans and 91.8% of non-Vietnam veterans were successfully located. Of these, 93.3% and 91.3% were interviewed, producing overall response rates of 87.3% for Vietnam veterans (N=7,924) and 83.8% for non-Vietnam veterans (N=7,364). Veterans who were not interviewed were different from those who were interviewed with respect to various demographic and military characteristics, but there was no indication that Vietnam nonrespondents were more unusual than other nonrespondents.

Trained interviewers, using computer-assisted telephone interview software, administered a structured questionnaire. The questionnaire covered demographic, socioeconomic, and lifestyle factors, health history, and current psychological symptoms. The health history section included a list of medical conditions and symptoms asked about by name, as well as open-ended questions about the medical reasons for current use of prescribed medications, for any hospitalizations since discharge, and for current limitations in activities. Interviewers could not distinguish Vietnam veterans from other veterans until late in the questionnaire when Vietnam veterans were asked about various factors unique to Vietnam. All interviews were conducted between February 1985 and July 1986.

Odds ratios were used to assess the presence and strength of associations between the Vietnam experience and particular outcomes. Odds ratios were adjusted for six baseline factors (age at enlistment, race, year of enlistment, enlistment status (drafted, volunteered), score on a general aptitude test taken at induction, and primary military occupational specialty (tactical, nontactical)) by using multiple logistic regression methods. Other potential confounders, such as current marital status, education, cigarette smoking, and alcohol use, were accounted for in many of the comparisons, when appropriate. Stratified analyses were performed for selected outcomes to identify demographic and other subgroups at special risk. Further, selected military factors and self-reported experiences in Vietnam were examined to assess their influence on particular outcomes.

As a group, Vietnam veterans appear to be similar to other Vietnam-era veterans with respect to indicators of current socioeconomic status, such as attained education, family income, employment characteristics, and marital status. On the other hand, Vietnam veterans reported a higher frequency of many different kinds of health problems than did non-Vietnam veterans. Health outcomes reported in excess by Vietnam veterans included a history of various physician-diagnosed diseases (*e.g.*, chloracne, hepatitis, hypertension), various somatic symptoms present at the time of the interview (*e.g.*, headache, dizziness, stomach ailments), each of 15 psychological symptoms experienced in the past 6 months, and illicit drug use in the past year. Further, they reported more use of prescribed medications, more limitations in activities, and gave their general health a lower rating than other veterans. There was little or no difference in reporting a history of cancer (all sites combined), benign neoplasms, respiratory diseases, and musculoskeletal problems. Inservice medical care for intestinal infections, malaria, mycoses (*i.e.*, fungal infections), hearing loss, and open wounds was reported more frequently by Vietnam veterans; the last three conditions are still affecting the current health status of some men.

More frequent reporting of health problems by Vietnam veterans was present in all three racial subgroups (whites, blacks, Hispanic and other), in both draftees and volunteers, and in both younger and older recruits. This internal consistency suggests that the increased prevalence of reported physician-diagnosed conditions, symptoms, and perceived ill-health is independent of certain baseline characteristics of veterans. The strength of the associations between various types of health outcomes and Vietnam service varied from "weak" for many diseases asked about by name to "strong" for certain types of symptoms, self-rated health, and history of physician-diagnosed chloracne.

Vietnam veterans reported having had difficulty conceiving children more often than did other veterans. The average number of children fathered per veteran after assignment to primary tour of duty was, however, the same in both groups.

Among Vietnam veterans certain health outcomes exhibited patterns suggestive of an association with combat exposure. Inservice occurrences of malaria, mycoses, and open wounds were related to both self-reported extent of combat and indirect indicators based on military records. Current health problems that were correlated with both types of combat measures include hearing loss, symptoms associated with post-traumatic stress disorder (PTSD), and open wounds that affect current health status. Other outcomes occurring in the postdischarge period that were related to self-reported combat exposure but not to the records-based indicators of combat were neurological symptoms, gastrointestinal ulcers, and hypertension.

Among both Vietnam and non-Vietnam veterans, a few health outcomes were associated with illicit drug use in the Army. These outcomes include sexually transmitted diseases incurred during active duty, heavy lifetime alcohol use, a history of hepatitis after discharge, current use of three of more prescribed medications, current prevalence of multiple neurologic symptoms, symptoms associated with PTSD experienced in the past 6 months, and use of illicit drugs in the past year. Vietnam veterans were no more affected by inservice drug use than were other Vietnam-era veterans.

Among Vietnam veterans, each of 33 selected health outcomes (including symptoms associated with PTSD) showed an increasing odds ratio with an increasing level of self-reported herbicide exposure in Vietnam after adjustment for reported combat exposure. Even among men who reported the most limited type of exposure (*i.e.*, passing through

defoliated areas) prevalence rates for every outcome were higher than for Vietnam veterans who did not report any exposure. The prevalences of these outcomes among Vietnam veterans with no reported herbicide exposure (43% of all Vietnam veterans) were about the same as those for non-Vietnam veterans.

The Vietnam veterans' increased reporting of so many different kinds of health problems may have more than one explanation. The increased reporting could be indicative of a higher prevalence of various physical conditions that are sequelae of psychological stressors associated with Vietnam service and its aftermath. Another possible explanation is Vietnam veterans' selective recall of health problems associated with (1) increased use of medical care, (2) a heightened awareness of their personal health status, (3) the expression of various negative feelings about their military experience, or (4) a concern about health hazards of the herbicide Agent Orange. We cannot, however, fully assess the separate or combined effects of these factors solely on the basis of data from this component of the VES.

Final conclusions about the health (in all its dimensions) of Vietnam veterans must be based on findings from all components of the VES. Detailed results of the other components are reported in Volumes III, IV, and V of this monograph and a synthesis of all findings is given in Volume I.

1. INTRODUCTION

In this monograph, *Health Status of Vietnam Veterans*, consisting of five volumes, we describe the methods and results of a study of male Vietnam-era Army veterans, conducted by the Centers for Disease Control (CDC) to determine if men who served in Vietnam have been at increased risk of incurring various types of health problems compared with men who served elsewhere. In the study, referred to as the Vietnam Experience Study (VES), we assess health effects of the general Vietnam military experience. The study was not designed to evaluate health problems associated with exposure to military herbicides, such as Agent Orange, in Vietnam. Results reported here are based on data collected from a random sample of veterans between 1985 and 1987. Information was obtained about many facets of their past and present health status, and about the health of their children. Results from the telephone interview component are presented here (Volume II); medical examination and laboratory results, in Volume III; psychological evaluation results, in Volume IV; and findings about pregnancy outcomes and the health of veterans' offspring, in Volume V. Findings from all components of the VES are summarized in Volume I, thereby conveying an integrated picture of the health of Vietnam veterans.

1.1 BACKGROUND

Since the late 1970s, questions have been raised about the possible long-term adverse health effects of military service in Vietnam (Holden, 1979). Specific concerns voiced by Vietnam veterans include various types of skin lesions, neurological problems, extreme fatigue, memory loss, gastrointestinal ailments, and birth defects in their offspring (Borgen, 1979; Dwyer and Smith, 1981; Stellman and Stellman, 1980; Wolfe, 1981). Many of these conditions have been attributed to exposure to the military herbicide known as "Agent Orange," which was used extensively throughout South Vietnam between 1966 and 1970 (Committee on the Effects of Herbicides in Vietnam, 1974).

Previous studies of the health of Vietnam veterans include (1) surveys of psychosocial and adjustment problems (Card, 1983; Helzer *et al.*, 1976; Robins *et al.*, 1975; Yager *et al.*, 1984); (2) mortality and cause-of-death studies, including one of Australian soldiers (Anderson *et al.*, 1986; Boyle *et al.*, 1987; Fett *et al.*, 1984; Holmes, 1986; Kogan and Clapp, 1985; Lawrence *et al.*, 1985); (3) a mortality study and morbidity survey of U.S. Air Force personnel engaged in aerial herbicide spraying in Vietnam (Operation Ranch Hand) (Lathrop *et al.*, 1984, 1987; Wolfe and Michalek, 1985); and (4) case-control studies of soft tissue sarcomas (Greenwald *et al.*, 1984; Kang *et al.*, 1986, 1987). All of these investigations are limited to certain types of health outcomes (*e.g.*, psychological symptoms, cancer) or refer to a unique group of Vietnam veterans (*e.g.*, the Ranch Hand Study), which preclude their generalizability. No systematic study has been conducted of morbidity from a wide range of health problems in a broad cross section of Vietnam veterans that incorporates an appropriate comparison group and that is large enough for increased risks of interest to be detected.

1.2 STUDY DEVELOPMENT AND SUPPORT

In December 1979, then President Jimmy Carter signed into law the "Veterans Health Programs Extension and Improvement Act of 1979" that called for the Veterans Administration (VA) to "conduct an epidemiological study of persons who, while serving in the Armed

Forces of the United States during the period of the Vietnam conflict, were exposed to any of the class of chemicals known as 'the dioxins' produced during the manufacture of the various phenoxy herbicides (including the herbicide known as 'Agent Orange') to determine if there may be long-term adverse health effects in such persons from such exposure" (P.L. 96-151, 38 U.S.C. 219). In November 1981, another law expanded the scope of that study to include "an evaluation of any long-term adverse health effects in humans of such [military] service as such health effects may result from other factors involved in such [military] service, including exposure to other herbicides, chemicals, medications, or environmental hazards or conditions" (P.L. 97-72, 38 U.S.C. 219).

In January 1983, responsibility for implementing the Congressional mandate was transferred from the VA to CDC. A team of CDC scientists prepared a "protocol outline," which set down the rudiments of CDC's study plans and served as the basis for a formal interagency agreement with the VA. In response to the legislative directives, CDC proposed three separate studies. One, the Agent Orange Study, was conceived to address the issue of exposure to dioxin-containing herbicides, and another, the VES, was designed to evaluate health effects resulting from other factors related to service in Vietnam. Since, in these studies, malignancies would not be identified in sufficient numbers for valid conclusions to be drawn, CDC proposed a third study, the Selected Cancers Study, to investigate certain infrequent forms of cancer that have been linked to occupational exposure to phenoxy herbicides or chlorophenols.

In May 1983, a draft of a full protocol was developed and submitted for approval to several review committees. One of these was a group of CDC scientists not affiliated with the operating component responsible for conducting the studies. Outside groups included a Congressional Office of Technology Assessment Special Advisory Panel, the Agent Orange Working Group (AOWG) of the Cabinet Council on Domestic Policy, and the Federal Advisory Committee on Special Studies Relating to the Possible Long-Term Health Effects of Phenoxy Herbicides and Contaminants. In addition, the national veterans' service organizations were thoroughly briefed on the studies.

Comments from these groups and organizations were considered, and, in November 1983, a revised protocol was prepared (Centers for Disease Control, 1983a, 1983b). This protocol and supplementary material were submitted to the Office of Management and Budget (OMB) for Paperwork Reduction Act review, and, in May of 1984, CDC received approval to conduct a pilot study for the telephone interview component of the VES.

The CDC Human Subjects Review Committee approved the VES protocol, including the questionnaire and introductory materials for the telephone interview component, and ensured that it complied with internal policy for protecting the rights of research subjects, including all elements of informed consent. A special assurance of confidentiality was given to veterans in accordance with Sections 304, 306, and 308 of the Public Health Service Act (42 U.S.C. 242b, 242k, and 242m). The assurance was explained to veterans in writing with the introductory material and orally at the beginning of the telephone interview.

The telephone questionnaire was reviewed and approved by AOWG and OMB. In addition, representatives of the national veterans' service organizations were given the opportunity to comment on it. The questionnaire was administered to 249 Vietnam-era Army veterans in a pilot study conducted in late 1984. It was then revised and finalized for use in the main study, which began in January 1985.

Financial support for the VES was provided by funds appropriated to the VA and transferred to CDC by interagency agreement. CDC has had the sole responsibility for the design and conduct of the study and for analyzing the data and reporting the results.

1.3 STUDY COMPONENTS

Originally, the VES had three interrelated components, all involving the same random sample of male Vietnam-era Army veterans. The first component was an assessment of postservice mortality in the sample; overall and cause-specific death rates of veterans who served in Vietnam were compared with those of veterans who served in the United States, Germany, or Korea. The results of this phase have already been published as a journal article and a monograph (Boyle *et al.*, 1987; Centers for Disease Control, 1987). The second component consists of telephone interviews with members of the original sample who were successfully located and contacted and who agreed to participate. Finally, the third component involves medical examinations, laboratory tests, and psychological evaluations for a random subsample of veterans who completed the telephone interview. A fourth component was added after the others had begun; it involves collecting and analyzing hospital birth records for a sample of children fathered by veterans.

1.4 OBJECTIVES OF THE TELEPHONE INTERVIEW COMPONENT

The primary objective of the telephone interview component of the VES was to obtain a broad perspective on the past and present health status of Vietnam veterans compared with other Vietnam-era veterans, in terms of self-reported health outcomes of various kinds. Interviews were considered an important part of the VES because they provided veterans the opportunity to voice their health concerns. This phase provided a relatively cost-effective means of gathering a sizeable amount of health and other data on a large number of veterans. At a minimum, we expected the telephone survey to provide reasonable estimates of the magnitude and extent of general and specific health problems as perceived by Vietnam veterans compared with other veterans.

Since Vietnam veterans have expressed concern about a multiplicity of ailments, the telephone interview elicited information on a wide range of health problems, including physician-diagnosed diseases and psychological and somatic symptoms. The large number of health outcomes examined makes the results more difficult to interpret because one expects a certain proportion of the comparisons to be "statistically significant" in the absence of any *real* differences between the groups. Another relevant issue is that the "exposure" being examined (*i.e.*, the Vietnam experience) is really a collection of specific exposures and experiences (*e.g.*, combat, infectious diseases, herbicides, insecticides), each of which could exert a different effect on long-term health. In the VES, it is difficult to link specific health outcomes to discrete components of the general Vietnam experience. We have, however, systematically examined the relationship between various indices of combat exposure and selected health problems. We collected some data on *perceived* exposure to herbicides in Vietnam and used them in certain analyses to help us interpret the results.

2. DATA AND METHODS

The telephone interview component of the VES combines elements of cohort and cross-sectional study designs. Essentially, it involves ascertainment of health outcomes among the survivors of the original random sample who were successfully traced and agreed to be interviewed. The design used for examining *current* health problems is similar to the "follow-up prevalence study" described by Kleinbaum *et al.*, and the frequency measure is *point prevalence* (Kleinbaum *et al.*, 1982). The design used for examining *previous* disease resembles that of a "backward prevalence study," and the frequency measure being estimated is period prevalence, not incidence, even though the occurrences reflect incident events (Kleinbaum *et al.*, 1982). In either situation, we have compared the relative frequencies (risks, rates) of a specific health outcome in both groups of veterans and have reached conclusions about whether the groups differ in their reported experience and, if so, by how much.

2.1 SELECTION OF VETERANS FOR STUDY

Details about sample selection for the VES and the retrieval of data from military personnel files are given elsewhere (Boyle *et al.*, 1987).

By way of review, the criteria for defining the original study group were as follows:

1. males only;
2. entered military service in the U.S. Army for the first time between January 1, 1965, and December 31, 1971;
3. served only one term of enlistment in the Army;
4. had at least 16 weeks of active service time;
5. earned a military occupational specialty (MOS) other than "trainee" or "duty soldier";
6. did not die during active duty; and
7. had a pay grade no higher than E-5 at separation from active duty.

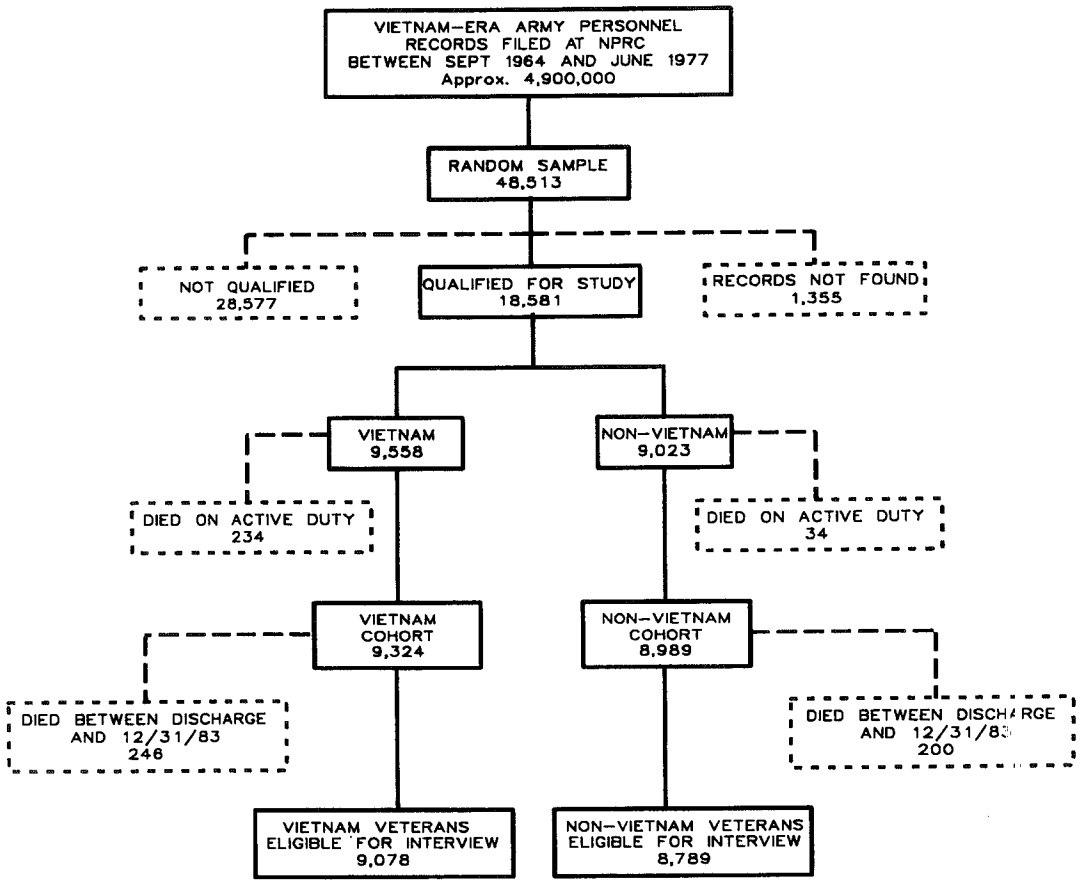
To be eligible for the Vietnam cohort, a veteran had to have served at least one tour of duty in Vietnam. For the comparison group, tours of duty were limited to the United States, Germany, or Korea. The latter group is referred to simply as "non-Vietnam" veterans. Figure 1 outlines the original sample selection process that began at the National Personnel Records Center (NPRC) in St. Louis, Missouri. After several retrieval attempts, 1,355 records remained unlocated. Reasons for not finding them were mainly administrative: subsequent reenlistment, upgrading of discharge type, and adjustment of pay.

Altogether, 18,313 Vietnam-era veterans qualified for the original study group. Of these, 446 died between separation from active duty and December 31, 1983, the closing date of the mortality study (Boyle *et al.*, 1987). Thus, the remaining 17,867 veterans (9,078 Vietnam and 8,789 non-Vietnam) were considered eligible for the telephone interview component of the VES.

2.2 SAMPLE SIZE AND POWER

Sample size for the VES telephone interview component was estimated and discussed in the protocol (Centers for Disease Control, 1983a). One limitation of the sample size calculations was the lack of good estimates of the cumulative incidence and prevalence of health outcomes of special interest, such as chloracne, liver diseases, and specific

Figure 1. Selection of Study Group. NPRC Indicates National Personnel Records Center in St. Louis, MO.



neurological symptoms. We decided that there should be a high probability of detecting meaningful increases in diseases with a "background" prevalence of 0.5% (5 per 1000). Thus, with about 6,000 men in each group and a Type I error probability of 0.05 (one-sided), we estimated that a twofold increase in the risk of such conditions could be detected with almost 95% power. Estimated power for a range of "expected" prevalence rates and relative risks based on the actual sample sizes achieved is given in Table 1.

2.3 LOCATING VETERANS

The process of locating, contacting, and interviewing veterans was conducted by Research Triangle Institute (RTI), Research Triangle Park, North Carolina, after it was awarded a competitive, fixed-price contract. The contract included a subcontract with Equifax, Inc., in Atlanta, to provide multilevel locating and contacting services. Methods of tracing and contacting veterans and administration of the questionnaire were pretested in a pilot study of 300 male Vietnam-era Army veterans in the fall of 1984. Tracing and interviewing for the main study began in February of 1985 and ended in July of 1986. No person directly involved in the tracing process knew the cohort status of any veteran

Table 1. Estimated Power (Percent) To Detect Various Levels of Increased Risk Based on the Actual Numbers of Veterans Interviewed, by Magnitude of Prevalence Rate Among Non-Vietnam Veterans[a]

Prevalence Among Non-Vietnam Veterans (%)	Risk Ratio				
	1.2	1.4	1.6	1.8	2.0
0.25	6	16	32	50	66
0.50	11	32	60	82	94
0.75	15	47	78	94	99
1.00	20	59	89	99	100
1.50	28	78	98	100	
2.00	37	89	100		
3.00	53	98	100		
4.00	66	100			
5.00	76	100			

[a] Power calculations are for a two-tailed test with alpha = 0.05 based on the method of Casagrande *et al.* (1978), adapted for unequal sample sizes (Vietnam = 7924, non-Vietnam = 7364).

For ease of processing, we subdivided the sample of veterans into 12 random subsamples of about 1430 men each and a final group of about 700. Each group contained almost equal numbers of Vietnam and non-Vietnam veterans. Starting in January 1985, a group was sent to RTI on the first day of each month. RTI had a maximum of 10 months to locate and interview veterans and to process the data collected for each group. Most of the work was completed in 4 months, and virtually all cases were resolved one way or another in 7 months.

Since telephone interviews were to be the basis for data collection (described below), RTI directed the locating process primarily at obtaining current telephone numbers of veterans; updating addresses was a secondary goal.

2.3.1 Locating Information

Information that would be helpful in locating veterans was gathered from military records (Boyle *et al.*, 1987) and other Federal data sources. It included:

1. the permanent address, for mailing purposes, given by the veteran at separation from active duty and listed on the Department of Defense (DD) Form 214 (Discharge Certificate);
2. the name(s) and address(es) of the veteran's mother, father, guardian, spouse, or a sibling, if one or more was reported by the veteran on DD Form 398 (Personal History) upon entry into the service;
3. an address provided by the Internal Revenue Service (IRS) from the veteran's most recently filed tax return. Unfortunately, the year in which the return was filed was not given. This service was available to CDC through the auspices of the National Institute for Occupational Safety and Health under Public Law 96-128; and
4. an address from the files of the VA if the veteran had applied for a benefit of some kind.

Virtually every veteran's military personnel record contained a mailing address as of separation from active duty. If, however, that address was outside the United States or was incomplete and no other address was available, no further effort was made to locate the man. Thirty-one veterans were so classified. Addresses from IRS or VA records, or both, were

obtained for about 95% of all veterans. Any veteran without a "permanent mailing address" from the military record was included in the locating process if a more recent address from the VA or IRS was available.

2.3.2 Locating Procedures

RTI designed a comprehensive procedure for locating and contacting veterans. The first step was a mass mailing of introductory letters, signed by the Director of CDC, and fact sheets containing answers to the most common questions veterans were expected to have about the study (Appendix A). The study was presented in very general terms as a health survey of Army veterans who were on active duty in the 1960s and 1970s. It was called the "Veterans Health Survey," and neither Vietnam nor Agent Orange was mentioned. The stated purpose of the study was to "find out if certain groups of veterans have more health problems than others and, if so, why." We knew, of course, that, no matter how neutral our approach sounded, many Vietnam veterans would probably realize the specific purpose of the study and its possible value to them. Materials were mailed to the most recent address available for a veteran. A toll-free telephone number was given in the letter for those veterans who might want to call RTI and arrange for an interview at their convenience. Address files were updated according to corrections received from postmasters.

After waiting several days to allow the introductory letters to reach veterans, RTI placed calls to telephone directory assistance operators in areas corresponding to the veterans' most recent addresses. If a veteran was no longer listed in that area, RTI tried to locate him through telephone contact with a relative. These and other telephone tracing procedures produced telephone numbers for 68% of all veterans. When a telephone number was found, the tracing process was stopped, and the veteran was assigned to an interviewer who attempted the initial contact. If attempts to contact the veteran indicated the number was not the correct one, RTI resumed the tracing process.

Names of veterans for whom RTI could not obtain a telephone number using the limited tracing procedures described above were sent to Equifax for further tracing. The primary objective of Equifax was to obtain current telephone numbers that RTI could use to reach veterans and conduct the interview.

The initial tracing steps at Equifax (central office tracing) consisted of automated searches of the Equifax-owned credit bureau files and those of other major credit bureau systems. Credit reports supplied information, such as updated addresses, names of employers, and spouses' names. No credit information was transmitted to RTI or was available to CDC from these searches. If no information was found about a veteran, credit bureau searches were done for parents or siblings, in an attempt to develop leads. When necessary, Equifax conducted searches of state motor vehicle operator records (*i.e.*, drivers' licenses) from its home office. However, since these are on a state-by-state basis, they were used secondarily to credit bureau searches, which were almost nationwide. Leads developed through these means were followed up with telephone inquiries.

If the Equifax central office procedures did not produce a telephone number, the subject was assigned to the Equifax field office closest to the veteran's last known residence. The Equifax field office procedures included searches of city and town directories, various types of public records, and utility company records and contacts with relatives, neighbors, and employers. If the field office discovered a telephone number, Equifax returned the veteran's

case to RTI personnel, who then assigned it to an interviewer. If the field office located the subject, but could not obtain a telephone number, Equifax initiated the in-person contact procedure described next.

Equifax had the capability of face-to-face contact with veterans for whom a telephone number could not be obtained and for veterans who were difficult or impossible to reach by phone. In these situations, an Equifax field-office representative visited the veteran at the address obtained, explained the purpose of the contact, and asked the veteran to place a call to RTI from a conveniently located telephone. If the veteran complied, RTI conducted the interview as described in Section 2.4.1. If the veteran had to use a phone away from his home, he was paid a travel stipend of $10 in cash.

In their contacts with veterans, relatives, neighbors, and employers, Equifax staff people used a neutral approach. Terms such as "Vietnam" and "Agent Orange" were avoided. Basically, Equifax personnel simply described the fact that Equifax had been asked to locate certain veterans as part of a research study being conducted by the U.S. Public Health Service. Further discussion of the purpose and nature of the study was left to RTI.

Veterans particularly difficult to locate or contact included men who—

1. had seasonal occupations;
2. lived in remote areas with no access to a telephone;
3. were away from home for long periods because of their jobs;
4. had no contact with their parents since discharge from the Army;
5. had changed their names; and
6. could be contacted only through an attorney.

RTI monitored and controlled all tracing and contacting procedures described above, using an automated system adapted especially for this project. The system incorporated virtually all possible pathways the tracing process could take, including starting over again because of erroneous information. It showed the status of any particular subject at any point in the tracing, contacting, and interviewing process. In addition, the length of time veterans spent in various stages of the process could be monitored to identify problem areas needing attention.

2.3.3 Veterans Ineligible for Interview

In tracing veterans, we found that the following situations precluded an interview.

1. The veteran had died after December 31, 1983, the cut-off date for the mortality component of the VES.
2. The veteran was in jail or prison. The guidelines of the CDC Institutional Review Board explicitly prohibited us from interviewing prisoners.
3. The veteran was mentally or physically incapable of being interviewed. For each such man, RTI documented the reason and the CDC staff approved it.

Veterans in these categories were identified as ineligible for an interview and were then categorized as nonrespondents. Three female veterans, discovered during the tracing process to have been inadvertently included in the original cohort, were excluded from all analyses.

2.4 INTERVIEWING VETERANS

The telephone was chosen as the most cost-effective means of interviewing a large number of veterans who were located all over the United States and in some foreign

countries. This technique compares favorably with face-to-face interviewing in terms of response rates, completeness, and validity of responses (Aneshensel *et al.*, 1982 Siemiatycki, 1979; Weeks *et al.*, 1983). Although we expected some veterans not to have telephones and others to have unlisted telephone numbers, study procedures were aimed at maximizing the number of interviews that could be done by telephone. In-person interviews were planned for veterans who wanted to participate, but could not, or would not, be interviewed by telephone. All data collected were obtained solely from veterans. All interviews were conducted between February 1985 and July 1986.

2.4.1 Computer-Assisted Telephone Interviewing

The large number of interviews required in the VES and the complexity of the questionnaire required an efficient means of interviewing by telephone. Fortunately, developments in computer software technology had advanced to the point that computer-assisted telephone interviewing (CATI) was readily adaptable to this study. Interviewers sat in front of video display computer terminals that were "on-line" to a central processing unit. Questions appeared on the video screens in the proper order, and skip patterns were followed automatically, depending on the respondent's answers. Answers were keyed in as numerical entries or as alphabetic strings for responses to open-ended queries. All data from respondents instantly entered an automated file. Range and logic edits were built into the system so that interviewers could immediately correct inappropriate entries. This feature substantially reduced the number of callbacks to veterans that otherwise would have been necessary. The system also permitted the interviewers to return to previous questions to modify earlier entries when the respondent changed his mind or when the interviewers realized that they had entered the wrong answer.

2.4.2 Field Interviews

To assure maximum participation in the study, RTI established a field interview capability for veterans living in the United States. Field interviews were, however, offered only to veterans who had an obvious physical impediment that discouraged phone conversation or who repeatedly refused a telephone interview. Six RTI interviewers based in locations around the country conducted the field interviews; they used a special printed version of the questionnaire. After the interview was completed, the interviewer telephoned the answers to an RTI in-house interviewer, who entered the responses directly into the CATI system. Only nine veterans were interviewed in this fashion, and no distinction will be made hereafter in the mode of interview.

2.4.3 Interviewer Training and Monitoring

An initial group of 26 interviewers and supervisors was chosen and trained for the study; several smaller groups were brought on periodically to replace staff who left the study. Altogether, 52 interviewers worked on the study, with 31 of them doing 96% of the total work. Women constituted 71% of the interviewing staff and conducted 60% of all interviews.

Each training session involved about 24 classroom hours and covered a variety of topics. CDC staff presented an overview of the study, and a psychiatrist gave the interviewers advice for interviewing this study population. The psychiatrist told the interviewers how to recognize various personality types, how to respond to any emotional demands the veterans might place on them, and how to direct a veteran with an "ax to grind" toward completing the interview. The most challenging part of the training was learning procedures for recording responses to open-ended questions, particularly responses about medical problems. None

of the interviewers had formal training or experience in a medical field. Such a requirement would have limited the number of available persons to the point that the study would probably not have been completed in a timely fashion, if at all. Special instructions in this area included the following:

1. phonetic spelling of unfamiliar words;
2. probes such as—
   "What did the doctor say the problem was?"
   "Did the doctor give it a medical name?"
   "What part of the body was affected?"
   "What kind of (*e.g.*, stomach problem) was it?"; and
3. having the veteran read the names of current medications directly from the labels, if possible.

Responses to open-ended questions had to be entered in 40 character fields to save interview time and to use "on-line" computer storage capacity economically. Interviewers were trained to listen to the entire response and, if necessary, distill its essence into the space allocated. Abbreviations were discouraged except for commonly understood words. If the veteran did not know the medical name of a particular condition, the interviewer entered the term "DKC" (Doesn't know condition) with the response.

Interviewers could not distinguish Vietnam veterans from other veterans until late in the interview (see Section 2.4.5). Throughout the data collection, Vietnam and non-Vietnam veterans were eligible for interview in roughly equal numbers. Vietnam veterans made up 44% to 58% of an interviewer's total number of completed interviews. The possible effects of various interviewer characteristics on response are discussed in Section 3.5.6.

RTI's supervisory staff monitored interviewer performance by listening to a 10% sample of each interviewer's work. Special "silent" audio/visual monitoring stations were used so that neither the interviewer nor the respondent was aware that the conversation was being monitored. Errors detected through this procedure were documented and reviewed with the interviewer involved. In addition, CDC staff also monitored the interviewers during periodic visits to RTI. Any problems CDC noted were documented and referred to the RTI supervisory staff. The most common problems discovered through these means were (1) minor deviations from the exact wording of questions, (2) reading questions too fast, (3) occasional interpretation of the meaning of a particular question for a veteran, and (4) insufficient probing for medical conditions.

In a further effort to maintain data quality and the morale of the interviewers, RTI project managers held special meetings every 3 months with the entire interviewing staff to discuss the accumulated experience. Feedback from the interviewers was used to improve various procedures. Another benefit of these meetings was the sharing of experiences and frustrations, which helped build morale and sustained interest in the project. This was especially beneficial because of the ambitious production goals, rigid time lines, and the personal and complex nature of the questionnaire.

2.4.4 Refusal Conversion Process

To maximize the response rate, RTI developed a multistage refusal conversion plan. The first step was the original interviewer's effort to deal effectively with reluctant veterans, thereby minimizing the chance of an initial refusal. These procedures were covered in the interviewer training sessions. Briefly, they included the following instructions.

1. Offer to return the telephone call if, on the first attempt, the veteran was reached at an inopportune time.
2. Attempt to keep the veteran talking to learn his real reasons for not wanting to be interviewed.
3. Acknowledge a veteran's concerns with brief, neutral statements.
4. Attempt to get the veteran started with the interview as quickly as possible; keep moving toward the opening questions.
5. Keep from arguing with a veteran or alienating him.
6. Answer questions with brief responses according to written answers.

Concerning the sixth point, CDC and RTI jointly prepared a set of questions--with answers—that veterans might have beyond the ones included with the introductory letter. These are shown in Appendix B. This information includes the importance to the study of non-Vietnam veterans and relatively healthy veterans.

Once a veteran refused an interview, follow-up procedures were implemented in an effort to obtain the interview later. These procedures included up to three separate conversion efforts: (1) a follow-up call by a converter-interviewer after about a week, (2) a second follow-up call by a more experienced RTI converter-interviewer, and (3) a final follow-up call by an off-site field supervisor who specialized in refusal conversions. If a conversion was obtained at the third stage, a telephone interview was conducted by using a printed version of the questionnaire. The responses were then transmitted to the RTI central office by telephone and entered directly into the CATI system. If the subject persistently refused to be interviewed, as a last resort at the final conversion effort, he was offered an in-person interview.

Not all refusal cases received equal attention. If a veteran expressed exceptionally hostile behavior at the first or second attempt at refusal conversion, RTI ended the process and declared him a "final refusal" case. Interviewers were instructed to avoid actions that could be interpreted as harassment. The RTI staff tried to ascertain reasons for refusal at each step in the process. Equifax encountered some refusals at the in-person contact stage. Since Equifax field representatives were not trained interviewers and were not part of the RTI formal refusal conversion procedure, the documentation on the reasons these veterans refused is limited. In some cases, the Equifax representative never actually spoke with the veteran. Many final refusals were ultimately established because family members refused to give out a phone number or refused the interview on behalf of the veteran. Other veterans never answered inquiries or apparently avoided the field representatives' visits. In some cases, veterans agreed to call RTI but never did. For these reasons, as well as limitations on cost and time for repeated, nonproductive field visits, Equifax took the initiative in declaring them "final refusals".

2.4.5 Questionnaire Content

The questionnaire used in the VES telephone interview component was designed to fit the specific needs of the study. It was a structured instrument, with an average administration time of 32 minutes (Appendix C). Some questions and topic areas were taken from questionnaires used by the National Center for Health Statistics in its Health Interview Survey and Health and Nutrition Examination Survey.

Major areas covered by the questionnaire were the following:

Table 2. Physician-Diagnosed Physical Health Problems Asked About by Name In the Questionnaire

Condition	Time Frame	Question Numbers
Skin Conditions		
Chloracne	Ever	A-07 to A-12
Other skin conditions[a] (up to four)	Since discharge	A-16 to A-19D
Anemia	Since discharge	A-21
Mononucleosis	Since discharge	A-22
Diabetes	Ever	A-23, A-24
Neoplasms		
Cancer[a] (up to three sites)	Ever	A-25A to A-27C
Benign tumor, growth, cyst[a] (up to three)	Ever	A-28A to A-30C
Liver Conditions		
Cirrhosis	Ever	A-31A, A-31B
Hepatitis/jaundice	Ever	A-32A, A-32B
Porphyria	Ever	A-33A, A-33B
Liver abcess	Ever	A-34A, A-34B
Other liver condition[a]	Ever	A-35A to A-35C
Gastrointestinal Ulcers		
Esophageal ulcer	Ever	A-36A, A36B
Stomach ulcer	Ever	A-37A, A-37B
Duodenal or intestinal ulcer	Ever	A-38A, A-38B
Urinary Tract Problems[a] (up to three)	Since discharge	A-39A to A-41C
Hypertension	Ever	A-43A to A-43D

[a] Specific type of condition (as described by veteran) was coded to ICD-9.

1. veteran's health status - past and present (Section A);
2. pregnancy outcomes among veteran's sexual partners (Section B);
3. health status of veteran's natural children (Section B);
4. demographic, social, and behavioral characteristics of veteran (Sections C, D, E, F, J);
5. doctor visits and hospitalizations in the Army (Section G);
6. information on tour of duty in Vietnam (Vietnam veterans only) (Section H); and
7. symptoms or feelings experienced in the 6 months immediately preceding the interview that could be associated with post-traumatic stress disorder (PTSD) (Section I).

The section pertaining to the veteran's own health (Section A) contained three general kinds of questions: (1) those dealing with various physician-diagnosed medical conditions and disease categories asked about by name (Table 2); (2) open-ended questions about current medication use (name of medication and reason for taking it), health problems requiring hospitalization, and medical reasons for current limitations in activities; and (3) questions about the presence of certain physical symptoms.

The diseases and symptoms veterans were asked about were chosen for one or more of the following reasons.

1. They are conditions of general public health interest.
2. They have been of concern to Vietnam veterans.
3. They have been associated with exposure to industrial processes in which the chemical 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (dioxin) was an unwanted by-product.
4. They have been found in animals experimentally exposed to dioxin.

Responses to open-ended questions ranged from statements about vague symptoms to statements about specific conditions described in correct medical terms. Although some responses did not seem to fit the questions to which they applied and others were difficult to classify, open-ended questions provided an opportunity to identify the unanticipated health concerns of veterans. Random samples of responses to four general types of open-ended medical questions are given in Appendix D.

A general type of open-ended question was placed at the end of Section A; it allowed veterans to report up to three *current* health problems that had not been mentioned earlier, regardless of whether a physician had evaluated the problems. Taken at face value, this question should have elicited conditions that were not asked about by name and that were not responsible for the current use of prescribed medications, hospitalization since discharge, or a current limitation in some activity.

The section about pregnancy outcomes and the health of veterans' children (Section B) included a series of questions about difficulties in conceiving children with any sexual partner and attempted to determine whether the problem was with the veteran or with his partner. The total number of pregnancies and children fathered by veterans were also solicited here.

Interviewers did not know the cohort status of a veteran until very late in the interview when Vietnam veterans were asked a series of questions about experiences unique to Vietnam (Section H). After the interviewer became aware of the veteran's military background, he or she asked the questions in a short section on psychological symptoms (Section I) and a brief section dealing with illicit drug use (Section J). We placed these sections at the end of the interview so that unusual emotional reactions or reluctance to answer them would not affect responses to other questions.

The 15 questions in Section I dealing with various emotional experiences were chosen to cover the three recognized symptomatology criteria for PTSD (American Psychiatric Association, 1980). We did not, however, intend in this part of the questionnaire to define a "case" of PTSD. Rather, the prevalence of symptoms associated, or compatible, with PTSD was the outcome of interest.

2.4.6 Definition of a Complete Interview

A complete interview was defined as one in which every question was asked of a veteran, with skip patterns taken into account. Thus, a completed interview could be one in which every response was a refusal. The relative frequency of refusals to answer specific questions was, however, small. The refusal rate (2.1%) for the family income question was the highest. Only two interviews were incomplete; in the final tabulations these were counted as nonrespondents (refusals).

2.5 CODING RESPONSES TO OPEN-ENDED QUESTIONS

Responses to open-ended questions concerned various subjects: medications, medical conditions (or symptoms), occupation and industry titles, and subjects such as names of chemicals and herbicides, and the means of exposure to herbicides. To maintain comparability with data from other studies, we used widely known and accepted coding systems for our data. If a response was unintelligible or contained insufficient information for coding, a special "Bad data" (BD) code was used that was distinct from the "Don't know" (DK) and "Refused" (RE) codes. A specially designed computer-assisted coding system, much like the CATI system, was used to facilitate the process.

2.5.1 Coding Systems

Medications

Medications were coded according to the June 1984 update of the Medication Code List (MCL) developed by Hugo Koch at the National Center for Health Statistics (Koch, 1982). If coders could not find the name of a medication in the MCL, they gave it a special code signifying "Other/Not Listed." Many of the drugs in this category were new medications that the MCL did not include; others may have been misspelled by the interviewers, and, therefore, they could not be identified.

Medical Conditions

Medical conditions were coded according to the Ninth Revision of the International Classification of Diseases (ICD-9) (World Health Organization, 1977). Codes in the "Symptoms, Signs, and Ill-Defined Conditions" chapter (780-799) and the Supplementary Classification section (VO1-V82) were used for nonspecific responses, such as "headache" and "back problems," and for a variety of medical tests and procedures. Other kinds of nonspecific responses, such as "viral liver infection," "stress," "virus," and "weak stomach," were coded as "other and unspecified" conditions within the major ICD-9 disease categories. These codes generally have the digits "8" or "9" after the decimal point. CDC staff developed additional guidelines for difficult coding situations and for maintaining consistency in coding nonspecific responses. For example, if a response mentioned a "possible" condition, it was coded to that condition. Special codes were used to distinguish responses such as "Vietnam syndrome" and "post-traumatic stress disorder (syndrome)." If two or more conditions were given in the response, the first one was preferred unless the second condition was a more specific description of the presumed problem. Injuries were coded according to Chapter 17 of the ICD-9 manual because of the nature of the questions eliciting these responses. The interview did not solicit information that would have made it possible to use the ICD-9 Supplementary Classification Section (E codes). Codes in that section refer to the "external cause" of the injury.

Occupation/Industry

Occupation and industry codes were assigned according to the 1980 U.S. Census Bureau system (U.S. Bureau of the Census, 1982). RTI developed detailed instructions to assist coders in applying the coding system.

Other Items

Codes for the names of chemicals and herbicides, and the means of exposure to herbicides were developed as unique responses were encountered. Gradually, an *ad hoc* list was created for each of these categories, and, after all the data had been collected, final code lists were compiled.

2.5.2 Quality Control

Various checks were applied to the coding process. Since the medical condition coding was the most extensive, complex, and important, RTI incorporated special "on-line" edits to reject codes that did not exist, applied only to women, or (for the veteran) referred to perinatal conditions.

The RTI supervisory staff also conducted a general quality control procedure. Each workday, interviews coded the previous day were ordered chronologically and grouped into batches of 10. One interview was chosen at random from each batch for review of all items that required codes. The review was done by the coding supervisor who had the original codes in front of her. If no errors were found in that interview, the entire batch of 10 interviews was accepted, and no further review was done. If exactly one error was found in any of the coded items, it was corrected, and four other interviews were selected at random from the batch and reviewed. If no other errors were found, the batch was considered acceptable and no further review was done. If one or more errors were found among the four other interviews, they were corrected, the remaining five interviews were reviewed, and all errors were corrected. If two or more errors were found in the original interview selected, they were corrected, and all nine remaining interviews in the batch were reviewed; if any errors were found in those nine, they were corrected. In this way, with RTI correcting all discovered errors, the estimated error rate in the data delivered to CDC was less than 1%.

In addition, to check for consistency, RTI recoded a sample of responses to open-ended questions. To ensure that the ICD-9 codes received adequate scrutiny, we randomly chose the sample from all veterans who had at least three medical conditions that required coding. The original codes were not available to the person doing the repeat coding. Overall, about 18% of all ICD-9 codes were not replicated to the fourth digit. However, the extent of agreement between the original and repeat ICD-9 codes was about the same for Vietnam and non-Vietnam veterans. When ICD-9 codes were grouped into analytic categories (*e.g.*, respiratory diseases, skin conditions), the extent of agreement reached 93%.

2.6 DATA EDITING AND ERROR RESOLUTION

As noted earlier, many range and consistency edits were built into the CATI and computer-assisted coding systems. In addition to these safeguards, RTI used a monthly batch editing process, including a check of skip patterns, before delivering data to CDC. In this way, several minor "bugs" and limitations in the CATI logic were found and corrected. A few of these errors necessitated callbacks to some veterans to clarify or verify responses. A final edit process was performed when the monthly data tapes were received at CDC. Several errors discovered at this stage were referred to RTI for correction.

2.7 ANALYTIC METHODS

In this section we describe how we approached the analysis of veterans' responses in the telephone interview. In most of our analyses we compared *all* Vietnam veterans with *all* non-Vietnam veterans. Other analyses involve comparisons among various subgroups of Vietnam veterans, such as those defined by levels of self-reported combat and herbicide exposure. All health outcome results described here are derived solely from self-reports from veterans and should be thought of as "reported hypertension," "reported hepatitis," and the like, as opposed to conditions verified from medical records or by physical examinations.

2.7.1 HEALTH OUTCOMES TO BE EXAMINED

As indicated in Section 2.4.5, the questionnaire elicited data on a wide variety of health outcomes. Here we describe how veterans' responses to these questions have been categorized and organized for analysis and presentation.

Categorization of Medications and Medical Conditions

The medication codes were grouped into "drug class" categories by using an algorithm developed by the National Center for Health Statistics. The system combines individual medication codes into 20 major categories according to primary therapeutic use (Table 3).

Coded medical conditions were grouped into broad and specific categories. The broad categories generally follow the chapters of the ICD-9 manual. The more specific categories are mutually exclusive and exhaustive subdivisions of the larger ones. Limiting factors for defining the subcategories included numbers of cases and the specificity of veterans' responses included in a given ICD-9 rubric.

Health Problems Experienced in the Army

Questions about health problems experienced during active duty in the Army were asked in open-ended fashion and were based on as many as six hospitalizations and five doctor visits for each veteran. The ICD-9 coded responses have been grouped in two ways. First, broad categories were defined that covered the entire spectrum of illnesses and injuries, with the available numbers of cases taken into consideration. Second, a set of specific disease conditions was compiled on the basis of *a priori* knowledge of environmental conditions in Vietnam, endemic diseases there, possible combat-related health effects, and U.S. Army medical data on illnesses treated in Vietnam (U.S. Army Center of Military History, 1977, 1982). A man could be counted in more than one disease/injury category if he reported multiple hospitalizations and/or doctor visits, but could be counted only once *within* a given category, even though he may have reported two or more conditions classified there. For

Table 3. Drug Classes Used for Categorizing Medications[a]

Anesthetics/adjuncts
Antidotes
Antimicrobials
Hematologics
Cardiovascular-renal
Central nervous system
Radiopharmaceuticals/contrast media
Gastrointestinals
Metabolics/nutrients
Hormones/hormonal mechanisms
Immunologics
Skin/mucous membrane
Neurologics
Oncolytics
Ophthalmics
Otics
Relief of pain
Antiparasitics
Respiratory tract
Unclassified/miscellaneous

[a] Source: National Drug Code Directory, 1982 Edition. Prepared by Drug Listing Branch, National Center for Drugs and Biologics, Food and Drug Administration, Public Health Service, U.S. Dept. of Health and Human Services.

these analyses, health problems responsible for hospitalization have been combined with those resulting in a doctor visit. Thus, in the results, no distinction is made between the two sources of medical care.

Socioeconomic Characteristics and Selected Health-Related Behaviors

These outcomes include the following:

1. attained educational level;
2. current total family income;
3. current employment status and type of usual occupation;
4. marital status;
5. alcohol use; and
6. cigarette smoking habits.

Indicators of Current General Health Status

These health measures consist of the following:

1. the veteran's self-rated current health status (excellent, good, fair, poor);
2. body mass index (*i.e.*, weight/height^2);
3. prescribed medications being taken, classified by primary therapeutic category;
4. limitations in activities caused by an impairment or health problem and classified as:
   a) limited in any way in any activity;
   b) limited in the type or amount of work that can be performed; and
   c) unable to go to work, which, for an employed person, could include a short-term illness.

Postdischarge History of Specific Health Problems

The questionnaire contains 10 major sources of health problems experienced by veterans since they were discharged from the Army. These are—

1. seventeen physician-diagnosed medical conditions or disease categories asked about by name (Table 2);
2. primary reason for any overnight hospitalization (Questions A-51A to A-55F);
3. medical reasons for taking up to three prescribed medications at the time of the interview (Questions A-04A to A-06C);
4. health problems responsible for current limitations in activities (Question A-59);
5. seven neurologic (neuromuscular) symptoms experienced during the 4 weeks immediately preceding the interview (Questions A-44 to A-50); briefly, these are (a) persistent or migraine headaches; (b) twitching, tics or tremors; (c) dizziness; (d) numbness in the extremities; (e) weakness in the arms or legs; (f) soreness in the limbs; and (g) ringing in the ears;
6. excessive hair growth anywhere on the body (Questions A-13 to A-15);
7. symptoms associated with PTSD experienced during the 6 months immediately preceding the interview (Questions I-01 to I-15);
8. history of having sought treatment for drug, alcohol, or emotional problems during the 12 months immediately preceding the interview (Questions I-16 to I-20);
9. any current health problems (not necessarily diagnosed by a physician) that were not asked about or reported earlier in the interview (Questions A-60A to A-61C); and
10. difficulty in conceiving children (Questions B-19 to B-29B).

Some of the conditions that were asked about by name were also mentioned in responses to open-ended questions about hospitalizations, medications, limitations in activities, and other current health problems. For example, a veteran may have said "Yes" to the "Yes/No" question about hypertension and also reported hypertension as a reason for hospitalization. He would be counted as a "case" in the separate analyses of both question areas. Some questions are in the form of lead-in queries (*i.e.*, "Yes/No") that ask about a broad disease category, such as skin conditions or urinary tract conditions. If the veteran answered affirmatively to the lead-in question, he was then asked to name the specific condition. Analyses of these types of questions take into account the coded responses to the follow-up question.

In general, results for health outcomes that were not asked about by name were derived from four types of questions: (1) medical reasons for taking physician-prescribed drugs; (2) conditions responsible for limitations in activities; (3) conditions requiring hospitalization; and (4) other current health problems. Responses in each of these four question areas were usually analyzed independently of the others for any given medical condition. However, we discuss the ensemble of results to obtain a complete picture of the impact of a particular disease or injury on the relative health status of Vietnam veterans. In some instances, we examined an outcome as defined by its being reported in any of the four sources. This was useful when the number of cases from any one source was small.

Within each of the four question areas, a veteran is counted in as many different ICD-9 categories as he reports problems, except that he is counted only *once within* a given category, even though he might have reported two or more different conditions classified there. Tables of results generally show the number of *veterans* reporting conditions in a given ICD-9 category rather than the number of different health problems reported.

Symptoms Associated With Post-Traumatic Stress Disorder (PTSD)

All veterans were asked how often they had experienced each of 15 psychological symptoms during the 6 months immediately preceding the interview. The choices were "very often," "often," "sometimes," or "never." The first nine symptom questions referred to problems with sleep, concentration and memory, irritability, loss of interest in daily activities, and feelings of detachment from others. The other six asked about symptoms such as nightmares, recurrent thoughts, painful memories, avoidance of activities, anxiety and guilt, that the veteran believed were related to his experiences in the Army. In addition to examining the responses to each question separately, we grouped the 15 questions according to the three symptom criteria for PTSD (American Psychiatric Association, 1980). We analyzed the prevalence of individual and grouped symptoms by defining a symptom as present if it was experienced "very often" or "often." A final summary analysis focused on veterans who experienced a pattern of symptoms meeting all three criteria of PTSD without defining such men as actually having the disorder. No attempt was made to identify a specific traumatic event with which to link reported symptoms.

Time of Occurrence in Relation to Military Service

The calendar year of first occurrence for most of the conditions listed in Table 2 and for excessive hair growth and difficulty conceiving children was elicited in the interview. If, for any given condition, the year of onset was before, or the same as, the veteran's year of entry into the Army, the veteran was excluded from most analyses of that condition. Cases occurring during the year of entry were not counted, since we could not tell whether they

preceded or followed enlistment. For skin conditions other than chloracne and excessive hair growth, we asked whether the problem started before, during, or after military service. Cases that occurred before active duty in the Army were ignored in the analyses, but such men were considered "at risk" of developing (and reporting) other skin conditions later. A similar strategy was employed for the question about urinary tract problems, which could have elicited up to three different conditions. If the year (or time period) of first occurrence was unknown, the man was not included in analyses involving time trends described below in Section 2.7.3.

2.7.2 Covariates Considered in the Analysis

In investigating possible associations between place of service and various health outcomes, we evaluated the influence of other variables that were potential confounders or effect modifiers. Some of these variables were taken from military records and thus applied to the veterans at entry into, or during, service. Other covariates applied to the men after military service and were derived from the telephone interview. Continuous variables were treated as categorical to reduce the number of assumptions inherent in the logistic model used in the multivariate analyses described in the next section (Rothman, 1986).

Entry Characteristics Obtained From Military Records

The following six characteristics were determined before a veteran was assigned to a particular military duty location and were obtained from military records for all veterans:

1. age at entry into the Army (age at enlistment);
2. race;
3. score on the general technical test (GT score) — a verbal/arithmetic aptitude test taken at entry into the Army;
4. enlistment status (draftee or volunteer);
5. primary military occupational specialty (primary MOS) — the specific job for which the man was trained after he had completed basic training; and
6. year of entry into the Army (year of enlistment).

These six covariates were evaluated for effect modification and confounding in all analyses of health outcomes for which the number of cases was adequate (see Section 2.7.3). Their categorization is shown in Table 4. They were selected according to the following criteria.

1. Some are independent risk factors for many diseases (age, race) or are thought to be correlated with socioeconomic status (GT score).
2. Some may have been associated with different military experiences or reactions to the experiences (age at entry, primary MOS, enlistment status, year of entry).
3. Some were associated with different probabilities of assignment to Vietnam (primary MOS, year of entry).
4. None of them could have been influenced by the military service experience, since they were fixed before, or shortly after, enlistment; thus, they could not be considered intervening variables in the causal chain for any health outcome.
5. None of them are subject to differential recall or reporting, since they were abstracted from military personnel records filled out at the time of enlistment.

Characteristics Acquired After Military Service Derived From the Interview

In analyses of health outcomes that occurred *after* discharge from the Army, we considered other variables as potential confounders or effect modifiers when the number of cases was adequate. Among these were—

Table 4. Definition and Categorization of Entry Characteristics

Characteristic	Categories Used in Analysis	Percent of Veterans in Category	
		Vietnam	Non-Vietnam
Age at entry into Army (years)	<20 (referent)	51.6	46.0
	≥20	48.4	54.0
Race	White (referent)	83.2	82.1
	Black	11.0	11.1
	Hispanic & other	5.8	6.8
Score on GT test[a]	40-89	24.7	21.4
	90-109 (referent)	33.5	31.6
	110-129	31.9	33.5
	130-160	9.9	13.5
Enlistment status	Drafted (referent)	64.4	67.2
	Volunteered	35.6	32.8
Primary MOS	Tactical operations[b]	34.2	26.8
	Other (referent)	65.8	73.2
Year of entry into Army	1965-66 (referent)	33.5	36.0
	1967-69	56.8	39.8
	1970-71	9.7	24.2

[a] Excludes 169 men with missing or out-of-range GT scores.
[b] Tactical operations include jobs such as infantryman, artillery crewman, armored vehicle crewman and combat engineer.

1. cigarette smoking habits in terms of the average number of cigarettes smoked per day during the person's entire period of regular cigarette smoking for current and ex-smokers;
2. consumption of alcoholic beverages in terms of the average number of alcoholic drinks consumed per month during the person's entire period of regular drinking for current and ex-drinkers;
3. educational attainment (*i.e.*, highest grade/year of regular school or college completed); and
4. current marital status.

Their categorization is shown in Table 5.

Since these variables reflect cumulative behavior and experiences up to the time of the interview, differences in the values of these variables between Vietnam and non-Vietnam veterans could represent differences (or a predisposition toward differences) existing before military service or differences occurring as the result of military service. In the latter sense, they could be intervening variables in the causal chain for certain health outcomes. If risk estimates change appreciably after being adjusted for these types of variables, the adjusted estimates must be carefully interpreted.

A hypothetical example illustrates how this latter type of variable is handled in the analysis. Suppose that Vietnam veterans report an increased prevalence of cirrhosis of the liver and an increased consumption of alcoholic beverages; then further suppose that, after the results have been adjusted for alcohol use, the risk of cirrhosis is no longer elevated. We would not interpret the adjusted estimate as indicating the absence of an increased risk of cirrhosis among Vietnam veterans. Rather, we would interpret it as indicating a difference in

Table 5. Definition and Categorization of Selected Characteristics Determined in the Interview

Characteristic	Categories Used in Analysis	Percent of Veterans in Category[a]	
		Vietnam	Non-Vietnam
Cigarette smoking history (average number of cigarettes/day)[b]	0-9 (referent)	31.6	35.2
	10-39	53.2	51.5
	≥40	15.2	13.3
Consumption of alcoholic beverages (average number of drinks/month)[c]	0-29 (referent)	54.9	57.6
	30-89	26.7	26.9
	≥90	18.4	15.5
Educational attainment (in years)	0-11	14.1	11.6
	12-15 (referent)	68.1	66.7
	≥16	17.8	21.7
Marital status (current)	Never married	8.7	8.9
	Married (referent)	74.2	74.5
	Divorced, separated, widowed	17.1	16.6
Body mass index[d]	<24	31.1	32.7
	24-28 (referent)	44.7	44.3
	>28	24.2	23.0
Current employment status	Employed (referent)	90.5	91.5
	Not employed	9.5	8.5
Potential exposure to herbicides in civilian life[e]	Yes	45.4	43.7
	No (referent)	54.6	56.3
Regular skin/clothing contact with industrial chemicals in civilian life	Yes	28.8	29.7
	No (referent)	71.2	70.3
Current use of illicit drugs[f]	None (referent)	87.8	90.4
	Marijuana only	9.8	7.8
	Hard drugs	2.5	1.8

[a] Men with missing data are excluded. See Appendix F.
[b] For ex-smokers, the amount refers to the period during which they smoked. For current smokers, the amount refers to the present. Men who never smoked cigarettes regularly are in the 0-9 category.
[c] For ex-drinkers, the amount refers to the period during which they drank alcoholic beverages. For current drinkers, the amount refers to the present. Men who never drank alcoholic beverages regularly are in the 0-29 category.
[d] Computed from Questions A-02 and A-03 after converting to kilograms and meters.
[e] Defined as having had at least 1 year of employment in one of the four jobs in Questions F-20A to F-23C or having lived on a farm or ranch for at least 1 year.
[f] Defined in the same way as drug use in the Army (see Appendix E).

the risk of cirrhosis of the liver between Vietnam and non-Vietnam veterans that seems to be explained by the Vietnam veterans' increased use of alcohol (which, in turn, could be a consequence of the Vietnam experience).

Characteristics determined at the interview and included in the analyses of individual outcomes are not limited to the four listed above; nor are those four used in all analyses. The variables to be included as potential covariates are determined separately for each different health outcome on the basis of *a priori* considerations. For example, cigarette smoking is incorporated in analyses of respiratory diseases but marital status is not. The covariates included in a particular analysis are given in footnotes in the tables.

Military Service Characteristics

For selected health outcomes, we undertook additional analyses to assess whether risks might be associated with specific factors related to military duty. The following four characteristics provide such information and were obtained from the interview:

1. frequency of various kinds of combat experiences;
2. perceived exposure to herbicides;
3. use of illicit drugs; and
4. particular illnesses requiring hospitalization or other medical attention.

Information on inservice illnesses and regular use of illicit drugs in the Army was elicited from all veterans, but information on self-reported combat exposure and perceived exposure to herbicides was elicited from Vietnam veterans only. Methods used to summarize data for the first three factors and categories used in the analyses are described in Appendix E. Some illnesses experienced in the Army (such as malaria, gonorrhea, and certain skin infections) occurred more frequently among troops stationed in Vietnam than elsewhere (U.S. Army Center of Military History, 1977, 1982). Although these illnesses are generally not known to cause long-term sequelae, we have considered some of them in certain analyses to see if they account for differences in postservice health between cohorts. For example, an inservice history of venereal disease is included in the analysis of subsequent impaired fertility.

We obtained, from Army personnel records, three other characteristics of military service: (1) duty military occupational specialty (duty MOS), (2) type of unit, and (3) midpoint of tour of duty in Vietnam. Definitions of these variables and their categorizations for analysis are given in Appendix E.

2.7.3 Statistical Techniques for Measuring Associations and Making Inferences

At the outset, we had to deal with two major statistical issues: (1) the number of covariates to include in multivariate modeling of particular health outcomes and (2) the strategy for assessing effect modification. With respect to the first issue, we incorporated the six entry characteristics in virtually every model used for any given outcome instead of choosing the most parsimonious model according to arbitrary statistical criteria. This strategy reduced the number of different models that were considered, placed emphasis on *a priori* potential confounders, and simplified the analyses and presentation of results. Regarding effect modification, we chose a strategy whereby identification of statistically significant interactions between place of service and selected covariates was based on a criterion of $p = 0.01$. The basis for this somewhat stringent criterion was rooted in the primary purpose of the VES: to determine if Vietnam veterans, *in general*, have more health problems than other Vietnam-era veterans. Systematic examination of risks within subgroups of veterans was really a secondary issue. Furthermore, assessment of effect modification by a purely statistical technique can yield results that may have no substantive meaning. Beyond this overall analytic strategy, we examined selected outcomes within certain subgroups of veterans, regardless of statistical considerations (see below).

Univariate Analyses

Our analysis of the possible association between service in Vietnam and a dichotomous health outcome began with a simple comparison of the proportion of Vietnam veterans who reported the outcome with the corresponding proportion of non-Vietnam veterans. Interpretation of these proportions as measures of risk, prevalence, or incidence depends on the

specific outcome and its time frame. For the purpose of this report, these proportions are referred to as "risks"; they can be used to assess crude *risk differences* as well as crude *risk ratios*. The former measure may be helpful in interpreting certain findings.

Crude odds ratios (ORs) and their approximate 95% confidence intervals (CIs) were computed by using standard SAS software (SAS Institute, 1985) when the number of cases of a given outcome among all veterans was 10 or more. The odds ratio is the ratio of the odds that a Vietnam veteran reported a particular health outcome (*i.e.*, number of "Yes" responses divided by number of "No" responses) to the odds that a non-Vietnam veteran reported the same health outcome. We chose the odds ratio as the estimate of relative risk rather than the risk ratio for two reasons: (1) it lent itself to computationally easier multivariate analyses (described below), and (2) so that the univariate and multivariate results would be comparable. Although the OR overstates, somewhat, the actual relative risk for the more common outcomes (*e.g.*, hypertension), it is still useful in judging the strength of an association. CIs based on small numbers of cases may not be good approximations of those based on an exact method, but this limitation should not affect the overall interpretation of results.

Multivariate Modeling

In subsequent analyses we assessed effect modification and potential confounding. The large number of covariates examined placed certain limits on the numbers of cases we required before we could conduct multivariate analyses of various levels of complexity. When the total number of cases of a particular health outcome was between 25 and 49, we used a logistic regression model (Harrell, 1986) to analyze main effects of the six entry characteristics in the absence of any interaction terms (Model 1). Since all six covariates were retained whether or not they were "significant predictors," ORs estimated from these models are adjusted for *all* covariates under consideration. Approximate 95% CIs for these adjusted ORs were derived from the coefficient for place of service (Vietnam, non-Vietnam) and its standard error, assuming a normal distribution.

A second model (Model 2) was introduced when the total number of cases was at least 50. Model 2 contained the six entry characteristics and any other covariate(s) deemed appropriate to the outcome being examined. In Model 2, when the number of cases was between 50 and 99, only main effects were examined.

In multivariate analyses using Model 1, when the number of cases of a given outcome among all veterans was 100 or more, we took into account possible interactions between each covariate and place of service. To determine "significant" interactions in a systematic way, we used a stepwise logistic regression technique that allowed several indicator terms for a particular categorical variable to be treated as a group rather than individually (Dixon, 1983). All main effects were retained in these models. We used $p=0.01$ as the criterion for entering and removing interaction terms from the model. If, in this way, we found no significant interactions, we obtained ORs and 95% CIs from the "main effects only" model in the manner already described. Interactions in Model 2 were not assessed unless the total number of cases was at least 150.

We computed standardized ORs and their approximate 95% CIs when one or more significant interactions were found. These ORs and CIs were derived from a logistic model that included all main effects and the significant interaction term(s) with the combined cohort of Vietnam and non-Vietnam veterans being used as the standard (Flanders and Rhodes, 1987; Wilcosky and Chambless, 1985).

Stratified Analyses

To determine if an association found in the overall analyses (*i.e.*, all Vietnam versus all non-Vietnam) is internally consistent or is stronger within certain subgroups of veterans, we examined a set of selected outcomes within subgroups of race (white, black, Hispanic and other), enlistment status (drafted, volunteered), and age at enlistment (<20, 20+). Outcomes selected were those asked about by name (*e.g.*, chloracne, hypertension) and those for which the overall findings indicated appreciable differences between Vietnam and non-Vietnam veterans. The three particular characteristics chosen for stratification are those that we believed could have been associated with different types of military experiences or reactions to the military experience.

Stratum-specific ORs for a particular characteristic (*e.g.*, race) that were adjusted for the other covariates and their 95% CIs were derived from a single logistic model that contained race, all other covariates, and the interaction terms involving race and place of service. No other interactions were considered in these analyses. The minimum numbers criteria for computing crude and multivariate ORs were not applied *within* strata.

Time Trends

For selected outcomes, we elicited information about the calendar year of diagnosis or first occurrence. With this information we could assess variation in risk over time. For these analyses, we used logistic regression to model the *interval* in which the condition occurred (Abbott, 1985). The time period starting with January 1 of the calendar year immediately *following* the year of enlistment and ending on the date of interview was divided into three periods: 1 to 6 years, 7 to 12 years, and 13 or more years. Two-year subintervals were used to group the onset times. The year of enlistment was ignored, since we could not be sure if an outcome which occurred in that year preceded or followed entry into the Army. We analyzed the data separately for each of the three intervals, obtaining time period-specific odds ratios.

The modeling strategy for controlling potential confounders is the same as that described previously. However, when modeling within one of the three time periods was precluded because the minimum numbers criteria (discussed above) were not met, we eliminated modeling in all three intervals. Interactions between place of service and the covariates in Models 1 and 2 were not examined in these analyses. Men who did not recall the year of first occurrence of a condition or who reported it as the year of entry into the Army were excluded.

Multichotomous Outcomes

A few outcomes elicited in the interview are multichotomous. Examples include the self-assessment of current health status and the frequency of each of 15 psychological symptoms. For descriptive purposes, we present the number and percent of Vietnam and non-Vietnam veterans who reported each level of the outcome. We also computed ORs by collapsing the several outcome categories into two groups. One group was chosen (arbitrarily) as the referent, and the other one became the "new" outcome of interest. Multivariate modeling of ORs then proceeded as described previously for dichotomous outcomes. The referent group is indicated in the relevant tables and accompanying text.

Analyses Involving Components of the Vietnam Experience

To determine if certain subgroups of Vietnam veterans have experienced higher (or lower) risks than others for selected outcomes, we analyzed variables that describe features of the Vietnam experience (such as type of unit and self-reported herbicide exposure). In these

analyses, we made internal comparisons *within* the group of Vietnam veterans. For each Vietnam experience variable, a category was chosen as the referent group (see Appendix E). ORs comparing other levels of a particular Vietnam experience variable to its referent group were derived from a single logistic model incorporating the relevant terms. We did not examine interactions between these components of the Vietnam experience and other covariates. Self-reported combat exposure, herbicide exposure, and illicit drug use were considered simultaneously in one model. Thus, ORs for each of those variables are adjusted for the other two. Duty MOS, type of unit, and midpoint of Vietnam tour were analyzed in three separate models. Furthermore, in multivariate analyses involving duty MOS, type of unit, and midpoint of Vietnam tour, we excluded primary MOS and year of enlistment from the models, since the latter variables were highly correlated with the former covariates. Outcomes chosen for these analyses included conditions asked about by name and other outcomes for which the overall findings indicated appreciable differences between Vietnam and non-Vietnam veterans.

2.7.4 Other Analytic Issues

Treatment of Missing Values

For virtually every question in the interview, some veterans gave a response of "Don't know" or elected not to give any answer (*i.e.*, "Refused"). Appendix F shows the frequency of these types of responses for important covariates and selected health outcomes that were asked about by name. The frequency of such responses was small for most items. This section deals with missing values for all variables except illicit drug use, combat exposure, and herbicide exposure. The latter are discussed in Appendix E.

In general, veterans with an unknown value (*i.e.*, "Don't know" or "Refused") for any particular covariate are included in all analyses that do not depend on that covariate. For example, crude rates for a particular health outcome are based on counts that include missing values of one or more covariates. However, veterans with missing covariate values are excluded from all analyses that involve those covariates. For example, an odds ratio adjusted for a particular covariate is based only on veterans with known values of that covariate. The numbers of "cases" shown in the tables *include* men with missing values of covariates.

With respect to health outcomes, missing data are of two types. The first type concerns a "Don't know" or "Refused" response to a "Yes/No" type of question, *e.g.*, "Has a doctor ever told you that you had chloracne?" For these questions, all such responses are considered a "No" response and the veterans are retained in the analyses. From an inspection of Appendix F, one can see that the frequencies of "Don't know" and "Refused" responses to these types of questions are small; therefore, treatment of them as a "No" response for analytic purposes is reasonable. For multichotomous outcomes, such as the 15-psychological-symptom questions (I-01 to I-15), veterans who responded "Don't know" or "Refused" were deleted from the analyses. The numbers of such men are shown in Appendix F.

The second type of missing health outcome data involves the responses to open-ended questions that required names of medical conditions. Such missing data consist of "Don't know," "Refused," and "Bad data" codes (see Section 2.5). These three types of missing data (combined) accounted for 0.7% of all responses to open-ended health outcome questions. For analytic purposes, such codes have been grouped with the ICD-9 codes that

make up the "Symptoms, Signs, and Ill-Defined Conditions Category" (ICD-9, 780-799). Veterans who gave a "Don't know," "Refused," or uncodable response to an open-ended question following an affirmative response to the lead-in "Yes/No" question are counted as a "Yes" in analyses of responses to the "Yes/No" question. For example, a veteran who answered "Yes" to the question "Have you seen a doctor because of any type of skin condition?", but who could not name the specific condition, is still counted as a "Yes" with respect to the former question.

Secondary Comparison Group

For selected outcomes, we considered it informative to repeat the analyses by using, as the comparison group, only veterans who had served in Germany or Korea. It could be that men who were assigned overseas, but not to Vietnam, may be more comparable to Vietnam veterans than those who remained in the United States for their entire period of active duty. Indeed, there are differences in certain characteristics between soldiers who never served outside the United States and others, such as type of discharge (honorable, nonhonorable), history of being absent without official leave (AWOL) or being in confinement (ever, never), and pay grade at discharge (E-1 to E-3 versus E-4 and E-5) that may reflect health-related behavior (Boyle *et al.*, 1987).

All analyses could not be repeated with the secondary comparison group because of time limitations in programming, executing, and assessing such a large number of comparisons. Instead, we chose twenty outcomes for examination. These outcomes consist of some of those listed in Table 2 and selected other outcomes that were found to be of interest on the basis of results of the main analyses. Multivariate analyses were limited to Model 1, and interactions were not assessed.

Analyses of Veterans Who Initially Refused or Were Hard To Locate

To gain insight into the possible effect of nonresponse, we obtained results for the same 20 health outcomes among veterans who initially refused to be interviewed, but later consented. This group may, to some extent, resemble veterans who were contacted but never interviewed. In these analyses we computed odds ratios within the subgroup of "refusal conversions" and compared them with odds ratios based on respondents who did not refuse initially. Further, we analyzed these same outcomes among interviewed veterans who were the most difficult to locate, that is, who required the Equifax field office staff to become involved or the special in-person contact procedure to be followed. Comparing selected results for these hard-to-locate veterans with all other interviewed veterans may provide some clues to the effect of excluding unlocated veterans. Multivariate analyses were limited to Model 1, and interactions were not assessed.

Veterans Who Volunteered for Vietnam Duty

Men who volunteered for service in Vietnam may be a unique group of veterans for which there is no valid comparison group. To assess the possible effect of this subgroup of Vietnam veterans on the overall results, we analyzed responses of Vietnam volunteers and nonvolunteers for the 20 selected outcomes, comparing each group to all non-Vietnam veterans. We did not have information on volunteer status from military records and had to rely on self-reports of this characteristic in the interview. Multivariate analyses were confined to Model 1, and interactions were not evaluated.

Effect of Interviewer Characteristics on Response

To assess the possible effect of interviewers' personal attributes on veterans' responses, we obtained some basic sociodemographic information on each interviewer. These data include age, race (white, other), sex, and educational attainment. For the same 20 health outcomes, odds ratios comparing all Vietnam veterans to all non-Vietnam veterans were computed within dichotomous categories of the four interviewer variables. Thus, we can determine whether outcome-specific ORs vary appreciably according to the interviewers' age, race, sex, or educational level. Multivariate analyses were limited to Model 1, and interactions were not examined.

3. RESULTS

3.1 TRACING, CONTACTING, AND INTERVIEWING RESULTS

The process for locating and interviewing veterans was very successful. Altogether, about 94% of Vietnam veterans and 92% of non-Vietnam veterans were located (Table 6). Of those located, 93% (7,924) of Vietnam veterans and 91% (7,364) of non-Vietnam veterans were interviewed. Thus, the overall proportions of eligible Vietnam and non-Vietnam veterans who were interviewed were 87% and 84%, respectively. The proportion of veterans found to be incarcerated, deceased, or with impairments precluding an interview was small and about the same in each group. About 78% of all interviewed veterans were located by RTI solely through telephone and mail procedures. The remainder had to be traced by using Equifax resources (12% by the home office, 10% through field offices). Altogether, 1,512 veterans refused the interview at first contact and 563 (37%) of them later consented. The latter group constituted 3.7% of all those interviewed.

Reasons for refusal among veterans whom RTI attempted to interview and among those whom Equifax tried to contact face-to-face are categorized in Table 7. The categories are shown in an order reflecting, roughly, the specificity of the responses, starting with the most nebulous reasons and ending with reasons rooted in the military experience. By and large, most refusals fell in the realm of "putoffs" or very general, nonspecific reasons. Only 10 Vietnam veterans and 4 non-Vietnam veterans declined to participate because of health reasons. No medical documentation of their illnesses was obtained.

3.2 CHARACTERISTICS OF RESPONDENTS AND NONRESPONDENTS

Selected demographic and military characteristics of interviewed and noninterviewed veterans are presented in Table 8. Among both Vietnam and non-Vietnam veterans, respondents differed from nonrespondents with respect to baseline (entry) characteristics, nonrespondents more often being nonwhite, younger at enlistment, and volunteers and

Table 6. Results of Tracing, Contacting, and Interviewing Processes, by Place of Service

Result	Vietnam		Non-Vietnam	
	No.	%	No.	%
Total[a]	9078	100.0	8789	100.0
Interviewed	7924	87.3	7364	83.8
Not Interviewed	1154	12.7	1425	16.2
Not located	590	6.5	722	8.2
Refused interview	420	4.6	529	6.0
Unable to contact	76	0.8	100	1.1
Incarcerated	31	0.3	32	0.4
Deceased (after 12/31/83)	25	0.3	28	0.3
Physically or mentally incapable of being interviewed	9	0.1	11	0.1
Other[b]	3	<0.1	3	<0.1

[a] Includes all veterans not known to have died before December 31, 1983, the closing date of the mortality component of the VES.

[b] Includes two Vietnam veterans who gave partial interviews, one Vietnam veteran who had been interviewed in the pilot study, and three non-Vietnam veterans confirmed to be women in the locating process.

Table 7. Distribution of Vietnam and Non-Vietnam Veterans Who Refused To Participate, by Reason for Refusal

Reason	Vietnam		Non-Vietnam	
	No.	%	No.	%
Total (all refusals)	420	100.0	529	100.0
	RTI Telephone Refusals			
No real reason determined: no interest, can't be bothered, too busy, don't want to participate	142	33.8	221	41.8
Implicit refusal: hard to contact, fails to return calls and messages, relative refuses on behalf of veteran, hangs up, telephone number changed, moves away and cannot be contacted	52	12.4	84	15.9
General reasons: I'm healthy, questions are too personal, I don't give information on telephone, I don't like surveys	30	7.1	43	8.1
Specific reasons such as confidentiality concerns, legitimacy of study, wants payment for interview, has litigation pending, didn't serve in Vietnam, you don't need me, get someone else	37	8.8	56	10.6
Animosity toward the "system"; dislike, distrust or anger toward Government, Army, military, VA, bureaucracy	47	11.2	43	8.1
Refuses to talk about military experience, does not want to rehash it, it's all behind me, too painful to discuss	44	10.5	25	4.7
Veteran says he has physical or psychological problems	10	2.4	4	0.8
No documentation available	1	0.2	1	0.2
	Equifax Field Refusals			
Veteran has an unpublished telephone number or no telephone, veteran will not give out telephone number or accompany field representative to a convenient telephone location	30	7.1	30	5.7
Relative refuses to give out telephone number of veteran or refuses on behalf of the veteran	13	3.1	10	1.9
Avoids visits by field representative, does not return calls, put-offs	14	3.3	12	2.3

having lower scores on the GT test. However, these differences prevailed in both Vietnam and non-Vietnam veterans. Noninterviewed veterans also differed from interviewed veterans with respect to characteristics acquired during military service. Thus, nonrespondents were more likely to have been given nonhonorable discharges and to have been discharged in the lowest pay grades.

Further examination of nonrespondents shows striking differences between those who were never located and those who were located but refused to be interviewed (Table 9). Those not located account almost entirely for the differences seen previously between all noninterviewed veterans and interviewed veterans. Although the unlocatable subset of the nonrespondent group appears to be very different from respondents with respect to demographic and military characteristics, about the same degree of divergence is seen for both Vietnam and non-Vietnam veterans. Thus, absence of interview data for the lost-to-follow-up group should not adversely affect the findings presented here.

3.3 DEMOGRAPHIC AND MILITARY CHARACTERISTICS OF RESPONDENTS

Among interviewed veterans, those who served in Vietnam were quite similar to non-Vietnam veterans in terms of several demographic characteristics (Table 10). The mean age at interview for both Vietnam and non-Vietnam veterans was 37 years. About 17% of both groups are nonwhite (11% black, 6% Hispanic and other).

Table 8. Comparison of Selected Characteristics Between Interviewed and Noninterviewed Veterans, by Place of Service

Characteristic	Vietnam		Non-Vietnam	
	Interviewed (N=7924)	Not Interviewed (N=1154)	Interviewed (N=7364)	Not Interviewed[a] (N=1422)
Region of Birth[b]				
% Northeast or Midwest	49.6	47.9	50.8	50.3
Race[c]				
% White	88.7	77.2	88.2	79.8
Age at Entry Into Army				
% <20 years	51.6	56.6	46.0	55.7
Year of Entry Into Army				
% Before 1967	33.6	32.6	36.0	33.3
Enlistment Status				
% Volunteer	35.6	39.9	32.8	41.1
Mean Score on GT Test	103.9	98.9	106.5	101.1
Primary MOS[d]				
% Tactical operations	34.2	33.9	26.8	30.2
Pay Grade at Discharge[e]				
% E1-E3	9.3	23.7	15.9	40.1
Type of Discharge[f]				
% Nonhonorable	1.8	8.0	6.2	21.2

[a] Excludes the three female veterans in Table 6.
[b] Based on military record. Differs slightly from interview data shown in Table 10.
[c] Based on military record. Includes some Hispanics and, thus, differs from results shown in Table 10.
[d] Primary military occupational specialty—the job for which the man was trained in the Army. Tactical operations includes jobs such as infantryman, armored vehicle crewman, artillery crewman, and combat engineer.
[e] Grades E1-E3 correspond to the various ranks of "private."
[f] Also called "character of service." Nonhonorable includes underhonorable, other than honorable, undesirable, general-underhonorable, bad conduct, and dishonorable.

Table 9. Comparison of Selected Characteristics Among Veterans Interviewed, Veterans Refusing Interviews, and Veterans Not Located, by Place of Service

Characteristic	Vietnam			Non-Vietnam		
	Interviewed (N=7924)	Refused (N=420)	Not Located (N=590)	Interviewed (N=7364)	Refused (N=529)	Not Located (N=722)
Region of Birth[a]						
% Northeast or Midwest	49.6	57.8	43.3	50.8	62.6	42.4
Race[b]						
% White	88.7	86.9	72.5	88.2	90.2	73.0
Age at Entry Into Army						
% <20 years	51.6	50.0	59.5	46.0	46.9	59.8
Year of Entry Into Army						
% Before 1967	33.6	37.4	30.0	36.0	39.1	29.2
Enlistment Status						
% Volunteer	35.6	33.8	43.7	32.8	32.3	47.0
Mean Score on GT Test	103.9	104.1	96.4	106.5	108.2	96.6
Primary MOS[c]						
% Tactical operations	34.2	31.4	35.9	26.8	28.5	29.8
Pay Grade at Discharge[d]						
% E1-E3	9.3	11.9	31.4	15.9	20.8	53.5
Type of Discharge[e]						
% Nonhonorable	1.8	2.6	11.4	6.2	7.9	29.9

[a] Based on military record. Differs slightly from interview data shown in Table 10.
[b] Based on military record. Includes some Hispanics and, thus, differs from results shown in Table 10.
[c] Primary military occupational specialty—the job for which the man was trained in the Army. Tactical operations includes jobs such as infantryman, armored vehicle crewman, artillery crewman, and combat engineer.
[d] Grades E1-E3 correspond to the various ranks of "private."
[e] Also called "character of service." Nonhonorable includes underhonorable, other than honorable, undesirable, general-underhonorable, bad conduct, and dishonorable.

In terms of characteristics associated with entry into the Army and military service, Vietnam and non-Vietnam veterans were similar with respect to some factors and different with respect to others (Table 11). Both groups of veterans were around 20 years old, on the average, when they entered the Army, and about one-third of both groups volunteered for military duty. On the GT test, Vietnam veterans scored about three points lower (on the average) than non-Vietnam veterans. In contrast, the two groups differed greatly with respect to factors related to the Vietnam conflict. Thus, proportionately more Vietnam veterans entered the Army before 1969, reflecting the buildup of forces toward their peak strength in Vietnam in April 1969 (Summers, 1985). Further, Vietnam veterans were more likely to be assigned military occupational specialties and units associated with direct combat activity. A smaller proportion of Vietnam veterans was discharged nonhonorably and in the lowest pay grades. Whether these last two results reflect differences in personal characteristics or are associated with service in a war zone is unclear. The proportions of veterans with a history of being AWOL or being in confinement in the Army are similar for the two groups. More detailed data on these characteristics are given in Appendix G.

Table 10. Comparison of Selected Demographic Characteristics Between Vietnam and Non-Vietnam Veterans Who Were Interviewed

Characteristic	Vietnam		Non-Vietnam	
	No.	%	No.	%
Total	7924	100.0	7364	100.0
Region of Birth				
Northeast	1492	18.8	1418	19.3
Midwest	2438	30.8	2322	31.5
South	2713	34.2	2404	32.7
West	1021	12.9	884	12.0
Outside U.S.A.	260	3.3	336	4.6
Region of Residence at Interview				
Northeast	1378	17.4	1279	17.4
Midwest	2273	28.7	2151	29.2
South	2681	33.8	2482	33.7
West	1498	18.9	1375	18.7
Outside U.S.A.	94	1.2	77	1.1
Year of Birth				
1937-44	999	12.6	1217	16.5
1945-49	5896	74.4	4608	62.6
1950-54	1029	13.0	1539	20.9
Race				
White	6593	83.2	6040	82.0
Black	874	11.0	820	11.1
Hispanic & other	457	5.8	504	6.8
Age at Interview (years)				
30-34	633	8.0	1174	15.9
35-39	5892	74.4	4545	61.7
≥40	1399	17.7	1645	22.3
Mean		37.5		37.4

3.4 HEALTH OUTCOMES: ALL VIETNAM VETERANS VERSUS ALL NON-VIETNAM VETERANS

In most instances, ORs derived from multivariate analyses (*i.e.*, Models 1 and 2) are similar to the crude ORs. Consequently, to simplify our description of the results, we usually refer to the crude ORs in the text unless adjustment (or standardization) produces an appreciably different point estimate. The latter situation will be pointed out where appropriate. All references to ORs (or results) being "statistically significant" mean that the corresponding 95% CIs do not include unity. We chose not to present CIs in the text for each OR quoted, since the patterns of differential reporting seemed to be more of an issue than the precision of each individual OR.

3.4.1 Health Problems Experienced in the Army

Table 12 provides an overview of health problems that resulted in medical care during active duty. The most common reason for Vietnam veterans' receiving medical care was injuries (including poisonings) (prevalence = 31.5%), followed by infectious and parasitic diseases (21.2%), respiratory diseases (20.0%), and skin diseases (10.0%). Many conditions

Table 11. Comparison of Selected Characteristics Associated With Military Service Between Vietnam and Non-Vietnam Veterans Who Were Interviewed

Characteristic[a]	Vietnam	Non-Vietnam
Mean Age at Entry Into Army (Years)	19.8	20.1
Year of Entry Into Army % Before 1969	71.9	60.6
Enlistment Status % Volunteer	35.6	32.8
Mean Score on GT Test	103.9	106.5
Primary MOS[b] % Tactical operations	34.2	26.8
Type of Unit[c] % Combat unit	57.0	44.8
Duty MOS[d] % Tactical operations	34.7	25.7
AWOL or Confinement Time[e] % With some	10.0	10.5
Type of Discharge[f] % Nonhonorable	1.8	6.2
Pay Grade at Discharge[g] % E1-E3	9.3	15.9

[a] Unknown values are excluded from the results shown here. See Appendix G.
[b] Primary military occupational specialty—the job for which the man was trained in the Army. Tactical operations includes jobs such as infantryman, armored vehicle crewman, artillery crewman, and combat engineer.
[c] This refers to the principal unit recorded in the military record for the man's foreign assignment or U.S. assignment if no foreign service was performed. Combat units include Infantry, Artillery, Armor, Cavalry, and Engineer.
[d] Duty military occupational specialty—the principal job recorded in the military record for the man's foreign assignment or U.S. assignment if no foreign service was performed.
[e] AWOL means Absent Without Official Leave.
[f] Also called "character of service." Nonhonorable includes underhonorable, other than honorable, undesirable, general-underhonorable, bad conduct, and dishonorable.
[g] Grades E1-E3 correspond to the various ranks of "private."

Table 12. Percent and Number of Vietnam and Non-Vietnam Veterans Reporting Medical Care in the Army, and Odds Ratios, by Specific Condition

Condition (ICD-9 Codes)	Vietnam		Non-Vietnam		Crude Results		Multivariate Results[a] Model 1	
	%	No.	%	No.	OR	95% CI	OR	95% CI
Infect and Parasitic Dis (001-139)	21.2	1681	9.9	725	2.5	2.2-2.7	2.4[b]	2.2-2.7
Intest infect (001-009)	2.9	227	1.1	82	2.6	2.0-3.4	2.7	2.1-3.5
Strep infect (034)	1.1	83	1.6	121	0.6	0.5-0.8	0.6	0.5-0.8
Viral exanthems (050-057)	1.2	96	1.2	88	1.0	0.8-1.4	1.1	0.8-1.5
Malaria (084)	4.9	391	<0.1	3	127.4	40.9-396.8	104.0	33.3-324.4
Sexually transmitted dis (090-099)	6.0	479	3.3	239	1.9	1.6-2.2	2.0	1.7-2.4
Mycoses (110-118)	3.9	309	0.6	46	6.5	4.7-8.8	6.5[c]	4.8-9.0
Neoplasms (140-239)	2.1	167	1.9	136	1.1	0.9-1.4	1.2	0.9-1.5
Benign and unspec (210-229,235-239)	2.1	167	1.8	133	1.2	0.9-1.5	1.2	0.9-1.5
Endoc, Nutrit and Metab Dis (240-279)	0.4	30	0.4	26	1.1	0.6-1.8	1.0	0.6-1.7
Mental Disorders (290-319)	2.1	167	2.0	149	1.0	0.8-1.3	1.1[d]	0.9-1.4
Neurotic and other disorders (300-316)	2.0	158	1.9	139	1.1	0.8-1.3	1.1[d]	0.9-1.4
Dis of Nerv Sys and Sense Organs (320-389)	6.4	505	4.9	364	1.3	1.1-1.5	1.3[e]	1.1-1.5
Dis of nerv sys (320-359)	1.6	126	1.6	120	1.0	0.8-1.3	1.0	0.7-1.2
Eye disorders (360-379)	1.2	94	1.2	89	1.0	0.7-1.3	1.0	0.7-1.4
Ear diseases (380-389)	3.8	298	2.2	164	1.7	1.4-2.1	1.7	1.4-2.0
Circulatory Dis (390-459)	2.0	159	2.4	174	0.8	0.7-1.1	0.9	0.7-1.1
Hypertension (401-405)	0.3	26	0.4	31	0.8	0.5-1.3	0.8	0.5-1.5
Hemorrhoids (455)	1.1	89	1.3	97	0.8	0.6-1.1	0.8	0.6-1.1

Table 12. Percent and Number of Vietnam and Non-Vietnam Veterans Reporting Medical Care in the Army, and Odds Ratios, by Specific Condition — Continued

Condition (ICD-9 Codes)	Vietnam		Non-Vietnam		Crude Results		Multivariate Results[a] Model 1	
	%	No.	%	No.	OR	95% CI	OR	95% CI
Respiratory Dis (460-519)	20.0	1581	23.5	1731	0.8	0.8-0.9	0.8	0.8-0.9
Acute resp infect (460-466,490)	9.4	747	11.9	876	0.8	0.7-0.9	0.8	0.7-0.9
Other upper resp dis (470-478)	0.8	63	1.5	107	0.5	0.4-0.7	0.6	0.4-0.8
Pnuemonia (480-486)	6.0	476	5.4	398	1.1	1.0-1.3	1.1	0.9-1.2
Influenza (487)	3.9	309	5.2	380	0.7	0.6-0.9	0.8	0.7-0.9
Digestive Dis (070, 520-579)	6.6	523	6.7	495	1.0	0.9-1.1	1.0	0.9-1.1
Dental dis (520-525)	2.0	158	2.3	166	0.9	0.7-1.1	0.9	0.7-1.1
Stomach and duodenal dis (531-537)	1.7	132	1.7	125	1.0	0.8-1.3	0.9	0.7-1.2
Appendicitis (540-543)	0.6	50	0.6	45	1.0	0.7-1.5	0.9	0.6-1.4
Abdomn hernia (550-553)	0.8	61	0.9	67	0.8	0.6-1.2	0.8	0.5-1.1
Hepatitis (070,573.3)	1.2	98	0.8	55	1.7	1.2-2.3	1.8	1.3-2.5
Genitourinary Dis (580-608)	2.8	224	2.4	176	1.2	1.0-1.5	1.2	0.9-1.4
Urinary dis (580-599)	2.0	158	1.6	120	1.2	1.0-1.6	1.2	0.9-1.5
Genital dis (600-608)	0.9	68	0.8	56	1.1	0.8-1.6	1.1[d]	0.8-1.6
Skin Dis (680-709,782.1)	10.0	790	6.1	446	1.7	1.5-1.9	1.8	1.6-2.0
Skin infect (680-686)	3.2	252	1.5	113	2.1	1.7-2.6	2.1[f]	1.7-2.7
Dermatitis (690-693)	0.6	48	0.8	56	0.8	0.5-1.2	0.7	0.5-1.1
Other skin dis (700-709)	3.4	266	2.6	193	1.3	1.1-1.6	1.3	1.1-1.6
Rash (782.1)	2.9	230	1.0	74	2.9	2.3-3.8	3.3	2.5-4.3
Musculoskeletal Dis (710-739)	5.1	407	6.7	490	0.8	0.7-0.9	0.8	0.7-0.9
Arthropathies (710-719)	1.3	105	1.9	140	0.7	0.5-0.9	0.7	0.6-1.0
Dorsopathies (720-724)	1.3	103	1.4	106	0.9	0.7-1.2	0.9	0.7-1.2
Other soft tissue disorders (725-729)	1.8	142	2.2	160	0.8	0.7-1.0	0.8	0.7-1.1
Osteopathies (730-739)	0.8	65	1.3	97	0.6	0.5-0.9	0.7	0.5-0.9

Table 12. Percent and Number of Vietnam and Non-Vietnam Veterans Reporting Medical Care in the Army, and Odds Ratios, by Specific Condition — Continued

Condition (ICD-9 Codes)	Vietnam		Non-Vietnam		Crude Results		Multivariate Results[a] Model 1	
	%	No.	%	No.	OR	95% CI	OR	95% CI
Symptoms, Signs and Ill-Defined Cond (780-799, except 782.1)	7.3	581	5.4	397	1.4	1.2-1.6	1.3	1.2-1.5
Fever (780.6)	2.4	186	1.0	76	2.3	1.8-3.0	2.3	1.7-3.0
Head and neck symptoms (780-784)	1.3	101	1.1	80	1.2	0.9-1.6	1.2	0.9-1.6
Cardiorespiratory symptoms (785-786)	0.7	59	0.9	63	0.9	0.6-1.2	0.9	0.6-1.3
Injuries and Poisonings (800-999)	31.5	2497	22.3	1643	1.6	1.5-1.7	1.5[g]	1.4-1.6
Fractures (800-829)	4.8	376	5.2	386	0.9	0.8-1.0	0.9	0.8-1.0
Dislocations (830-839)	1.2	93	1.6	118	0.7	0.6-1.0	0.7	0.5-1.0
Sprains and strains (840-848)	4.4	348	5.0	367	0.9	0.8-1.0	0.9	0.8-1.0
Intracranial injuries (850-854)	0.9	73	0.6	45	1.5	1.0-2.2	1.5	1.0-2.2
Open wounds (870-897)	14.4	1143	4.1	301	4.0	3.5-4.5	3.5[h]	3.1-4.0
Superficial injuries (910-919)	1.4	111	1.0	70	1.5	1.1-2.0	1.6	1.1-2.1
Contusions (920-924)	1.0	80	1.0	76	1.0	0.7-1.3	1.0	0.7-1.3
Burns (940-949)	1.2	96	0.7	52	1.7	1.2-2.4	1.8	1.2-2.5
Other and unspec injuries (958-959)	2.7	214	2.3	169	1.2	1.0-1.4	1.1	0.9-1.4
Poisoning (960-989)	0.7	59	0.7	52	1.1	0.7-1.5	1.0[i]	0.7-1.5
Supplementary Class (V01-V82)	3.2	257	3.8	278	0.9	0.7-1.0	0.9	0.7-1.0

[a] Model 1 contains the six entry characteristics. Model 2 not applicable here.
[b] Standardized for primary MOS and race.
[c] Standardized for race.
[d] Standardized for age at entry into Army.
[e] Standardized for year of entry into Army.
[f] Standardized for primary MOS.
[g] Standardized for primary MOS and year of entry into Army.
[h] Standardized for primary MOS, year of entry into Army, and GT score.
[i] Standardized for GT score.

classified in the last two categories were, however, of infectious etiology, so infections, in the aggregate, were the most common cause of inservice medical care.

Vietnam veterans were more likely to report care for an infectious or parasitic disease (ICD-9, 001-139) than were other veterans (crude OR = 2.5). Intestinal infections, malaria, sexually transmitted diseases (STD), and mycoses accounted for most of this excess. Neoplasms, endocrine, nutritional and metabolic diseases, and mental disorders were reported relatively infrequently and were evenly distributed between the cohorts. Diseases of the nervous system and sense organs were reported somewhat more frequently by Vietnam veterans (crude OR = 1.3), with ear diseases accounting for much of the difference. Respiratory diseases, primarily infections, were reported more often by non-Vietnam veterans (crude OR = 0.8).

Reported care for digestive diseases among Vietnam veterans did not show an excess, but care for genitourinary diseases showed a slight excess (crude OR = 1.2). Skin diseases, especially infections and rashes, were more common among Vietnam veterans (crude OR = 1.7). Musculoskeletal diseases, excluding conditions classified as injuries, were reported more often by non-Vietnam veterans (crude OR = 0.8). Vietnam veterans were more likely to report medical care for vaguely described problems that could not be classified in a specific disease category. These reports are included as symptoms, signs, or ill-defined conditions (ICD-9, 780-799, except 782.1), and the crude odds ratio for this category is 1.4.

While in the Army, almost 32% of Vietnam veterans received medical care for injuries. The most common type of injury was open wounds (both combat and noncombat-related) (14.4%), followed by fractures (4.8%) and sprains and strains (4.4%). Vietnam veterans had much higher rates of open wounds (crude OR = 4.0), but had slightly lower rates for fractures and sprains and strains (both crude ORs = 0.9).

Table 13 focuses on certain conditions that, on the basis of prior information, Vietnam veterans might have been expected to report at higher rates. Malaria, reported by 391 Vietnam veterans and by only 3 non-Vietnam veterans, was the most common of these conditions. Mycoses (primarily of the skin) and other skin infections (ICD-9, 680-686) were, respectively, 6.5 and 2.1 times more frequently reported by Vietnam veterans than by non-Vietnam veterans. Intestinal infections were reported 2.6 times more often by Vietnam veterans, although few men named a specific agent. Hepatitis, either viral or unspecified, was also more commonly reported by Vietnam veterans (crude OR = 1.7).

Vietnam veterans were almost twice as likely to report treatment for a sexually transmitted disease. Gonorrhea, the most commonly named STD, was reported by 3.3% of Vietnam veterans (crude OR = 1.7), but syphilis was rarely reported by either group. Many veterans were unable to name the specific STD for which they had been treated.

The proportion of veterans treated for substance abuse was small in both groups (less than 1%). Vietnam veterans reported more medical care for drug-related problems (crude OR = 1.8), but less medical care for alcohol-related problems (crude OR = 0.4). Among Vietnam veterans, 1.4% sought help for hearing loss while in the Army (crude OR = 1.7). Only 18 Vietnam veterans reported medical care for conditions classified as "acute stress reaction" (ICD-9, 308) compared with 6 non-Vietnam veterans.

3.4.2 Current Socioeconomic Characteristics, Cigarette Smoking, and Alcohol Use

Attained education differed somewhat by cohort status; 14.1% of Vietnam veterans compared with 11.6% of non-Vietnam veterans had not completed high school (Table 14).

Table 13. **Percent and Number of Vietnam and Non-Vietnam Veterans Reporting Medical Care in the Army for Conditions of *A Priori* Interest, and Odds Ratios, by Specific Condition**

Condition (ICD-9 Codes)	Vietnam		Non-Vietnam		Crude Results		Multivariate Results[a] Model 1	
	%	No.	%	No.	OR	95% CI	OR	95% CI
Intestinal Infect (001-009)	2.9	227	1.1	82	2.6	2.0-3.4	2.7	2.1-3.5
Salmonella infect (002-003)	0.1	5	<0.1	1	–	–	–	–
Shigellosis (004)	<0.1	2	0.0	0	–	–	–	–
Amoebiasis (006)	0.2	14	<0.1	2	6.5	1.5-28.7	–	–
Ill-def intest infect (008.8,009)	1.8	145	0.5	36	3.8	2.6-5.5	3.9	2.7-5.7
Melioidosis (025)	<0.1	1	0.0	0	–	–	–	–
Arthropodborne viral dis (060-066)	0.2	13	0.1	4	3.0	1.0-9.3	–	–
Typhus (080-081)	0.1	8	0.0	0	–	–	–	–
Malaria (084)	4.9	391	<0.1	3	127.4	40.9-396.8	104.0	33.3-324.4
Syphilis (090-097)	0.2	12	0.1	6	1.9	0.7-5.0	–	–
Gonorrhea (098)	3.3	259	1.9	142	1.7	1.4-2.1	1.8	1.4-2.2
Chancroid (099.0)	<0.1	1	<0.1	1	–	–	–	–
Other and Unspec STD (099.1-099.9)	2.6	209	1.2	91	2.2	1.7-2.8	2.3	1.8-3.0
Mycoses (110-118)	3.9	309	0.6	46	6.5	4.7-8.8	6.5[b]	4.8-9.0
Helminthiases (120-129)	0.4	31	<0.1	1	28.9	3.9-211.9	29.3	4.0-216.3
Alcohol-Related Problems (291,303.0, 305.0)	0.1	10	0.3	22	0.4	0.2-0.9	0.5	0.2-1.0
Drug-Related Problems (292,304, 305.2-305.9)	0.6	51	0.4	26	1.8	1.1-2.9	2.7	1.6-4.4
Acute Stress Reaction (308)	0.2	18	0.1	6	2.8	1.1-7.0	–	–
Hearing Loss (388.1,389)	1.4	108	0.8	58	1.7	1.3-2.4	1.6	1.2-2.3
Peptic Ulcer Dis (531-534)	0.6	49	0.8	57	0.8	0.5-1.2	0.7	0.5-1.1
Hepatitis (070,573.3)	1.2	98	0.8	55	1.7	1.2-2.3	1.8	1.3-2.5
Skin Infect (680-686)	3.2	252	1.5	113	2.1	1.7-2.6	2.1[c]	1.7-2.7
Heat Rash (705.1)	0.3	24	0.1	4	5.6	1.9-16.1	4.8	1.6-14.2
Acne (706.1)	0.5	37	0.4	27	1.3	0.8-2.1	1.6	0.9-2.7
Dyschromia (709.0)	0.1	9	<0.1	3	2.8	0.8-10.3	–	–

[a] Model 1 contains the six entry characteristics. Model 2 not applicable here.
[b] Standardized for race.
[c] Standardized for primary MOS.

Table 14. Distribution of Education and Income Among Vietnam and Non-Vietnam Veterans, and Odds Ratios

	Vietnam		Non-Vietnam		Crude Results		Multivariate Results			
							Model 1[a]		Model 2[b]	
Characteristic	%	No.	%	No.	OR	95% CI	OR	95% CI	OR	95% CI
Education[c]										
Less than high school	14.1	1120	11.6	850	1.3	1.1-1.4	1.1[d]	1.0-1.2	1.1[d]	1.0-1.2
High school graduate	39.6	3132	37.9	2785	1.0	–	1.0	–	1.0	–
Some college	28.5	2260	28.9	2125						
College graduate	11.5	909	12.8	938						
Graduate school	6.3	497	9.0	658						
Income[e]										
<$10,000	9.7	750	9.4	671	1.0	0.9-1.2	1.0	0.9-1.1	1.0	0.9-1.1
$10,000-$29,999	46.6	3613	45.0	3219	1.0	–	1.0	–	1.0	–
$30,000-$49,999	33.4	2592	33.3	2379						
≥$50,000	10.3	797	12.4	883						

[a] Model 1 contains the six entry characteristics.
[b] Model 2 contains the six entry characteristics, education (for analysis of income only), and alcohol use.
[c] Highest grade or year of regular schooling attained as of interview.
[d] Standardized for enlistment status.
[e] Combined family (gross) income for the calendar year immediately preceding the year of interview.