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**AIR FORCE COMPLIANCE STUDY  
FINAL COMPLIANCE REPORT**

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The Air Force Health Study is a study to investigate the health effects in Air Force personnel following exposure to herbicides. This report presents the results of compliance and noncompliance at six Air Force Health Study examinations. The results from the 1982 baseline examination, the 1985 follow-up examination, the 1987 follow-up examination, the 1992 follow-up examination, the 1997 follow-up examination, and the 2002 follow-up examination were presented in seven reports: the Baseline Morbidity Study Results (24 February 1987), the Air Force Health Study First Followup Examination Results (15 July 1987), the Air Force Health Study 1987 Followup Examination Results (16 January 1990), the Air Force Health Study Serum Dioxin Analysis of 1987 Examination Results (7 February 1991), the Air Force Health Study 1992 Followup Examination Results (2 May 1995), the Air Force Health Study 1997 Follow-up Examination Results (22 February 2000), and the Air Force Health Study 2002 Follow-up Examination Results (31 March 2005).

Portions of these documents have been reproduced or paraphrased in this report. The purpose of this notice is to acknowledge the authors of these previous study reports and documents.

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# 1 INTRODUCTION AND BACKGROUND

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## 1.1 INTRODUCTION

The purpose of the Air Force Health Study (AFHS) was to determine whether adverse health effects relative to a similar but unexposed group of Air Force veterans existed and could be attributed to occupational exposure to Agent Orange. A baseline examination and five follow-up examinations over 20 years provided a comprehensive approach to the detection of adverse health effects. Complete details on the design of the AFHS are given in the study protocol (1).

For the baseline examination, the population ascertainment process identified 1,264 Ranch Hand personnel who served in Vietnam between 1962 and 1971. At the beginning of the AFHS, a Comparison group was identified. Comparison veterans maintained or flew C-130 aircraft in Southeast Asia (SEA) during the same time period that the Ranch Hand unit was active. Their units used C-130 transport planes flown and serviced by crews with similar training and background as those of Ranch Hand veterans. Comparison veterans spent on average less than 30 percent of their SEA service in Vietnam and were stationed mostly in Guam, Japan, the Philippines, Taiwan, and Thailand. These veterans may have been stationed in one, but usually in at least two, countries and many had repeated tours of duty in the region. A computerized selection procedure was used to identify Comparisons with similar characteristics to each Ranch Hand veteran. A maximum of 10 Comparisons for each Ranch Hand was selected, matching on age, race, and military occupation (officer-pilot, officer-navigator, officer-other, enlisted flyer, enlisted groundcrew). After review of military personnel records, an average of eight Comparison subjects were matched to each Ranch Hand.

A replacement strategy was devised to maintain participation of the Comparisons. Noncompliant original Comparisons were to be replaced by Comparisons with the same values of the matching variables (age, race, and military occupation in SEA) and the same health perception. In this way, the replacement Comparisons would serve as surrogates for Comparisons who did not participate. The replacement strategy is described in more detail later in this chapter.

A multitude of factors may have influenced participation in the AFHS. These may be classified broadly as health, logistical, demographic, operational, or publicity factors. For example, health factors are thought to include self-perception of health (compared to others of the same age), as well as demonstrable health indicators, such as medication use and workdays lost due to illness or injury. Logistical factors include no time or interest, reluctance to spend time away from family or job, distance to the examination site, confidentiality concerns, or financial hardship. Demographic factors include flying status, age, race, or military duty status (active duty, reserves, guard, retired, separated). Operational factors include any aspect of study operation that may affect compliance, such as scheduling, physical examination, interview, or debriefing, as well as any differential treatment of Ranch Hands and Comparisons. Publicity factors are related to national attitudes and media presentations regarding the Agent Orange issue, the Vietnam War, the AFHS, veterans' health care, or health care in general.

The issues involved in deciding whether to volunteer for the AFHS are complex, making statistical assessment of compliance bias difficult and necessarily crude in that many of the factors contributing to self-selection cannot be measured directly.

This chapter describes the process of replacing Comparisons who did not choose to participate and the scheduling process of veterans for the AFHS. Reasons for refusal also are described and defined.

## 1.2 REPLACEMENT PROTOCOL

During the design phase of the AFHS, the authors of the study protocol (1) anticipated that a loss of participants between examinations would pose the greatest threat to study validity. In particular, they expected differential compliance, with relatively more Ranch Hands choosing to return to the study than Comparisons and with health differences of unknown character between noncompliant Ranch Hands and noncompliant Comparisons. To partially correct the situation, the study design specified that noncompliant Comparisons would be replaced by Comparisons with the same values of the matching variables (age, race, and military occupation) and the same current health perception (poor, fair, good, excellent). Military occupation was stratified into the following five categories: (1) flying officer—pilot, (2) flying officer—nonpilot, (3) nonflying officer, (4) flying enlisted, and (5) nonflying enlisted (also referred to as enlisted groundcrew). This method of replacement would tend to reduce bias resulting from refusal in the Comparison group and would maintain group size. No corresponding strategy for the Ranch Hands was possible because all living Ranch Hands had been identified and invited to participate.

The first Comparison in each randomized matched set was identified as the original Comparison for his respective Ranch Hand. Original Comparisons found to be deceased during the baseline examination were replaced by the next living replacement in the randomized matched set. This replacement then became the original Comparison. If the original Comparison was noncompliant, a replacement Comparison was invited in his place. Noncompliance of the original Comparison was determined if any of the following three conditions were met:

1. The original Comparison refused to participate.
2. The original Comparison was partially compliant (completed the questionnaire but did not complete the physical examination).
3. The original Comparison was unlocatable.

In these three cases, the first comparison retained his identity as the “original Comparison.”

A Comparison was invited to participate in an examination if he had participated or had been invited to participate in any previous examination. It is therefore possible that more than one matched Comparison for a Ranch Hand could attend an AFHS examination. If no previously invited Comparisons (original or replacement) for a particular Ranch Hand agreed to participate at an examination, schedulers attempted to recruit a replacement. These replacements were selected from the remaining set of up to nine candidate Comparisons (previously matched by age, race, military rank, and military occupation), whose self-reported health status at the time of replacement matched that of the noncompliant original Comparison for a given Ranch Hand. Health status was recorded in four categories: excellent, good, fair, and poor. If a willing health-matched veteran was not found in the matched set, self-reported perception of health status was dichotomized into “excellent or good” and “fair or poor” categories and the dichotomized health statuses were matched. If this second method for identifying a suitable replacement failed, no replacement was made. There were two exceptions to the replacement strategy. The study protocol required that the noncompliant original Comparisons report their health status during the scheduling effort so that they could be used to recruit replacement Comparisons with the same health status. On occasion, original Comparisons refused to speak with the scheduler or were unlocatable. In these cases, a replacement Comparison for the original Comparison was recruited in the order in which he was listed in the randomized matched set. Also, as specified in the study protocol, no replacement was made if a formerly invited Comparison in a matched set was found to be deceased.

At the scheduling operation for the baseline examination, an event occurred that led to the identification of an additional category of Comparisons, the “shifted Comparison.” Because of errors in the database regarding their unit of assignment in SEA, 212 original Comparisons were discovered to be ineligible for participation in the study. These men had not served in SEA but, because of a duplication of codes, were mistakenly included in the Comparison population. They were deleted from the AFHS. This resulted in another Comparison in each previously randomized match set being asked to participate in the study. These new original Comparisons were called “shifted” Comparisons, labeled “S” in the report on the 1982 baseline examination, to describe the effective movement of these Comparisons in each matched set to fill the space left by the removed ineligible original Comparison. The eligible original Comparisons were labeled “O” in the report on the 1982 baseline examination. Shifted Comparisons more accurately are referred to as shifted original Comparisons to emphasize that they are not replacement Comparisons and that they are the legitimate original Comparisons for their respective Ranch Hands. Shifted original Comparisons are not replacement Comparisons because their invitation to participate in the study was not the result of a previous refusal of another Comparison in their respective matched sets. Shifted original Comparisons were identified to reflect concern that the process by which Comparisons were determined ineligible may not have uniformly distributed ineligible Comparisons.

Health matching of replacements was not used during the baseline examination, but was implemented during the 1985, 1987, 1992, 1997, and 2002 follow-up examinations. During the 1985 examination, a telephone questionnaire was administered to refusals and their potential replacements. This questionnaire served as the basis for health matching required by the study protocol, and assessed self-perception of health, days lost from work due to illness, and medication use. Although the study protocol is not explicit on this point, it implies that the decision to include or exclude the replacements from the study should be based only on this health contrast. At the 1987 follow-up examination, instead of using a telephone questionnaire, refusals were asked during the scheduling process for their self-perception of health. During the 1992, 1997, and 2002 follow-up examinations, schedulers requested a current perception of health from all veterans (compared to others their age) contacted by telephone. Self-perception of health was used in the replacement strategy to address the possibility that replacement Comparisons might differ from the noncompliant original Comparisons they replaced with regard to health, which might bias the study either toward or against the null hypothesis of no difference in health between Ranch Hands and Comparisons.

The appendix to this report presents a flowchart of the complete algorithm, as used by AFHS technical staff, for replacing Comparisons.

### **1.3 SCHEDULING STRATEGY**

The scheduling process included the following three objectives:

1. Maximizing participation rates
2. Ensuring that Ranch Hands and Comparisons were recruited using consistent procedures and amount of effort
3. Ensuring that, whenever possible, each Ranch Hand had at least one compliant Comparison who was matched with that Ranch Hand on age, race, and military occupation.

These objectives led to a set of conflicting priorities: maximizing participation rates meant giving each veteran every opportunity and encouragement to participate, without being so persistent as to lose the cooperation of somewhat ambivalent veterans. This careful approach had to be balanced against the need to quickly identify noncompliant Comparisons. Until these noncompliant Comparisons were removed

from the scheduling process, they could not be replaced. In general, prospective participants were contacted for scheduling in random order; however, priority was given to certain veterans who needed to be contacted early in the scheduling period in the 1997 and 2002 follow-up examinations. These included the following:

- Veterans residing overseas, because they would be more difficult to contact and required advance time to make travel arrangements
- Passive refusals or “no-shows” for previous physical examinations (a further discussion of passive refusals is provided in Section 1.5.2).

For the 1992 follow-up examination, priority also was given to veterans who requested specific examination dates from the Air Force prior to the beginning of the scheduling process. In addition, veterans who listed their occupation as “teacher” were given priority in scheduling due to their probable travel time constraints.

During the first 2 months of scheduling, an attempt was made to contact all veterans invited to previous examinations who were not categorized as adamant refusals. In addition, all previously invited veterans were provided with the date that scheduling would begin and the toll-free number of the scheduling operation.

Although every reasonable attempt was made to contact eligible veterans, accommodate unusual schedules, and convert refusals, experience in past examinations had shown that certain types of veterans ultimately would not schedule appointments. To continue with the replacement of Comparisons, these cases needed to be closed early. Therefore, the following rules concerning adamant refusals and passive refusals were established to limit the number of calls to certain types of individuals who were not likely to participate, such as the following:

- If the scheduler did not get an answer on the telephone after eight attempts, a certified letter was sent to that individual. If there was direct evidence that the individual appeared at the post office to claim the letter, but did not contact the scheduling office, he was considered a passive refusal.
- An individual who broke an examination appointment and did not attempt to reschedule was considered a passive refusal.
- An individual who was scheduled for a physical examination but twice canceled the appointment was considered a passive refusal.
- An individual who was extremely adamant in his refusal to initial scheduling contacts was coded as an adamant refusal.
- A veteran classified as an adamant refusal in previous follow-up examinations was not contacted.

For the 1992 and 1997 follow-up examination, conversion attempts were made for all veterans who initially refused, except for adamant refusals. Three conversion attempts were made for the 1992 follow-up examination and one attempt was made for the 1997 follow-up examination. These attempts were not made for the 2002 follow-up examination because very few veterans were converted into participants through this effort.

Veterans who were designated as refusals at any stage in the scheduling process were provided with the toll-free number for the study and allowed to volunteer to participate at any time.

#### **1.4 STRATEGIES TO ENCOURAGE COMPLIANCE AND FUTURE PARTICIPATION IN THE AFHS**

The Air Force encouraged compliance to and future participation in the AFHS in a number of ways through their policies and procedures. The choice of subcontractors was important, as all subcontractors were expected to be experts in their fields, as well as especially attentive to the needs of the veterans.

During the scheduling process, the contractor responsible for scheduling was active in contacting veterans and encouraging involvement in the study. Participants were allowed flexibility regarding the time of year they attended the AFHS examinations. Many participants used this flexibility to attend the AFHS with friends, creating and maintaining camaraderie among the participants. The scheduling staff requested information from each participant concerning their special needs and coordinated with the clinic and hotel staffs to ensure that those needs were accommodated while the participant was at the clinic site.

During the logistics process, civilian participants were paid a stipend for completing the AFHS. According to Air Force regulations, active duty participants were ineligible for the stipend. After their debriefing at the clinic, the participants were given their stipends and reimbursed for expenses associated with the trip from their homes to the clinic. If a participant needed a cash advance from the future reimbursement, arrangements were made for the advance.

The Air Force paid for family members or friends who were required as medical escorts to assist participants with travel and completing examinations at Scripps Clinic for the 2002 follow-up examination.

Spouses and family members were allowed to stay free of charge in the hotel rooms of the participants. In earlier phases of the AFHS, the hotel arranged activities for family members and provided transportation at no extra charge to the Air Force or the participants' families. The hotel that accommodated AFHS participants allowed extended stays at the AFHS-negotiated hotel rate. For participants who drove to the examination site in oversized vehicles, such as recreational vehicles, the hotel accommodated the vehicle or provided a list of nearby locations that could accommodate these vehicles.

The participants were transported between the hotel and Scripps Clinic on a shuttle bus. The shuttle bus maintained a flexible schedule to accommodate clinic appointments that ended at different times throughout the day. For the 1982 baseline examination, the participants walked to the examination site at the Kelsey-Seybold Clinic in Houston, which was next door to the hotel at which they were staying.

At Scripps Clinic, the participants were provided with amenities designed to make their examination experiences as comfortable as possible. The clinic provided a waiting room with magazines and a television for participants to use in between examinations. If a participant thought that he would not be able to locate an examination room, a member of the AFHS clinic staff would accompany him. Scripps Clinic attempted to develop schedules to accommodate smokers and diabetics. For example, examinations and procedures that required abstinence from tobacco or food were scheduled early in the day for current smokers and diabetics.

Scripps Clinic offered special examinations for participants and spouses at the participant's request for a reduced price. Special medical equipment was set up at Scripps Clinic or arrangements were made at a

nearby hospital if necessary. If a participant forgot his medications, a prescription was filled at Scripps Clinic or at the nearby Veterans Affairs hospital.

The Air Force provided onsite monitors at Kelsey-Seybold and Scripps Clinic to help answer questions that the participants might have and monitor examination activities. The AFHS onsite monitor conducted briefings for the participants and family members, at which the results of the AFHS were presented and questions were answered. The monitor stayed in the same hotel as the participants and had an office in the clinic. The monitor was always available to discuss problems that the participants were having.

As an ongoing reminder of the importance of the study, the AFHS staff sent a yearly newsletter to all participants, describing activities and results from reports and journal articles. The AFHS staff maintained a toll-free number for participants to call and ask questions or request information pertaining to their medical records. The AFHS staff made repeated calls to remind participants to follow up on medical recommendations from their clinic examinations. Air Force personnel attended the annual Ranch Hand reunions to brief the Ranch Hands on the latest findings and activities and to encourage participation in the AFHS.

### **1.5 REASONS FOR REFUSAL**

When a veteran refused to participate at a physical examination, schedulers were instructed to attempt to determine a reason for refusal. Partially compliant veterans participated only by completing the in-home baseline questionnaire interview given at the 1982, 1985, or 1987 examinations. These veterans were treated as refusals and a reason for refusal was obtained and recorded.

Reasons for refusal included the following:

- Health reasons
- Logistical reasons
  - Financial hardship
  - No interest or no time
  - Job commitment
  - Travel distance, family concerns
- Other reasons
  - Dissatisfaction with the U.S. Air Force or the U.S. Government
  - Dissatisfaction with the AFHS
  - Dissatisfaction with previous AFHS examinations
  - Fear of physical examination
  - Confidentiality concerns, adverse impact on career
  - Other.



In addition, other veterans who declined to attend a physical examination may have been classified as follows:

- Adamant refusal
- Passive refusal.

A further discussion of adamant and passive refusals follows.

### **1.5.1 Adamant Refusals**

Veterans were first classified as adamant refusals for the 1992 examination. A veteran who communicated a desire not to have any contact with or from the AFHS under any circumstances was classified as an adamant refusal. A veteran who was extremely adamant in his refusal to initial scheduling contacts also was coded as an adamant refusal. Unless the veteran contacted the AFHS management team and expressed a desire to participate in a subsequent AFHS examination, attempts were not made to contact the veteran for future examinations.

Veterans were declared adamant refusals primarily for the 1992 AFHS examination, but additional adamant refusals were added for the 1997 and 2002 follow-up examinations. During the 1992 physical examination process, 185 veterans were classified as adamant refusals. Seven veterans on the list of adamant individuals died between the 1992 and 1997 follow-up examinations. During the course of the 1997 examination, 21 additional veterans were designated as “newly” adamant individuals, resulting in 199 veterans designated as adamant refusals for the 1997 follow-up examination.

Of the 199 veterans who were designated as adamant refusals for the 1997 physical examination, 10 died between the 1997 and 2002 physical examination, one who was previously designated as adamant asked to be and was allowed to become part of the 2002 follow-up physical examination, and one who was previously designated as an adamant refusal was designated as ineligible. Consequently, 187 of the 199 previously designated adamant refusals were considered adamant refusals as the 2002 physical examination process began. Based on contacts with veterans by either mail or telephone during the 2002 physical examination process, 31 additional veterans were designated as adamant refusals, bringing the total of adamant refusals to 218 at the end of the 2002 follow-up physical examination process.

### **1.5.2 Passive Refusals**

A veteran could be classified as a passive refusal in a variety of ways. For the 2002 follow-up examination, if a veteran was scheduled for a physical examination but twice canceled the appointment or failed to appear for the appointment and did not attempt to reschedule, he was classified as a passive refusal. If the scheduler did not get an answer on the telephone after eight attempts, a certified letter was sent to that individual. If there was direct evidence that the individual appeared at the post office to claim the letter, but did not contact the scheduling office, he was considered a passive refusal.

Some veterans were particularly difficult to reach because of the presence of a “gatekeeper” who did not allow the schedulers to speak directly to the potential participant. A veteran was designated as a final passive refusal for the 1997 and 2002 follow-up examinations after a minimum of three contacts with a gatekeeper and failure to reach the veteran by other means. These contact methods included varying calling times, leaving messages, or sending a certified letter. Eight gatekeeper contacts were allowed in the 1992 follow-up examinations before a veteran was declared a refusal. Up to eight gatekeeper contacts were allowed for the 1997 and 2002 follow-up examinations if the scheduling supervisor decided additional attempts were still warranted (e.g., if an individual had previously scheduled and canceled or if

it seemed reasonable that he might reschedule). After these gatekeeper contacts had been exhausted, the individuals were designated as final passive refusals and, if eligible for replacement, were replaced.

For the 2002 follow-up examination, the Air Force introduced a procedure to facilitate the scheduling process for those veterans who refused to participate in the 1997 follow-up examinations. All refusals from the 1997 follow-up examination were contacted by telephone or sent a letter by the Air Force 6 months prior to the beginning of the scheduling process in March 2002. Each refusal was asked by telephone or letter if he wished to participate in the 2002 follow-up examination. Individuals contacted by telephone who declined the invitation to participate in the 2002 physical examination were asked to provide a reason for their nonparticipation. Individuals contacted by letter were asked to return a card that was enclosed with the letter stating their wishes. If a veteran declined the invitation, he was asked to provide a reason for his nonparticipation. In either case, individuals were given the toll-free number and invited to contact the AFHS if they changed their mind. Individuals who did not return the card were sent a second letter. If there was no response to the second letter the individual was classified as a passive refusal.

Preliminary analyses for this report indicated a relatively large number of passive refusals for the 2002 follow-up examination relative to previous examinations. Because classification as a passive refusal adds little information to the primary cause for refusal, AFHS staff reviewed the record of calls for veterans classified as passive refusals to determine whether a more appropriate classification was in order. Attempts also were made by AFHS staff to contact passive refusals in late 2005 and early 2006 to determine if a real reason for refusal could be ascertained.

## REFERENCE

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1. Lathrop, G.D., W.H. Wolfe, R.A. Albanese, and P.M. Moynahan. 1982. Epidemiologic investigation of health effects in Air Force personnel following exposure to herbicides: Study protocol. NTIS: AD A 122 250. USAF School of Aerospace Medicine, Brooks Air Force Base, TX.

## 2 EFFECTS OF DECLINING PARTICIPATION AND THE REPLACEMENT STRATEGY ON POWER

### 2.1 INTRODUCTION

As described in Section 1.2, the authors of the Air Force Health Study (AFHS) protocol anticipated that a loss of participants between examinations would pose the greatest threat to study validity. To partially correct the situation, the study design specified that noncompliant Comparisons would be replaced by Comparisons with the same values of the matching variables (age, race, and military occupation at the baseline examination) and the same current health perception. No corresponding strategy for the Ranch Hands was possible because all living Ranch Hands had been identified and invited to participate.

Table 2-1 gives the number of participants for each of the six AFHS examinations. The total number of Comparisons is given, as is the number of original and replacement Comparisons for each examination.

**Table 2-1. Participation for the AFHS Examinations**

<b>Group/Examination</b>	<b>1982</b>	<b>1985</b>	<b>1987</b>	<b>1992</b>	<b>1997</b>	<b>2002</b>
<i>Original Comparisons</i>	935	954	938	912	839	737
<i>Replacement Comparisons</i>	288	338	360	368	412	437
All Comparisons	1,223	1,292	1,298	1,280	1,251	1,174
Ranch Hands	1,046	1,017	996	953	870	777
Total Participants	2,269	2,309	2,294	2,233	2,121	1,951

The total number of Comparisons who participated was greater at the 1985, 1987, 1992, and 1997 follow-up examinations than at the baseline examination. Although the number of original Comparisons has been decreasing since the 1985 follow-up examination, the number of replacement Comparisons increased for each examination, which helped to maintain the size of the Comparison group. The policy of inviting a Comparison to participate in an examination if he had participated or had been invited to participate in any previous examination also helped to maintain the size of the Comparison group.

### 2.2 POWER

A type I error is making a false conclusion that an association exists when there is no association. The other possible inference error, a type II error, is the failure to detect an association when one actually exists. The power of a statistical test is 1 minus the probability of a type II error. The power of the test is the probability that the test will reject the hypothesis of no group or dioxin effect when an effect does in fact exist. As participation in the AFHS decreases, the power of the statistical hypothesis tests to detect an association consequently will decrease.

The fixed size of the Ranch Hand cohort also limits the ability of this study to detect some associations if they exist. This limitation is most obvious for specific types of cancer, such as soft tissue sarcoma and non-Hodgkin's lymphoma. These conditions are so uncommon that fewer than two cases were expected in this study, indicating that there is virtually no statistical power to detect low-to-moderate associations between dioxin and cancer.

To illustrate the effects of decreasing participation on the ability to detect an association, the power to detect a group effect (difference between Ranch Hands and Comparisons) for a discrete dependent variable in the 2002 follow-up examination was compared to the corresponding power based on participation in the 1985 follow-up examination. These two follow-up examinations were chosen because participation was at its highest for the 1985 follow-up examination and at its lowest for the 2002 follow-up examination.

Table 2-2 contains the approximate power at a significance level of 0.05 to detect specified relative risks for a given prevalence rate of a discrete dependent variable for the 1985 follow-up examination. Similar calculations were performed based on participation in the 2002 follow-up examination. Table 2-3 presents these calculations. The power of a test for a discrete variable depends on the significance level, actual relative risk, prevalence of the condition, and the Ranch Hand and Comparison sample sizes. As an example, Table 2-2 shows a power of 0.22 to detect a relative risk of 2.0 for a disease with a prevalence of 0.005 and a power of 0.65 to detect a relative risk of 2.0 for a disease with a prevalence of 0.02.

**Table 2-2. Approximate Power To Detect a Group Effect at a 5-Percent Level of Significance Based on Participation in the 1985 Follow-up Examination (Discrete Dependent Variable)**

Prevalence of Condition	Relative Risk								
	1.10	1.20	1.30	1.40	1.50	1.75	2.00	10.00	20.00
0.005	0.05	0.06	0.07	0.09	0.11	0.16	0.22	0.91	0.97
0.01	0.06	0.07	0.10	0.13	0.16	0.27	0.38	1.00	1.00
0.02	0.06	0.09	0.14	0.21	0.28	0.47	0.65	1.00	1.00
0.03	0.07	0.12	0.19	0.28	0.39	0.64	0.81	1.00	1.00
0.04	0.07	0.14	0.24	0.36	0.48	0.75	0.91	1.00	1.00
0.05	0.08	0.16	0.28	0.42	0.57	0.84	0.95	1.00	1.00
0.10	0.11	0.26	0.47	0.68	0.83	0.98	1.00	1.00	1.00
0.15	0.13	0.35	0.61	0.82	0.94	1.00	1.00	1.00	1.00
0.20	0.15	0.42	0.71	0.90	0.97	1.00	1.00	1.00	1.00

**Table 2-3. Approximate Power To Detect a Group Effect at a 5-Percent Level of Significance Based on Participation in the 2002 Follow-up Examination (Discrete Dependent Variable)**

Prevalence of Condition	Relative Risk								
	1.10	1.20	1.30	1.40	1.50	1.75	2.00	10.00	20.00
0.005	0.05	0.06	0.07	0.08	0.10	0.14	0.20	0.91	0.97
0.01	0.05	0.07	0.09	0.12	0.15	0.24	0.34	1.00	1.00
0.02	0.06	0.09	0.13	0.18	0.24	0.42	0.59	1.00	1.00
0.03	0.06	0.10	0.17	0.25	0.34	0.57	0.76	1.00	1.00
0.04	0.07	0.12	0.21	0.31	0.42	0.69	0.86	1.00	1.00
0.05	0.07	0.14	0.24	0.37	0.50	0.78	0.92	1.00	1.00
0.10	0.10	0.22	0.41	0.61	0.77	0.96	1.00	1.00	1.00
0.15	0.11	0.30	0.54	0.75	0.89	0.99	1.00	1.00	1.00
0.20	0.13	0.36	0.63	0.84	0.95	1.00	1.00	1.00	1.00

The greatest decrease in power between 1985 and 2002 is at a relative risk of 1.30 and a prevalence of 0.20. The power decreased from 0.71 for the 1985 follow-up examination to 0.63 for the 2002 follow-up examination, a difference of 0.08. Although the power decreased, the validity of the study does not appear to be compromised.

Similar calculations were done to examine the effect that the replacement strategy had on increasing the power to detect an association. To examine the effects of augmenting the original Comparison group with replacement Comparisons, power was compared using Ranch Hands and original Comparisons. Table 2-4 contains the approximate power at a significance level of 0.05 to detect specified relative risks for a given prevalence rate of a discrete dependent variable for the 1985 follow-up examination using Ranch Hands and original Comparisons. Table 2-5 presents similar calculations using Ranch and original Comparisons.

**Table 2-4. Approximate Power To Detect a Group Effect at a 5-Percent Level of Significance Based on Participation in the 1985 Follow-up Examination Using Ranch Hands and Original Comparisons (Discrete Dependent Variable)**

Prevalence of Condition	Relative Risk								
	1.10	1.20	1.30	1.40	1.50	1.75	2.00	10.00	20.00
0.005	0.05	0.06	0.07	0.08	0.10	0.14	0.18	0.76	0.84
0.01	0.06	0.07	0.09	0.11	0.14	0.22	0.31	0.96	0.99
0.02	0.06	0.09	0.13	0.18	0.24	0.39	0.54	1.00	1.00
0.03	0.06	0.11	0.17	0.24	0.33	0.54	0.71	1.00	1.00
0.04	0.07	0.12	0.20	0.30	0.41	0.66	0.83	1.00	1.00
0.05	0.07	0.14	0.24	0.36	0.49	0.75	0.90	1.00	1.00
0.10	0.10	0.23	0.41	0.60	0.76	0.95	0.99	1.00	1.00
0.15	0.12	0.30	0.54	0.75	0.89	0.99	1.00	1.00	1.00
0.20	0.13	0.36	0.64	0.84	0.95	1.00	1.00	1.00	1.00

**Table 2-5. Approximate Power To Detect a Group Effect at a 5-Percent Level of Significance Based on Participation in the 2002 Follow-up Examination Using Ranch Hands and Original Comparisons (Discrete Dependent Variable)**

Prevalence of Condition	Relative Risk								
	1.10	1.20	1.30	1.40	1.50	1.75	2.00	10.00	20.00
0.005	0.05	0.06	0.06	0.07	0.09	0.12	0.15	0.65	0.74
0.01	0.05	0.06	0.08	0.10	0.12	0.18	0.25	0.91	0.96
0.02	0.06	0.08	0.11	0.15	0.19	0.32	0.44	1.00	1.00
0.03	0.06	0.09	0.14	0.20	0.26	0.44	0.60	1.00	1.00
0.04	0.07	0.11	0.17	0.25	0.33	0.55	0.72	1.00	1.00
0.05	0.07	0.12	0.20	0.29	0.40	0.64	0.81	1.00	1.00
0.10	0.09	0.19	0.33	0.49	0.65	0.89	0.97	1.00	1.00
0.15	0.10	0.24	0.44	0.64	0.80	0.97	1.00	1.00	1.00
0.20	0.11	0.29	0.53	0.74	0.88	0.99	1.00	1.00	1.00

As expected, the same patterns hold when comparing Tables 2-4 and 2-5. For a relative risk of 1.75 and a prevalence of 0.04, the power decreased from 0.66 for the 1985 follow-up examination to 0.55 for the 2002 follow-up examination, a difference of 0.11. All other decreases in power between the 1985 and 2002 follow-up examinations were no larger in magnitude than this decrease.

The effects of a decrease in participation between AFHS examinations can be compared to the effects of using replacement Comparisons by examining Tables 2-3 and 2-4. Table 2-2 presents power calculations using all participants from the 1985 follow-up examination, the examination with the greatest number of participants. Table 2-3 presents power calculations using all participants from the 2002 follow-up examination, the examination with the least number of participants. Table 2-4 presents power calculations using Ranch Hands and original Comparisons from the 1985 follow-up examination. Comparing Tables 2-3 and 2-4 will provide a comparison of the loss of power across examinations due to follow-up with the loss of power that would have occurred if there was not a replacement strategy for Comparisons. If the individual entries are compared between Tables 2-3 and 2-4, the power is generally less in Table 2-4. That is, if a replacement strategy had not been used, the loss of power would have been greater than the loss of power that occurred due to the natural attrition of participants between the 1985 and 2002 follow-up examinations.

The joint effects of the use of replacement Comparisons and attrition as the AFHS progressed can be examined by comparing Tables 2-2 and 2-5. Differences of 0.20 or greater are present for the combination of some prevalences and relative risks of 1.75 or greater (last four columns of the table).

### 2.3 CONCLUSION

The loss of power because of declining participation as the AFHS progressed was expected and does not appear to have compromised the validity of the AFHS. The loss of power because of declining participation, however, generally was smaller than the loss of power that would have occurred if a replacement strategy had not been used. The replacement strategy succeeded in its attempts to prevent a large decrease in the number of Comparisons that participated in the AFHS.

### 3 FACTORS THAT MAY AFFECT COMPLIANCE

#### 3.1 INTRODUCTION

The number of veterans who participated in the Air Force Health Study (AFHS), who were eligible to participate, and the percentage of eligible veterans who participated is given in Table 3-1. Veterans who were eligible to participate included those who participated, who refused, and who were unlocatable. Deceased veterans were not eligible for participation and, thus, were not included. Separate statistics are provided for Ranch Hands and all Comparisons, and for Ranch Hands and original Comparisons, as described subsequently in Section 3.2.

**Table 3-1. Eligibility and Participation for the AFHS Examinations**

Examination	Ranch Hands and All Comparisons			Ranch Hands and Original Comparisons		
	Participated	Eligible	Percentage of Eligible	Participated	Eligible	Percentage of Eligible
1982	2,269	2,875	78.9%	1,981	2,444	81.1%
1985	2,309	2,912	79.3%	1,971	2,430	81.1%
1987	2,294	2,918	78.6%	1,934	2,410	80.2%
1992	2,233	2,898	77.1%	1,865	2,340	79.7%
1997	2,121	2,930	72.4%	1,709	2,253	75.9%
2002	1,951	3,024	64.5%	1,514	2,135	70.9%

Note: Eligible veterans included those who participated, who refused, and who were unlocatable; deceased veterans were not eligible for participation and, thus, were not included.

Compliance rates were similar for the 1982, 1985, 1987, and 1992 examinations. The compliance rates dropped for the 1997 and 2002 follow-up examinations.

This chapter discusses factors that may have affected compliance rates. In particular, the effects of group (Ranch Hand, Comparison), race (non-Black, Black), military occupation (officer, enlisted flyer, enlisted groundcrew), age, dioxin level, and military commitment (career, noncareer) are examined. Differences between original Comparisons and replacement Comparisons are illustrated, and definitions of compliance that examine participation across the six examinations are investigated.

#### 3.2 GROUP

The number and percentage of veterans who were compliant and noncompliant are shown by group (Ranch Hand, all Comparisons, which included original Comparisons and replacement Comparisons) and examination in Table 3-2. Ranch Hands had a significantly larger compliance rate at all examinations than all Comparisons ( $p < 0.001$  for all examinations).

It was expected, however, that the compliance rate would be greater for original Comparisons than for replacement Comparisons. Most original Comparisons were contacted at the beginning of the study in 1982 and for all follow-up examinations thereafter. Replacement Comparisons were contacted only after an original Comparison refused to participate in the study. Therefore, new replacement Comparisons were invited to participate in the AFHS at each follow-up examination. Replacement Comparisons may



not have been invited to participate until as late as 2002. As a result, 30 or more years may have passed since their Southeast Asia tour of duty.

Because of the inherent expected differences between original and replacement comparisons, a contrast in the compliance rate between these two subgroups was examined. The number and percentage of veterans who were compliant and noncompliant also are shown by Comparison subgroup and examination in Table 3-2. Original Comparisons had a significantly larger compliance rate at all examinations than replacement Comparisons ( $p < 0.02$  for all examinations). The difference in compliance rates for original and replacement Comparisons was increased from the 1992 to 2002 follow-up examinations, but was relatively stable from 1982 to 1992.

**Table 3-2. Analysis of Compliance Rates by Group (Ranch Hands vs. All Comparisons and Original Comparisons vs. Replacement Comparisons)**

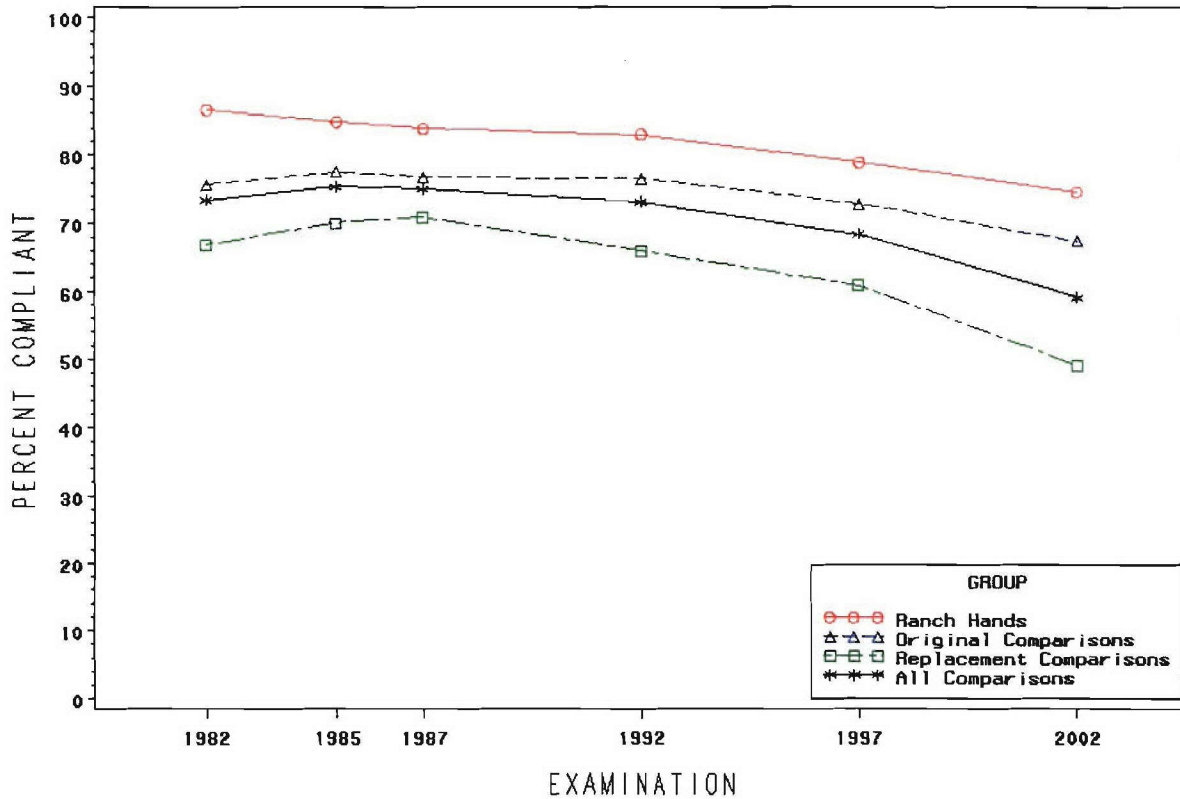
AFHS Examination	Group	Compliant	Not Compliant <sup>a</sup>	p-Value <sup>b</sup>
		n (%)	n (%)	
1982	Ranch Hand	1,046 (86.5%)	163 (13.5%)	<b>&lt;0.001</b>
	All Comparisons	1,223 (73.4%)	443 (26.6%)	
	Original Comparisons	935 (75.7%)	300 (24.3%)	<b>&lt;0.001</b>
	Replacement Comparisons	288 (66.8%)	143 (33.2%)	
1985	Ranch Hand	1,017 (84.8%)	182 (15.2%)	<b>&lt;0.001</b>
	All Comparisons	1,292 (75.4%)	421 (24.6%)	
	Original Comparisons	954 (77.5%)	277 (22.5%)	<b>0.002</b>
	Replacement Comparisons	338 (70.1%)	144 (29.9%)	
1987	Ranch Hand	996 (83.8%)	192 (16.2%)	<b>&lt;0.001</b>
	All Comparisons	1,298 (75.0%)	432 (25.0%)	
	Original Comparisons	938 (76.8%)	284 (23.2%)	<b>0.012</b>
	Replacement Comparisons	360 (70.9%)	148 (29.1%)	
1992	Ranch Hand	953 (82.9%)	196 (17.1%)	<b>&lt;0.001</b>
	All Comparisons	1,280 (73.2%)	469 (26.8%)	
	Original Comparisons	912 (76.6%)	279 (23.4%)	<b>&lt;0.001</b>
	Replacement Comparisons	368 (65.9%)	190 (34.1%)	
1997	Ranch Hand	870 (78.9%)	232 (21.1%)	<b>&lt;0.001</b>
	All Comparisons	1,251 (68.4%)	577 (31.6%)	
	Original Comparisons	839 (72.9%)	312 (27.1%)	<b>&lt;0.001</b>
	Replacement Comparisons	412 (60.9%)	265 (39.1%)	
2002	Ranch Hand	777 (74.6%)	264 (25.4%)	<b>&lt;0.001</b>
	All Comparisons	1,174 (59.2%)	809 (40.8%)	
	Original Comparisons	737 (67.4%)	357 (32.6%)	<b>&lt;0.001</b>
	Replacement Comparisons	437 (49.2%)	452 (50.8%)	

<sup>a</sup>Includes veterans who refused and were unlocatable; deceased veterans were not eligible for participation and, thus, were not included.

<sup>b</sup>P-value based on continuity-adjusted chi-square statistic.

Note: The p-values appearing in bold type represent a statistically significant association ( $p\text{-value} < 0.05$ ).

Figure 3-1 presents a plot of the percentage compliant for each examination, with Ranch Hands, original Comparisons, replacement Comparisons, and all Comparisons represented separately.



**Figure 3-1. Percentage of Veterans Who Were Compliant by Group (Ranch Hands, Original Comparisons, Replacement Comparisons, and All Comparisons)**

Because of the inherent differences in the AFHS experiences and connections between original Comparisons and replacement Comparisons, subsequent compliance rates were contrasted using original Comparisons. As described in Chapter 2, replacement Comparisons and the replacement strategy were extremely important in maintaining the integrity of the AFHS, and there is no intention to minimize the contributions of the replacement Comparisons to the integrity of the AFHS in further analyses.

The number and percentage of veterans who were compliant and noncompliant are shown by group (Ranch Hand, original Comparison) and examination in Table 3-3. Ranch Hands had a significantly larger compliance rate at all examinations than original Comparisons ( $p < 0.001$  for all examinations), but the difference in compliance was relatively constant from 1985 to 2002, differing between 6 and 7 percent.

**Table 3-3. Analysis of Compliance Rates by Group (Ranch Hands vs. Original Comparisons)**

AFHS Examination	Group	Compliant	Not Compliant <sup>a</sup>	p-Value <sup>b</sup>
		n (%)	n (%)	
1982	Ranch Hand	1,046 (86.5%)	163 (13.5%)	<b>&lt;0.001</b>
	Original Comparison	935 (75.7%)	300 (24.3%)	
1985	Ranch Hand	1,017 (84.8%)	182 (15.2%)	<b>&lt;0.001</b>
	Original Comparison	954 (77.5%)	277 (22.5%)	
1987	Ranch Hand	996 (83.8%)	192 (16.2%)	<b>&lt;0.001</b>
	Original Comparison	938 (76.8%)	284 (23.2%)	
1992	Ranch Hand	953 (82.9%)	196 (17.1%)	<b>&lt;0.001</b>
	Original Comparison	912 (76.6%)	279 (23.4%)	
1997	Ranch Hand	870 (78.9%)	232 (21.1%)	<b>&lt;0.001</b>
	Original Comparison	839 (72.9%)	312 (27.1%)	
2002	Ranch Hand	777 (74.6%)	264 (25.4%)	<b>&lt;0.001</b>
	Original Comparison	737 (67.4%)	357 (32.6%)	

<sup>a</sup>Includes veterans who refused and were unlocatable; deceased veterans were not eligible for participation and, thus, were not included.

<sup>b</sup>P-value based on continuity-adjusted chi-square statistic.

Note: The p-values appearing in bold type represent a statistically significant association (p-value<0.05).

### 3.3 RACE

The number and percentage of veterans who were compliant and noncompliant are shown by race and examination in Table 3-4. There was no association between compliance and race in any of the AFHS examinations (p>0.37 for all examinations). Compliance rates for Black and non-Black veterans differed by approximately 2 percent or less for all examination cycles except 2002, when the difference was nearly 4 percent.

**Table 3-4. Analysis of Compliance Rates by Race (Ranch Hands and Original Comparisons Included)**

AFHS Examination	Race	Compliant	Not Compliant <sup>a</sup>	p-Value <sup>b</sup>
		n (%)	n (%)	
1982	Non-Black	1,863 (81.1%)	433 (18.9%)	0.752
	Black	118 (79.7%)	30 (20.3%)	
1985	Non-Black	1,851 (81.1%)	432 (18.9%)	0.954
	Black	120 (81.6%)	27 (18.4%)	
1987	Non-Black	1,817 (80.3%)	445 (19.7%)	0.787
	Black	117 (79.1%)	31 (20.9%)	

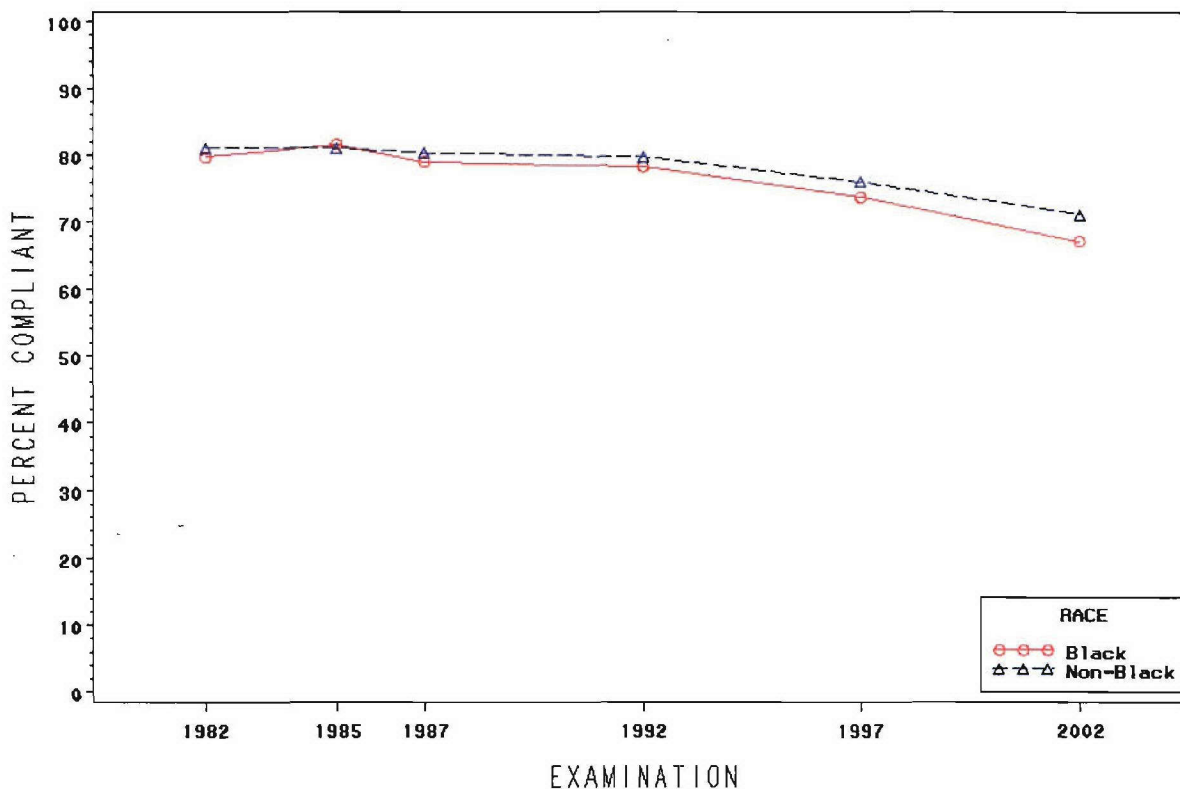
**Table 3-4. Analysis of Compliance Rates by Race (Ranch Hands and Original Comparisons Included) (Continued)**

AFHS Examination	Race	Compliant	Not Compliant <sup>a</sup>	p-Value <sup>b</sup>
		n (%)	n (%)	
1992	Non-Black	1,753 (79.8%)	444 (20.2%)	0.752
	Black	112 (78.3%)	31 (21.7%)	
1997	Non-Black	1,605 (76.0%)	507 (24.0%)	0.618
	Black	104 (73.8%)	37 (26.2%)	
2002	Non-Black	1,424 (71.2%)	577 (28.8%)	0.374
	Black	90 (67.2%)	44 (32.8%)	

<sup>a</sup>Includes veterans who refused and were unlocatable; deceased veterans were not eligible for participation and, thus, were not included.

<sup>b</sup>P-value based on continuity-adjusted chi-square statistic.

Figure 3-2 provides a plot of the percentage compliant for each examination with Blacks and non-Blacks represented separately.



**Figure 3-2. Percentage of Veterans Who Were Compliant by Race (Non-Blacks and Blacks)**

### 3.4 MILITARY OCCUPATION

The number and percentage of veterans who were compliant and noncompliant is shown by military occupation and examination in Table 3-5. The association between compliance and military occupation was significant in all of the AFHS examinations ( $p \leq 0.001$  for all examinations). A greater percentage of enlisted flyers were compliant at all of the examinations. Enlisted groundcrew were the least compliant in all examinations except the 1982 baseline examination. Officers were similar to enlisted groundcrew in the earlier phases of the AFHS examination, but the percentage of officers who were compliant was closer to enlisted flyers than enlisted groundcrew in the later phases of the AFHS.

**Table 3-5. Analysis of Compliance Rates by Military Occupation (Ranch Hands and Original Comparisons Included)**

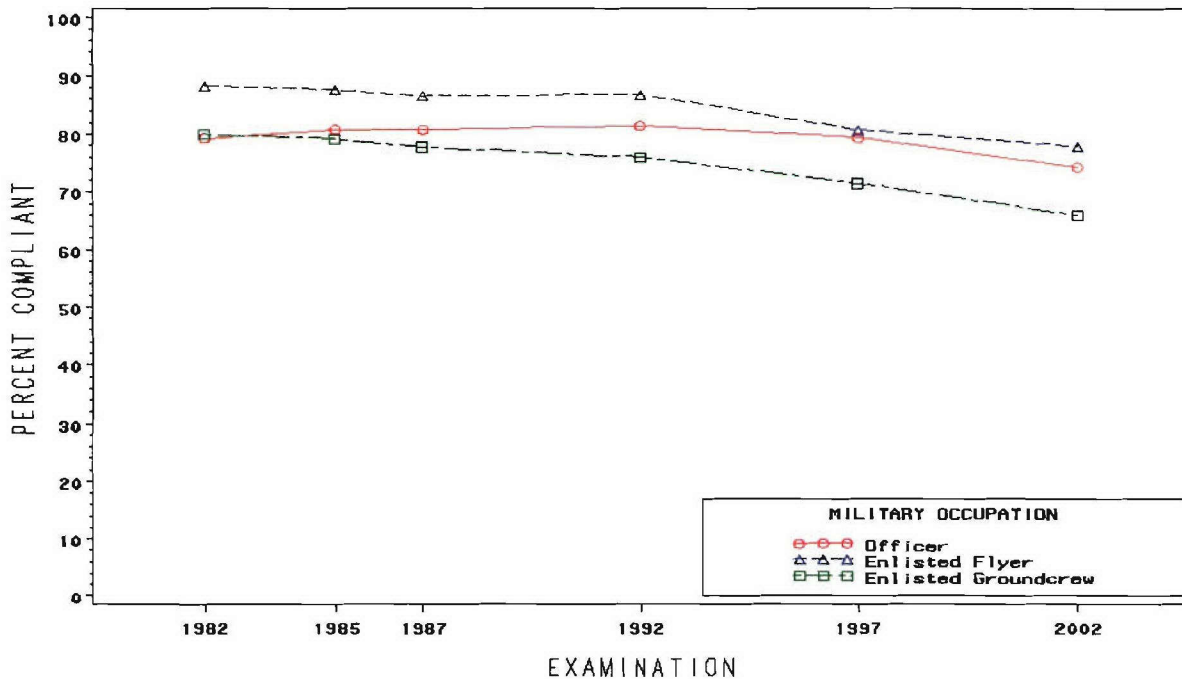
AFHS Examination	Military Occupation	Compliant	Not Compliant <sup>a</sup>	p-Value <sup>b</sup>
		n (%)	n (%)	
1982	Officer	719 (79.3%)	188 (20.7%)	<b>&lt;0.001</b>
	Enlisted Flyer	353 (88.3%)	47 (11.7%)	
	Enlisted Groundcrew	909 (79.9%)	228 (20.1%)	
1985	Officer	730 (80.8%)	174 (19.2%)	<b>0.001</b>
	Enlisted Flyer	351 (87.5%)	50 (12.5%)	
	Enlisted Groundcrew	890 (79.1%)	235 (20.9%)	
1987	Officer	723 (80.7%)	173 (19.3%)	<b>&lt;0.001</b>
	Enlisted Flyer	343 (86.4%)	54 (13.6%)	
	Enlisted Groundcrew	868 (77.7%)	249 (22.3%)	
1992	Officer	709 (81.4%)	162 (18.6%)	<b>&lt;0.001</b>
	Enlisted Flyer	327 (86.7%)	50 (13.3%)	
	Enlisted Groundcrew	829 (75.9%)	263 (24.1%)	
1997	Officer	664 (79.3%)	173 (20.7%)	<b>&lt;0.001</b>
	Enlisted Flyer	292 (80.7%)	70 (19.3%)	
	Enlisted Groundcrew	753 (71.4%)	301 (28.6%)	
2002	Officer	594 (74.3%)	206 (25.7%)	<b>&lt;0.001</b>
	Enlisted Flyer	260 (77.8%)	74 (22.2%)	
	Enlisted Groundcrew	660 (65.9%)	341 (34.1%)	

<sup>a</sup>Includes veterans who refused and were unlocatable; deceased veterans were not eligible for participation and, thus, were not included.

<sup>b</sup>P-value based on Pearson's chi-square statistic.

Note: The p-values appearing in bold type represent a statistically significant association ( $p\text{-value} < 0.05$ ).

Figure 3-3 shows a plot of the percentage compliant for each examination, with officers, enlisted flyers, and enlisted groundcrew represented separately.



**Figure 3-3. Percentage of Veterans Who Were Compliant by Military Occupation (Officers, Enlisted Flyers, and Enlisted Groundcrew)**

### 3.5 YEAR OF BIRTH

The number and percentage of veterans who were compliant and noncompliant are shown by examination and year of birth in Table 3-6. Year of birth has been categorized into 10-year periods. There was a significant association between compliance and year of birth at the time of the examination for all of the AFHS examinations ( $p < 0.001$  for all examinations). For all examinations, the compliance rate increases as age increases until the oldest age group (born in 1920 or before) was examined. For the 1982, 1985, and 1987 examinations, the oldest age group had a higher compliance rate than the youngest age group. For the 1992, 1997, and 2002 examinations, the compliance rate for the oldest age group was lower than the compliance rate for the youngest age group.

**Table 3-6. Analysis of Compliance Rates by Year of Birth (Ranch Hands and Original Comparisons Included)**

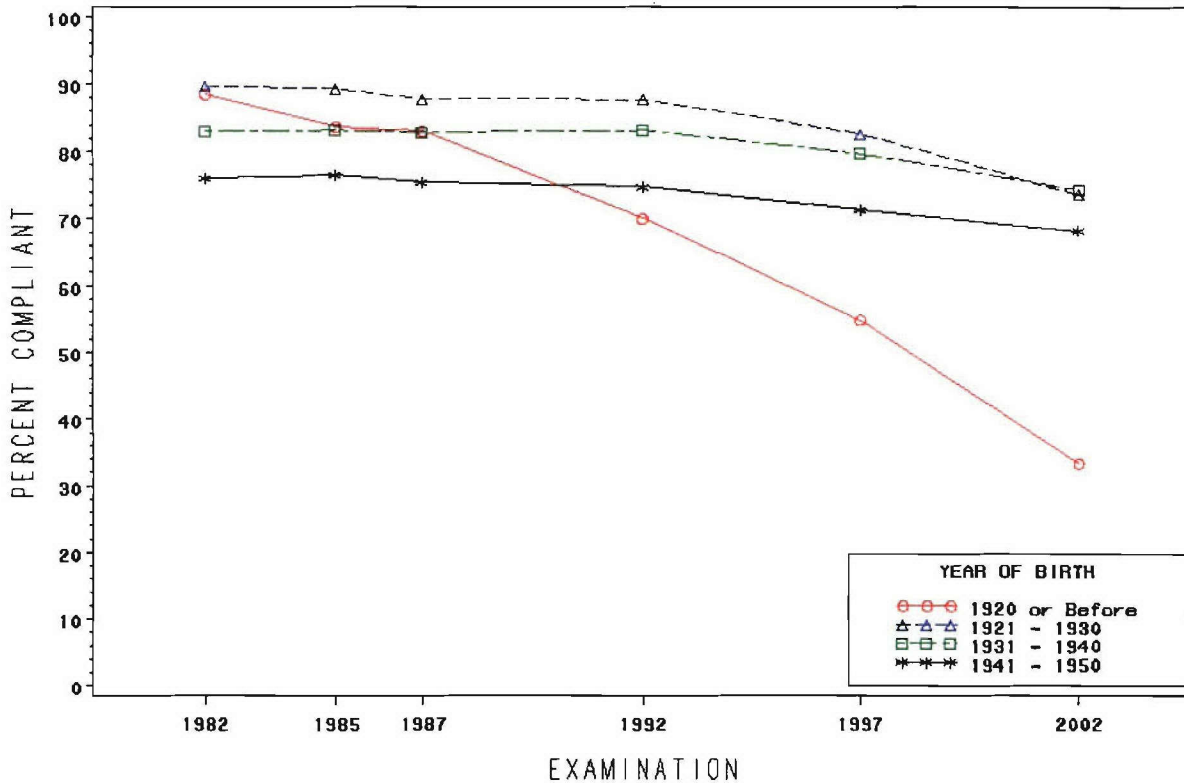
AFHS Examination	Year of Birth (Age at Examination)	Compliant	Not Compliant <sup>a</sup>	p-Value <sup>b</sup>
		n (%)	n (%)	
1982	Born 1920 or Before (≥62 years old)	46 (88.5%)	6 (11.5%)	<b>&lt;0.001</b>
	Born 1921-1930 (52-61 years old)	328 (89.6%)	38 (10.4%)	
	Born 1931-1940 (42-51 years old)	789 (83.0%)	162 (17.0%)	
	Born 1941-1950 (32-41 years old)	818 (76.1%)	257 (23.9%)	
1985	Born 1920 or Before (≥65 years old)	41 (83.7%)	8 (16.3%)	<b>&lt;0.001</b>
	Born 1921-1930 (55-64 years old)	315 (89.2%)	38 (10.8%)	
	Born 1931-1940 (45-54 years old)	788 (83.2%)	159 (16.8%)	
	Born 1941-1950 (35-44 years old)	827 (76.5%)	254 (23.5%)	
1987	Born 1920 or Before (≥67 years old)	39 (83.0%)	8 (17.0%)	<b>&lt;0.001</b>
	Born 1921-1930 (57-66 years old)	303 (87.8%)	42 (12.2%)	
	Born 1931-1940 (47-56 years old)	778 (82.9%)	161 (17.1%)	
	Born 1941-1950 (37-46 years old)	814 (75.4%)	265 (24.6%)	
1992	Born 1920 or Before (≥72 years old)	28 (70.0%)	12 (30.0%)	<b>&lt;0.001</b>
	Born 1921-1930 (62-71 years old)	284 (87.7%)	40 (12.3%)	
	Born 1931-1940 (52-61 years old)	751 (83.2%)	152 (16.8%)	
	Born 1941-1950 (42-51 years old)	802 (74.7%)	271 (25.3%)	
1997	Born 1920 or Before (≥77 years old)	17 (54.8%)	14 (45.2%)	<b>&lt;0.001</b>
	Born 1921-1930 (67-76 years old)	248 (82.7%)	52 (17.3%)	
	Born 1931-1940 (57-66 years old)	695 (79.7%)	177 (20.3%)	
	Born 1941-1950 (47-56 years old)	749 (71.3%)	301 (28.7%)	
2002	Born 1920 or Before (≥82 years old)	7 (33.3%)	14 (66.7%)	<b>&lt;0.001</b>
	Born 1921-1930 (72-81 years old)	198 (73.6%)	71 (26.4%)	
	Born 1931-1940 (62-71 years old)	607 (74.4%)	209 (25.6%)	
	Born 1941-1950 (52-61 years old)	702 (68.2%)	327 (31.8%)	

<sup>a</sup>Includes veterans who refused and were unlocatable; deceased veterans were not eligible for participation and, thus, were not included.

<sup>b</sup>P-value based on Pearson's chi-square statistic.

Note: The p-values appearing in bold type represent a statistically significant association (p-value<0.05).

Figure 3-4 shows a plot of the percentage compliant for each examination for different year-of-birth groups.



**Figure 3-4. Percentage of Veterans Who Were Compliant by Year of Birth**

A sharp decline in compliance was seen in veterans born in 1920 or before, beginning with the 1987 examination when this group included veterans who were 67 years old or older. The second oldest group (those born between 1921 and 1930) had relatively stable compliance rates until 1992, when compliance started to decline. This group of veterans was between 62 and 71 years old at the time of the 1992 follow-up examination. The difference in the compliance rates of the group born between 1931 and 1940 and the group born between 1941 and 1950 was similar throughout the AFHS examinations. Veterans born between 1931 and 1940 were more likely to comply than veterans born between 1941 and 1950.

As seen for the oldest participants at the 1992, 1997, and 2002 follow-up examinations in Table 3-6, the decline in the compliance rate was more evident after a veteran reached 72 years of age. Inspection of the compliance rates relative to the actual ages of the veterans suggested that the sharp decrease in compliance actually began when the veteran was between 75 and 80 years of age.



### 3.6 DIOXIN

Of the 3,502 Ranch Hands and Comparisons eligible to participate in at least one AFHS examination, 2,551 have at least one measured dioxin level. Of the 951 veterans without a measured dioxin level, 935 did not participate in an AFHS examination at the 1987 follow-up examination, which was the first examination in which blood was drawn to test dioxin levels, or after. Consequently, data are available for most veterans who participated in at least one AFHS follow-up examination in 1987 or later.

After a participant had a determination of his dioxin level, a letter was sent to him to inform him of his measured dioxin level. A sentence in the letter stated, "The current dioxin body burden in persons not occupationally exposed to dioxin is approximately 0-10 parts per trillion (ppt)." Based on this letter and for purposes of analysis, the measured dioxin level has been divided into two categories: no more than 10 ppt and more than 10 ppt. The number and percentage of veterans who were compliant and noncompliant is shown by dioxin category ( $\leq 10$  ppt and  $> 10$  ppt) and examination in Table 3-7.

Analysis is presented only for the 1992, 1997, and 2002 follow-up examinations. In addition, as stated above, the 1987 follow-up examination was the first examination at which blood was drawn to test dioxin levels. Therefore, knowledge of dioxin level could not have influenced whether a veteran participated or not until the 1992 examination.

No association between compliance and dioxin was detected in the 1992, 1997, or 2002 examinations ( $p > 0.20$  for all examinations).

**Table 3-7. Analysis of Compliance Rates by Dioxin Level (Ranch Hands and Original Comparisons Included)**

AFHS Examination	Dioxin Level	Compliant	Not Compliant <sup>a</sup>	p-Value <sup>b</sup>
		n (%)	n (%)	
1992	$\leq 10$ ppt	1,297 (94.1%)	82 (5.9%)	0.281
	$> 10$ ppt	559 (95.4%)	27 (4.6%)	
1997	$\leq 10$ ppt	1,201 (90.3%)	129 (9.7%)	0.205
	$> 10$ ppt	503 (88.2%)	67 (11.8%)	
2002	$\leq 10$ ppt	1,073 (84.5%)	197 (15.5%)	0.342
	$> 10$ ppt	440 (82.6%)	93 (17.4%)	

<sup>a</sup>Includes veterans who refused and were unlocatable; deceased veterans were not eligible for participation and, thus, were not included.

<sup>b</sup>P-value based on continuity-adjusted chi-square statistic.

Figure 3-5 shows a plot of the percentage compliant for each examination, with measured dioxin levels  $\leq 10$  ppt and  $> 10$  ppt represented separately. Similar compliance rates were seen between participants with dioxin levels less than or equal to 10 ppt and participants with dioxin levels greater than 10 ppt.

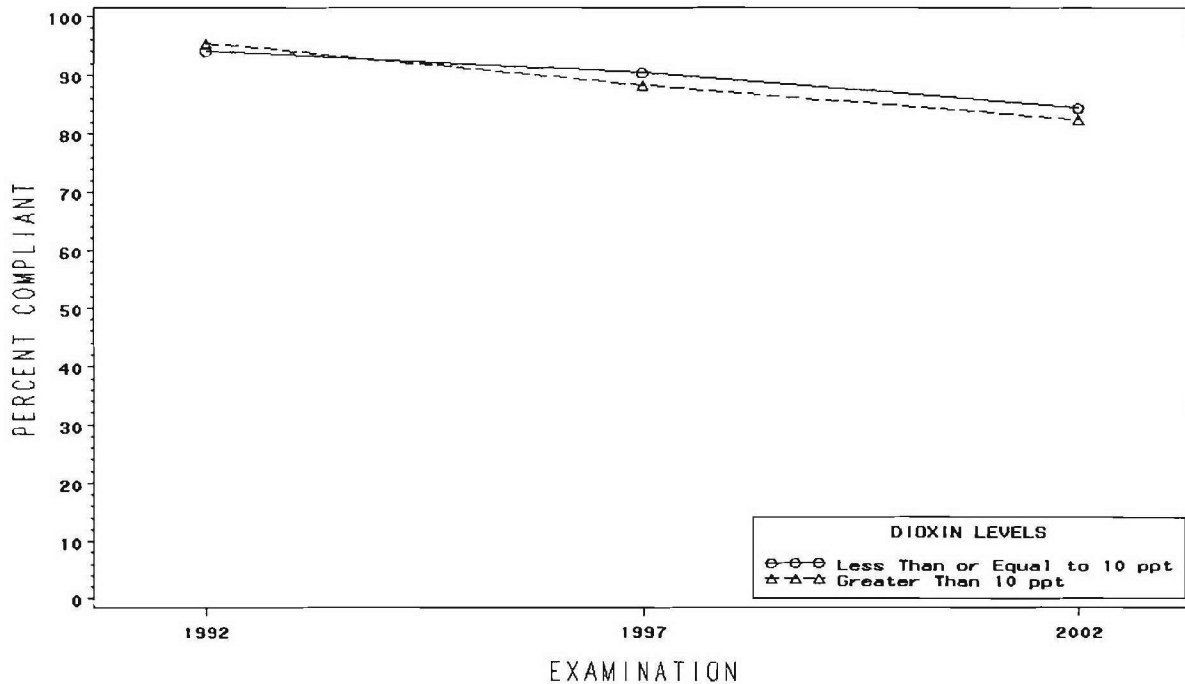


Figure 3-5. Percentage of Veterans Who Were Compliant by Dioxin Level ( $\leq 10$  ppt and  $> 10$  ppt)

### 3.7 MILITARY COMMITMENT

Military records were examined and a commitment to the military was divided into one of two categories: career or noncareer. Veterans classified in the career military commitment category were those veterans who, at the 1982 baseline examination, were retired from military service, were on active duty with 10 or more years of military service, or died while on active duty. Noncareer military veterans were those veterans who, at the 1982 baseline examination, had left the military service in a status other than retired. The reason for examining military status was the hypothesis that veterans who made the military their career may have been more committed to the AFHS.

The number and percentage of veterans who were compliant and noncompliant are shown by military commitment category (career and noncareer) and examination in Table 3-8. There was a significant association between compliance and military commitment for all of the AFHS examinations ( $p < 0.001$  for all examinations). Veterans who made a career out of the military were more likely to participate in AFHS examinations than veterans who did not make a career out of the military.

**Table 3-8. Analysis of Compliance Rates by Military Commitment (Ranch Hands and Original Comparisons Included)**

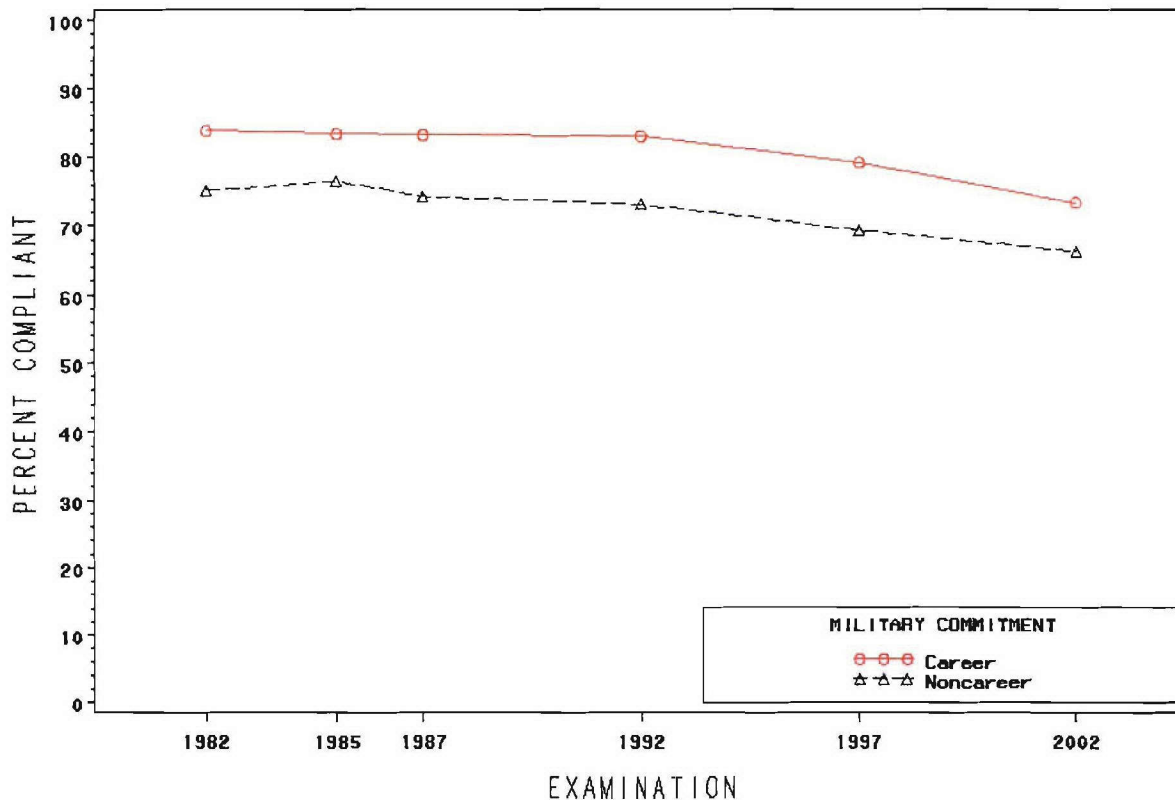
AFHS Examination	Military Commitment	Compliant	Not Compliant <sup>a</sup>	p-Value <sup>b</sup>
		n (%)	n (%)	
1982	Career	1,383 (83.9%)	266 (16.1%)	<b>&lt;0.001</b>
	Noncareer	598 (75.2%)	197 (24.8%)	
1985	Career	1,357 (83.4%)	270 (16.6%)	<b>&lt;0.001</b>
	Noncareer	614 (76.5%)	189 (23.5%)	
1987	Career	1,338 (83.2%)	270 (16.8%)	<b>&lt;0.001</b>
	Noncareer	596 (74.3%)	206 (25.7%)	
1992	Career	1,284 (83.1%)	262 (16.9%)	<b>&lt;0.001</b>
	Noncareer	581 (73.2%)	213 (26.8%)	
1997	Career	1,172 (79.2%)	307 (20.8%)	<b>&lt;0.001</b>
	Noncareer	537 (69.4%)	237 (30.6%)	
2002	Career	1,013 (73.4%)	367 (26.6%)	<b>&lt;0.001</b>
	Noncareer	501 (66.4%)	254 (33.6%)	

<sup>a</sup>Includes veterans who refused and were unlocatable; deceased veterans were not eligible for participation and, thus, were not included.

<sup>b</sup>P-value based on continuity-adjusted chi-square statistic.

Note: The p-values appearing in bold type represent a statistically significant association (p-value<0.05).

Figure 3-6 shows a plot of the percentage compliant for each examination with career and noncareer veterans represented separately.



**Figure 3-6. Percentage of Veterans Who Were Compliant by Military Commitment (Career and Noncareer)**

To further investigate the effect of military commitment and other previously described factors on compliance, an analysis of compliance rates was performed, adjusting for group, age, race, military occupation, and military commitment simultaneously. The association between military commitment and compliance can be explained by age. Older AFHS veterans were more likely to make the military their career, whereas younger AFHS veterans were more likely to have a career outside of the military.

### 3.8 ALTERNATIVE DEFINITIONS OF COMPLIANCE

The preceding sections examined compliance at each examination separately. For a particular factor, such as race or age, the patterns were similar for each examination.

Two alternative definitions of compliance were examined that combined the history of participation across all six examinations. First, a veteran was defined as compliant if he attended at least one of the six AFHS examinations. Using this definition of compliance, a veteran would be classified as noncompliant if he refused or was unlocatable at all examinations for which he was eligible to participate. Table 3-9 presents the results for the first definition of compliance. The association between dioxin and compliance

was not investigated because veterans who were noncompliant to all examinations did not have a dioxin level.

**Table 3-9. Analysis of Compliance (Attended at Least One AFHS Examination) by Group, Race, Military Occupation, Year of Birth, and Military Commitment (Ranch Hands and Original Comparisons Included)**

Factor	Category	Compliant	Not Compliant <sup>a</sup>	p-Value <sup>b</sup>
		n (%)	n (%)	
Group	Ranch Hand	1,115 (91.2%)	108 (8.8%)	<b>&lt;0.001</b>
	Original Comparison	1,065 (84.5%)	196 (15.5%)	
Race	Non-Black	2,050 (88.0%)	280 (12.0%)	0.238
	Black	130 (84.4%)	24 (15.6%)	
Military Occupation	Officer	806 (87.7%)	113 (12.3%)	<b>0.006</b>
	Enlisted Flyer	379 (92.2%)	32 (7.8%)	
	Enlisted Groundcrew	995 (86.2%)	159 (13.8%)	
Year of Birth	Born 1920 or Before	49 (92.4%)	4 (7.6%)	<b>&lt;0.001</b>
	Born 1921-1930	342 (92.9%)	26 (7.1%)	
	Born 1931-1940	867 (89.0%)	107 (11.0%)	
	Born 1941-1950	922 (84.7%)	167 (15.3%)	
Military Commitment	Career	1,504 (89.9%)	169 (10.1%)	<b>&lt;0.001</b>
	Noncareer	676 (83.4%)	135 (16.6%)	

<sup>a</sup>Includes veterans who refused or were unlocatable at all examinations for which they were eligible.

<sup>b</sup>P-value based on continuity adjusted chi-square statistic when factor is divided into two categories; p-value based on Pearson's chi-square statistic when factor is divided into more than two categories.

Note: Forty Ranch Hands were deceased prior to beginning of 1982 baseline examination and, thus, were not included.

The p-values appearing in bold type represent a statistically significant association (p-value<0.05).

Of Ranch Hand and original Comparison veterans who were invited to at least one examination, 87.8 percent chose to participate at least once. When compliance was defined as participation in at least one examination, similar trends to previous analyses were observed. Ranch Hands had a significantly higher compliance rate than original Comparisons. There was no association between compliance and race. The compliance rate was higher for enlisted flyers than officers and enlisted groundcrew. Older veterans had a higher compliance rate than younger veterans. Veterans who made the military their careers had a significantly higher compliance rate than veterans who did not make the military their careers.

A second definition of compliance that combined the history of participation across all six examinations was used. For this definition of compliance, a veteran was defined as compliant if he attended all six AFHS examinations. Using this definition of compliance, a veteran would be classified as noncompliant if he was eligible to participate in all six examinations and refused or was unlocatable in at least one examination. The results using this second definition of compliance are presented in Table 3-10.

**Table 3-10. Analysis of Compliance (Attended All Six AFHS Examinations) by Group, Race, Military Occupation, Year of Birth, Dioxin Level, and Military Commitment (Ranch Hands and Original Comparisons Included)**

Factor	Category	Compliant	Not Compliant <sup>a</sup>	p-Value <sup>b</sup>
		n (%)	n (%)	
Group	Ranch Hand	671 (65.4%)	355 (34.6%)	<b>&lt;0.001</b>
	Original Comparison	616 (57.6%)	453 (42.4%)	
Race	Non-Black	1,211 (61.6%)	756 (38.4%)	0.689
	Black	76 (59.4%)	52 (40.6%)	
Military Occupation	Officer	499 (63.4%)	288 (36.6%)	<b>&lt;0.001</b>
	Enlisted Flyer	227 (70.3%)	96 (29.7%)	
	Enlisted Groundcrew	561 (57.0%)	424 (43.0%)	
Year of Birth	Born 1930 or Before	186 (64.6%)	102 (35.4%)	<b>&lt;0.001</b>
	Born 1931-1940	519 (65.5%)	273 (34.5%)	
	Born 1941-1950	582 (57.3%)	433 (42.7%)	
Dioxin Level	≤10 ppt	891 (71.7%)	351 (28.3%)	0.277
	>10 ppt	395 (74.4%)	136 (25.6%)	
Military Commitment	Career	870 (64.2%)	486 (35.8%)	<b>&lt;0.001</b>
	Noncareer	417 (56.4%)	322 (43.6%)	

<sup>a</sup>Includes veterans who were eligible to participate in all six examinations and refused or were unlocatable in at least one examination.

<sup>b</sup>P-value based on continuity adjusted chi-square statistic when factor is divided into two categories; p-value based on Pearson's chi-square statistic when factor is divided into more than two categories.

Note: Veterans who were deceased prior to the beginning of the 2002 follow-up examination and veterans who were not identified as part of the AFHS population for the 1982 baseline examination were not included. The p-values appearing in bold type represent a statistically significant association (p-value<0.05).

Of Ranch Hand and original Comparison veterans eligible to attend all six examinations, 61.4 percent chose to participate in all examinations. When compliance was defined as participation in all six examinations, similar trends to previous analyses were observed. Ranch Hands had a significantly higher compliance rate than original Comparisons. No association existed between compliance and race or between compliance and dioxin. A greater percentage of enlisted flyers were compliant to all six examinations than officers, and a greater percentage of officers were compliant to all six examinations than enlisted groundcrew. Older veterans had a higher compliance rate than younger veterans. Veterans who made the military their careers had a significantly higher compliance rate than veterans who did not make the military their careers.

### 3.9 CONCLUSION

The effects of group, race, military occupation, year of birth (or age), dioxin level, and military commitment on AFHS compliance were generally consistent in all six examinations. The results were similar when definitions of compliance that combined the history of participation across all six examinations were used.

Ranch Hands had a significantly higher compliance rate than original Comparisons. Original Comparisons had a significantly higher compliance rate than replacement Comparisons. No association existed between compliance and race or between compliance and dioxin.

The compliance rate was higher for enlisted flyers than enlisted groundcrew. The compliance rate for officers was similar to enlisted groundcrew at the beginning of the AFHS, but was closer to enlisted flyers by the end of the AFHS. One possible explanation could be that officers and enlisted flyers tended to make the military their career more often than enlisted groundcrew (see Section 3.7). Because of the ongoing link to the military, officers and enlisted flyers may have felt a greater sense of duty to participate in the AFHS examinations.

Older veterans had a higher compliance rate than younger veterans. One possible explanation is that younger participants are less compliant because of career and family. Older veterans may have grown children and be finishing their careers. More time, in conjunction with a greater concern for health, may have contributed to a higher compliance rate from this group.

Veterans who made the military their career had a significantly higher compliance rate than veterans who did not make the military their career. Older AFHS veterans were more likely to make the military their career, whereas younger AFHS veterans were more likely to have careers outside of the military.

## **4 REASONS FOR NONCOMPLIANCE AND FACTORS THAT MAY AFFECT NONCOMPLIANCE**

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### **4.1 INTRODUCTION**

As discussed in Chapter 3, compliance rates were similar for the 1982, 1985, 1987, and 1992 Air Force Health Study (AFHS) examinations. The compliance rates dropped for the 1997 and 2002 follow-up examinations.

This chapter discusses reasons for noncompliance and the factors that may have affected these reasons. Reasons for refusal have been grouped into five categories, as described in Chapter 1:

- Health reasons
- Logistical reasons (financial hardship, no interest or no time, job commitment, travel distance, or family concerns)
- Other reasons (dissatisfaction with the U.S. Air Force or the U.S. Government, dissatisfaction with the AFHS, dissatisfaction with previous AFHS examinations, fear of physical examination, confidentiality concerns, adverse impact on career, or other)
- Adamant refusal
- Passive refusal.

In addition to the five general reasons for refusal, a sixth noncompliance category was created for veterans who were unlocatable. Information describing attempts to contact veterans who could not be contacted by the scheduling subcontractor were forwarded to AFHS staff, and AFHS staff made additional attempts to locate these veterans (e.g., through Internal Revenue Service records not available to the subcontractor). The Air Force ultimately classified a veteran as unlocatable if attempts by AFHS staff to contact or locate a veteran were unsuccessful.

The effects of group (Ranch Hand, Comparison), race (non-Black, Black), military occupation (officer, enlisted flyer, enlisted groundcrew), year of birth, dioxin level, and military commitment (career, noncareer) on noncompliance also are examined in this chapter.

### **4.2 REASONS FOR NONCOMPLIANCE**

Table 4-1 presents, for each of the six examinations, the number and percentage of total veterans who refused for health reasons, refused for logistical reasons, were passive refusals, were considered adamant refusals, refused for other reasons, or were unlocatable. In addition to these six reasons for noncompliance, a veteran may have been deceased at the time of the physical examination. These seven categories, along with the number and percentage of total veterans who were compliant (participated), are shown in Table 4-1.



**Table 4-1. Summary Statistics for Noncompliance, Deceased, and Compliance by AFHS Examination (Ranch Hands and All Comparisons Included)**

Category/Year	1982	1985	1987	1992	1997	2002
Refusal – Health	16 0.5%	38 1.3%	34 1.1%	50 1.6%	117 3.6%	200 5.7%
Refusal – Logistical	504 17.3%	340 11.3%	315 10.4%	268 8.6%	348 10.7%	460 13.1%
Refusal – Other	68 2.3%	70 2.3%	163 5.4%	45 1.4%	87 2.7%	72 2.1%
Refusal – Adamant	-- --	-- --	-- --	185 6.0%	199 6.1%	218 6.2%
Refusal – Passive	7 0.2%	51 1.7%	45 1.5%	49 1.6%	22 0.7%	80 2.3%
Unlocatable	11 0.4%	104 3.5%	67 2.2%	68 2.2%	36 1.1%	43 1.2%
Deceased*	40 1.4%	85 2.8%	116 3.8%	206 6.6%	315 9.7%	478 13.6%
Compliant	2,269 77.8%	2,309 77.0%	2,294 75.6%	2,233 71.9%	2,121 65.4%	1,951 55.7%
Total	2,915	2,997	3,034	3,104	3,245	3,502

\*Forty Ranch Hands were deceased prior to beginning of 1982 baseline examination, but are included in these summaries to reflect the complete Ranch Hand population.

--: Veterans were classified as adamant refusals in only 1992, 1997, and 2002.

For the 1982 baseline examination, the median age of the 2,269 compliant participants was 44 and the median age at death of the 40 deceased veterans was 37. The median age of the 16 veterans who refused for health reasons was 47½.

For the 2002 follow-up examination, the median age of the 1,951 compliant participants was 62 and the median age at death of the 478 deceased veterans was 61. The median age of the 200 veterans who refused for health reasons was 69.

The compliance rates are relatively similar for the 1982, 1985, and 1987 examinations. A larger decrease in the compliance rate was observed for the 1992, 1997, and 2002 follow-up examinations. The number of veterans who refused for health reasons and logistical reasons increased for the 1997 and 2002 follow-up examinations. The rate of deceased veterans increased slightly through the 1987 follow-up examinations, but increased between 3 and 4 percent in the 5-year periods of examinations subsequent to 1987.

Because deceased veterans would not be eligible to participate in an examination, the percentages in Table 4-1 were recalculated and the category of deceased veterans was omitted (i.e., only veterans eligible to participate were examined). Table 4-2 shows these results.

**Table 4-2. Summary Statistics for Noncompliance and Compliance by Examination for AFHS Veterans Eligible To Participate (Ranch Hands and All Comparisons Included)**

Category/Year	1982	1985	1987	1992	1997	2002
Refusal – Health	16 0.6%	38 1.3%	34 1.2%	50 1.7%	117 4.0%	200 6.6%
Refusal – Logistical	504 17.5%	340 11.7%	315 10.8%	268 9.2%	348 11.9%	460 15.2%
Refusal – Other	68 2.4%	70 2.4%	163 5.6%	45 1.6%	87 3.0%	72 2.4%
Refusal – Adamant	-- --	-- --	-- --	185 6.4%	199 6.8%	218 7.2%
Refusal – Passive	7 0.2%	51 1.8%	45 1.5%	49 1.7%	22 0.8%	80 2.6%
Unlocatable	11 0.4%	104 3.6%	67 2.3%	68 2.3%	36 1.2%	43 1.4%
Compliant	2,269 78.9%	2,309 79.2%	2,294 78.6%	2,233 77.1%	2,121 72.4%	1,951 64.5%
Total	2,875	2,912	2,918	2,898	2,930	3,024

--: Veterans were classified as adamant refusals in 1992, 1997, and 2002 only.

The compliance rates are relatively similar for the 1982, 1985, 1987, and 1992 examinations. A larger decrease in the compliance rate was observed for the 1997 and 2002 follow-up examinations. The number of veterans who refused for health reasons and who refused for logistical reasons increased for the 1997 and 2002 follow-up examinations.

As described in Chapter 3, original Comparisons and replacement Comparisons are inherently different, and contrasts of compliance rates were usually analyzed for Ranch Hands versus original Comparisons. The statistics have been recalculated using Ranch Hands and original Comparisons in Table 4-3. Subsequent analyses in this chapter are based on Ranch Hands and original Comparisons. Deceased veterans also were excluded from subsequent analysis; therefore, these analyses are based on eligible Ranch Hands and original Comparisons.

**Table 4-3. Summary Statistics for Noncompliance and Compliance by Examination for AFHS Veterans Eligible To Participate (Ranch Hands and Original Comparisons Included)**

Category/Year	1982	1985	1987	1992	1997	2002
Refusal – Health	15 0.6%	30 1.2%	29 1.2%	43 1.8%	86 3.8%	132 6.2%
Refusal – Logistical	388 15.9%	242 10.0%	230 9.5%	190 8.1%	203 9.0%	231 10.8%
Refusal – Other	49 2.0%	61 2.5%	131 5.4%	37 1.6%	72 3.2%	53 2.5%

**Table 4-3. Summary Statistics for Noncompliance and Compliance by Examination for AFHS Veterans Eligible To Participate (Ranch Hands and Original Comparisons Included) (Continued)**

Category/Year	1982	1985	1987	1992	1997	2002
Refusal – Adamant	--	--	--	143	151	159
	--	--	--	6.1%	6.7%	7.4%
Refusal – Passive	6	39	35	34	16	31
	0.2%	1.6%	1.5%	1.5%	0.7%	1.5%
Unlocatable	5	87	51	28	16	15
	0.2%	3.6%	2.1%	1.2%	0.7%	0.7%
Compliant	1,981	1,971	1,934	1,865	1,709	1,514
	81.1%	81.1%	80.2%	79.7%	75.9%	70.9%
Total	2,444	2,430	2,410	2,340	2,253	2,135

--: Veterans were classified as adamant refusals in only 1992, 1997, and 2002.

The statistics shown in Table 4-3 are presented separately for Ranch Hands and original Comparisons in Table 4-4.

**Table 4-4. Summary Statistics for Noncompliance and Compliance by Examination for AFHS Veterans Eligible To Participate**

Reason for Noncompliance/ Group	Number (%)					
	1982	1985	1987	1992	1997	2002
<b>Refusal – Health</b>						
Ranch Hand	10 (0.8%)	17 (1.4%)	14 (1.2%)	23 (2.0%)	45 (4.1%)	67 (6.4%)
Original Comparison	5 (0.4%)	13 (1.1%)	15 (1.2%)	20 (1.7%)	41 (3.6%)	65 (5.9%)
<b>Refusal – Logistical</b>						
Ranch Hand	127 (10.5%)	89 (7.4%)	89 (7.5%)	75 (6.5%)	87 (7.9%)	91 (8.7%)
Original Comparison	261 (21.1%)	153 (12.4%)	141 (11.5%)	115 (9.7%)	116 (10.1%)	140 (12.8%)
<b>Refusal – Other</b>						
Ranch Hand	22 (1.8%)	24 (2.0%)	56 (4.7%)	17 (1.5%)	33 (3.0%)	28 (2.7%)
Original Comparison	27 (2.2%)	37 (3.0%)	75 (6.1%)	20 (1.7%)	39 (3.4%)	25 (2.3%)
<b>Refusal – Adamant</b>						
Ranch Hand	--	--	--	52 (4.5%)	55 (5.0%)	58 (5.6%)
Original Comparison	--	--	--	91 (7.6%)	96 (8.3%)	101 (9.2%)
<b>Refusal – Passive</b>						
Ranch Hand	2 (0.2%)	13 (1.1%)	13 (1.1%)	16 (1.4%)	6 (0.5%)	15 (1.4%)
Original Comparison	4 (0.3%)	26 (2.1%)	22 (1.8%)	18 (1.5%)	10 (0.9%)	16 (1.5%)

**Table 4-4. Summary Statistics for Noncompliance and Compliance by Examination for AFHS Veterans Eligible To Participate (Continued)**

Reason for Noncompliance/ Group	Number (%)					
	1982	1985	1987	1992	1997	2002
<b>Unlocatable</b>						
Ranch Hand	13 (0.8%)	21 (1.3%)	21 (1.3%)	29 (1.9%)	69 (4.7%)	103 (7.5%)
Original Comparison	2 (0.3%)	9 (1.1%)	8 (1.0%)	14 (1.8%)	17 (2.2%)	29 (3.8%)
<b>Compliant</b>						
Ranch Hand	1,046 (86.5%)	1,017 (84.8%)	996 (83.8%)	953 (82.9%)	870 (78.9%)	777 (74.6%)
Original Comparison	935 (75.7%)	954 (77.5%)	938 (76.8%)	912 (76.6%)	839 (72.9%)	737 (67.4%)
<b>Total</b>						
Ranch Hand	1,209	1,199	1,188	1,149	1,102	1,041
Original Comparison	1,235	1,231	1,222	1,191	1,151	1,094

--: Veterans were classified as adamant refusals in 1992, 1997, and 2002 only.

Figure 4-1 shows a plot of the percentages for each of the noncompliant categories (refusal for health reasons, refusal for logistical reasons, refusal for other reasons, adamant refusals, passive refusals, and unlocatable veterans). A plot is provided for each noncompliance reason, and Ranch Hands and original Comparisons are represented separately on each plot. When only eligible Ranch Hands and original Comparisons were considered, the percentage of veterans who refused for health reasons and other reasons, as well as the percentage of passive refusals and unlocatable veterans, were similar between Ranch Hands and original Comparisons. A greater percentage of original Comparisons were adamant refusals than Ranch Hands, but the difference between the percentages was similar for the 1992, 1997, and 2002 examinations. Adamant refusals were not recorded in examinations prior to 1992. The percentage of veterans who refused for logistical reasons was increased in original Comparisons for all examinations, with a large difference between Ranch Hands and original Comparisons for the 1982 baseline examination.

All previous summaries showed a decrease in compliance because of an increase in refusal for health reasons. Refusal for health reasons, as well as the difference in the refusal rates for logistical reasons between Ranch Hands and original Comparisons, are explored in more depth in the subsequent sections.

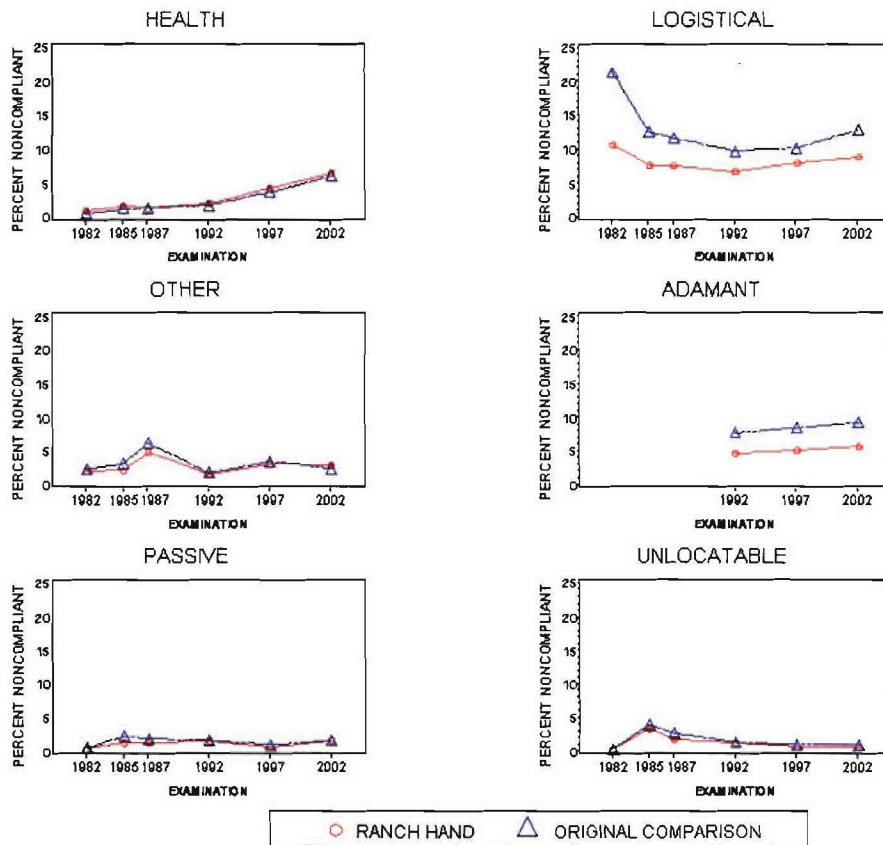


Figure 4-1. Percentage of Veterans Who Were Noncompliant by Reason, Examination, and Group (Ranch Hands and Original Comparisons)

### 4.3 REFUSAL FOR HEALTH REASONS

#### 4.3.1 Ranch Hands and Original Comparisons Combined

The effects of group, race, military occupation, year of birth, dioxin level, and military commitment on refusal for health reasons are explored in this section. Table 4-5 presents the rates of refusal and tests for association with Ranch Hands and original Comparisons combined.

**Table 4-5. Analysis of Refusal for Health Reasons by Group, Race, Military Occupation, Year of Birth, Dioxin Level, and Military Commitment (Ranch Hands and Original Comparisons Included)**

Factor/Category	Number (%) Refusing for Health Reasons					
	1982	1985	1987	1992	1997	2002
<b>Group</b>						
Ranch Hand	10 (0.8%)	17 (1.4%)	14 (1.2%)	23 (2.0%)	45 (4.1%)	67 (6.4%)
Original Comparison	5 (0.4%)	13 (1.1%)	15 (1.2%)	20 (1.7%)	41 (3.6%)	65 (5.9%)
p-Value <sup>a</sup>	p=0.281	p=0.533	p=0.999	p=0.670	p=0.592	p=0.701
<b>Race</b>						
Non-Black	14 (0.6%)	29 (1.3%)	28 (1.2%)	42 (1.9%)	82 (3.9%)	121 (6.0%)
Black	1 (0.7%)	1 (0.7%)	1 (0.7%)	1 (0.7%)	4 (2.8%)	11 (8.2%)
p-Value <sup>a</sup>	p=0.999	p=0.808	p=0.827	p=0.469	p=0.689	p=0.412
<b>Military Occupation</b>						
Officer	3 (0.3%)	7 (0.8%)	5 (0.6%)	8 (0.9%)	22 (2.6%)	45 (5.6%)
Enlisted Flyer	2 (0.5%)	5 (1.2%)	5 (1.3%)	6 (1.6%)	16 (4.4%)	19 (5.7%)
Enlisted Groundcrew	10 (0.9%)	18 (1.6%)	19 (1.7%)	29 (2.7%)	48 (4.6%)	68 (6.8%)
p-Value <sup>a</sup>	p=0.274	p=0.246	p=0.065	<b>p=0.016</b>	p=0.077	p=0.545
<b>Year of Birth</b>						
Born 1920 or Before	1 (1.9%)	2 (4.1%)	5 (10.6%)	5 (12.5%)	11 (35.5%)	11 (52.4%)
Born 1921-1930	1 (0.3%)	5 (1.4%)	6 (1.7%)	12 (3.7%)	21 (7.0%)	39 (14.5%)
Born 1931-1940	10 (1.1%)	11 (1.2%)	8 (0.9%)	12 (1.3%)	35 (4.0%)	51 (6.3%)
Born 1941-1950	3 (0.3%)	12 (1.1%)	10 (0.9%)	14 (1.3%)	19 (1.8%)	31 (3.0%)
p-Value <sup>a</sup>	p=0.068	p=0.317	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>
<b>Dioxin Level</b>						
≤10 ppt	--	--	--	11 (0.8%)	36 (2.7%)	64 (5.0%)
>10 ppt	--	--	--	6 (1.0%)	20 (3.5%)	41 (7.7%)
p-Value <sup>a</sup>	--	--	--	p=0.819	p=0.424	<b>p=0.037</b>
<b>Military Commitment</b>						
Career	13 (0.8%)	21 (1.3%)	21 (1.3%)	29 (1.9%)	69 (4.7%)	103 (7.5%)
Noncareer	2 (0.3%)	9 (1.1%)	8 (1.0%)	14 (1.8%)	17 (2.2%)	29 (3.8%)
p-Value <sup>a</sup>	p=0.188	p=0.872	p=0.648	p=0.977	<b>p=0.005</b>	<b>p=0.001</b>

<sup>a</sup>P-value based on continuity adjusted chi-square statistic when factor is divided into two categories; p-value based on Pearson's chi-square statistic when factor is divided into more than two categories.

--: Analysis was not performed because dioxin levels were not known until after the 1987 follow-up examination.

Note: The p-values appearing in bold type represent a statistically significant association (p-value<0.05).

As presented in Table 4-5, when examining refusals because of health reasons separately for each examination and each factor, there was no association between refusal for health reasons and either group or race for all six examinations. Military occupation was significantly associated with refusal for health reasons in 1987 ( $p=0.016$ ). Enlisted groundcrew were more likely to refuse for health reasons in 1987 than enlisted flyers and officers. In the 1987 and later follow-up examinations, year of birth was significantly associated with refusal for health reasons ( $p<0.001$  for each of these examinations). As expected, older veterans refused more often for health reasons than did younger veterans. Dioxin level was associated with refusal for health reasons for the 2002 follow-up examination ( $p=0.037$ ). A further discussion of this association is given in the next section of this chapter, where the association between dioxin level and other factors and refusal for health reasons is discussed separately for Ranch Hands and original Comparisons. For the 1997 and 2002 follow-up examinations, veterans who made the military their career refused more often for health reasons than veterans who did not make the military their career ( $p=0.005$  and  $p=0.001$ , respectively).

To study these associations further, refusals because of health reasons were investigated, adjusting for group, race, military occupation, year of birth, and military commitment simultaneously. The association between military commitment and refusal for health reasons can be explained by year of birth (or age). Older AFHS veterans, who refused more often for health reasons, were more likely to make the military their career, whereas younger AFHS veterans were more likely to have careers outside the military. In addition, although occupation was not significantly associated with refusal because of health reasons when investigated alone for the 1997 and 2002 follow-up examinations, the association between occupation and refusal for health reasons became significant when adjusted for age ( $p<0.04$  for the 1997 and 2002 follow-up examinations). The age-adjusted refusal rate for health reasons was greater for enlisted groundcrew, the youngest occupation on average, than for enlisted flyers and officers.

#### 4.3.2 Ranch Hands and Original Comparisons Examined Separately

Interactions of the refusal rate for health reasons between group and the other factors of race, military occupation, year of birth, and military commitment were explored. None of these interactions was significant when analyzing refusal rates for health reasons for the 1982, 1985, 1987, 1992, and 1997 examinations. For the 2002 follow-up examination, there were significant group-by-age and group-by-military commitment interactions. Tables 4-6 and 4-7 provide the numbers and percentages of veterans who refused for health reasons for Ranch Hands and original Comparisons, respectively.

**Table 4-6. Analysis of Refusal for Health Reasons by Race, Military Occupation, Year of Birth, Dioxin Level, and Military Commitment (Ranch Hands Only)**

Factor/Category	Number (%) Refusing for Health Reasons					
	1982	1985	1987	1992	1997	2002
<b>Race</b>						
Non-Black	9 (0.8%)	17 (1.5%)	13 (1.2%)	22 (2.0%)	44 (4.2%)	64 (6.6%)
Black	1 (1.4%)	0 (0.0%)	1 (1.4%)	1 (1.4%)	1 (1.5%)	3 (4.7%)
p-Value <sup>a</sup>	$p=0.999$	$p=0.592$	$p=0.999$	$p=0.999$	$p=0.443$	$p=0.745$

**Table 4-6. Analysis of Refusal for Health Reasons by Race, Military Occupation, Year of Birth, Dioxin Level, and Military Commitment (Ranch Hands Only) (Continued)**

Factor/Category	Number (%) Refusing for Health Reasons					
	1982	1985	1987	1992	1997	2002
<b>Military Occupation</b>						
Officer	1 (0.2%)	4 (0.9%)	2 (0.5%)	4 (0.9%)	12 (2.9%)	24 (6.1%)
Enlisted Flyer	2 (1.0%)	2 (1.0%)	2 (1.0%)	5 (2.7%)	7 (3.9%)	9 (5.5%)
Enlisted Groundcrew	7 (1.3%)	11 (2.0%)	10 (1.8%)	14 (2.6%)	26 (5.1%)	34 (7.0%)
p-Value <sup>a</sup>	p=0.192	p=0.306	p=0.137	p=0.138	p=0.258	p=0.738
<b>Year of Birth</b>						
Born 1920 or Before	1 (4.2%)	1 (4.5%)	2 (10.0%)	1 (5.6%)	5 (38.5%)	4 (40.0%)
Born 1921-1930	1 (0.6%)	2 (1.2%)	1 (0.6%)	5 (3.2%)	13 (8.8%)	20 (15.0%)
Born 1931-1940	5 (1.1%)	9 (1.9%)	4 (0.9%)	10 (2.2%)	18 (4.2%)	30 (7.6%)
Born 1941-1950	3 (0.6%)	5 (0.9%)	7 (1.3%)	7 (1.3%)	9 (1.7%)	13 (2.6%)
p-Value <sup>a</sup>	p=0.245	p=0.348	<b>p=0.003</b>	p=0.301	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>
<b>Dioxin Level</b>						
≤10 ppt	--	--	--	4 (0.9%)	14 (3.3%)	19 (4.6%)
>10 ppt	--	--	--	6 (1.1%)	19 (3.5%)	37 (7.3%)
p-Value <sup>a</sup>	--	--	--	p=0.999	p=0.999	p=0.134
<b>Military Commitment</b>						
Career	8 (1.0%)	12 (1.5%)	9 (1.1%)	16 (2.1%)	37 (5.0%)	50 (7.3%)
Noncareer	2 (0.5%)	5 (1.3%)	5 (1.3%)	7 (1.8%)	8 (2.2%)	17 (4.7%)
p-Value <sup>a</sup>	p=0.641	p=0.994	p=0.999	p=0.927	<b>p=0.032</b>	p=0.136

<sup>a</sup>P-value based on continuity adjusted chi-square statistic when factor is divided into two categories; p-value based on Pearson's chi-square statistic when factor is divided into more than two categories.

--: Analysis was not performed because dioxin levels were not known until after the 1987 follow-up examination.

Note: The p-values appearing in bold type represent a statistically significant association (p-value<0.05).

**Table 4-7. Analysis of Refusal for Health Reasons by Race, Military Occupation, Year of Birth, Dioxin Level, and Military Commitment (Ranch Hands and Original Comparisons)**

Factor/Category	Number (%) Refusing for Health Reasons					
	1982	1985	1987	1992	1997	2002
<b>Race</b>						
Non-Black	5 (0.4%)	12 (1.0%)	15 (1.3%)	20 (1.8%)	38 (3.5%)	57 (5.6%)
Black	0 (0.0%)	1 (1.3%)	0 (0.0%)	0 (0.0%)	3 (4.0%)	8 (11.4%)
p-Value <sup>a</sup>	p=0.999	p=0.999	p=0.316	p=0.488	p=0.999	p=0.081



**Table 4-7. Analysis of Refusal for Health Reasons by Race, Military Occupation, Year of Birth, Dioxin Level, and Military Commitment (Ranch Hands and Original Comparisons) (Continued)**

Factor/Category	Number (%) Refusing for Health Reasons					
	1982	1985	1987	1992	1997	2002
<b>Military Occupation</b>						
Officer	2 (0.4%)	3 (0.7%)	3 (0.7%)	4 (0.9%)	10 (2.3%)	21 (5.1%)
Enlisted Flyer	0 (0.0%)	3 (1.5%)	3 (1.5%)	1 (0.5%)	9 (4.9%)	10 (5.9%)
Enlisted Groundcrew	3 (0.5%)	7 (1.2%)	9 (1.6%)	15 (2.7%)	22 (4.1%)	34 (6.6%)
p-Value <sup>a</sup>	p=0.601	p=0.555	p=0.382	<b>p=0.037</b>	p=0.197	p=0.659
<b>Year of Birth</b>						
Born 1920 or Before	0 (0.0%)	1 (3.7%)	3 (11.1%)	4 (18.2%)	6 (33.3%)	7 (63.6%)
Born 1921-1930	0 (0.0%)	3 (1.7%)	5 (2.8%)	7 (4.2%)	8 (5.3%)	19 (14.0%)
Born 1931-1940	5 (1.1%)	2 (0.4%)	4 (0.8%)	2 (0.4%)	17 (3.8%)	21 (5.0%)
Born 1941-1950	0 (0.0%)	7 (1.3%)	3 (0.5%)	7 (1.3%)	10 (1.9%)	18 (3.4%)
p-Value <sup>a</sup>	<b>p=0.046</b>	p=0.209	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>
<b>Dioxin Level</b>						
≤10 ppt	--	--	--	7 (0.7%)	22 (2.4%)	45 (5.2%)
>10 ppt	--	--	--	0 (0.0%)	1 (4.2%)	4 (17.4%)
p-Value <sup>a</sup>	--	--	--	p=0.999	p=0.999	<b>p=0.040</b>
<b>Military Commitment</b>						
Career	5 (0.6%)	9 (1.1%)	12 (1.5%)	13 (1.7%)	32 (4.3%)	53 (7.6%)
Noncareer	0 (0.0%)	4 (1.0%)	3 (0.7%)	7 (1.7%)	9 (2.2%)	12 (3.0%)
p-Value <sup>a</sup>	p=0.114	p=0.999	p=0.396	p=0.999	p=0.106	<b>p=0.003</b>

<sup>a</sup>P-value based on continuity adjusted chi-square statistic when factor is divided into two categories; p-value based on Pearson's chi-square statistic when factor is divided into more than two categories.

--: Analysis was not performed because dioxin levels were not known until after the 1987 follow-up examination.

Note: The p-values appearing in bold type represent a statistically significant association (p-value<0.05).

The refusal rate for health reasons for the 2002 follow-up examination was greater for the oldest group of original Comparisons (Table 4-7: 63.6%) than for the oldest group of Ranch Hands (Table 4-7: 40.0%). The difference in refusal rates for health reasons for the 2002 follow-up examination was greater between career military and noncareer military original Comparisons (Table 4-7: 7.6% vs. 3.0%, p=0.003) than for career military and noncareer military Ranch Hands (Table 4-6: 7.3% vs. 4.7%, p=0.136).

Plots of the percentages of veterans who refused for health reasons for Ranch Hands and original Comparisons at the six AFHS examinations are shown in Figure 4-2 through Figure 4-6 for race, military occupation, year of birth, dioxin level, and military commitment, respectively.

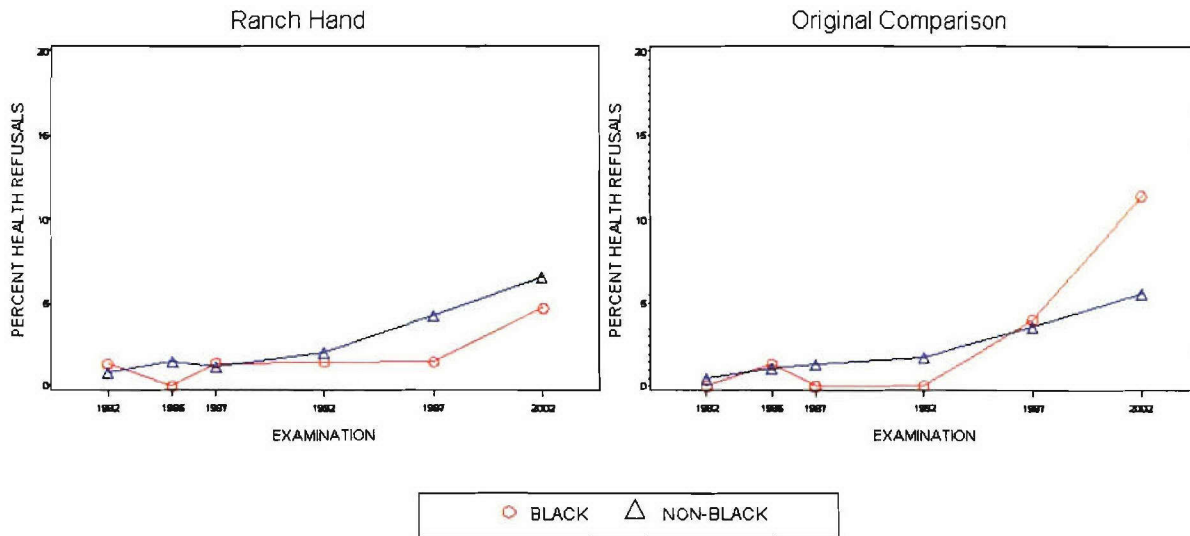


Figure 4-2. Percentage of Veterans Who Refused for Health Reasons by Race, Examination, and Group (Ranch Hands and Original Comparisons)

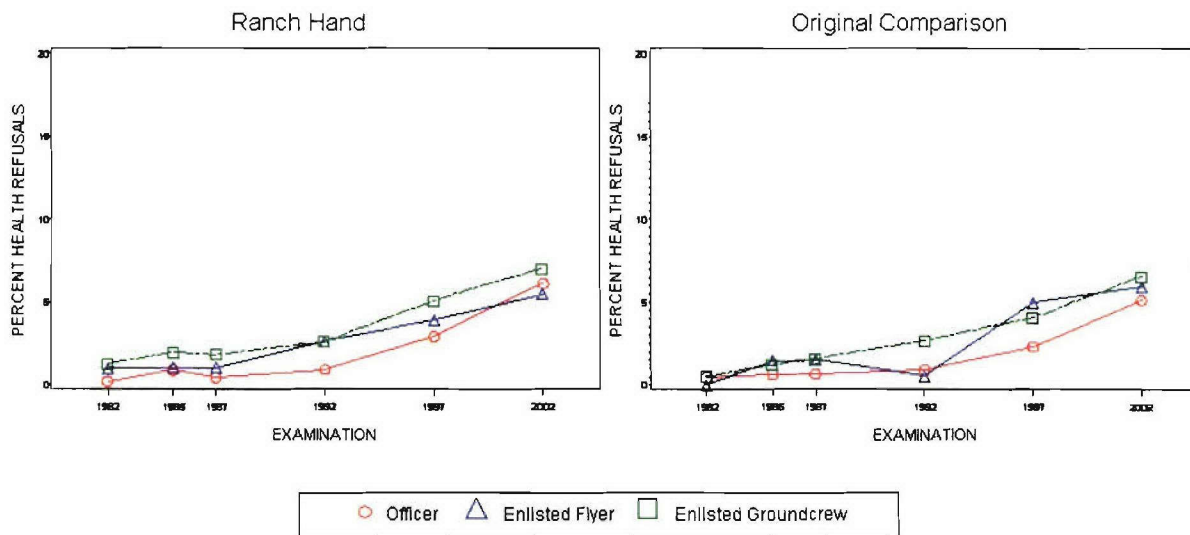


Figure 4-3. Percentage of Veterans Who Refused for Health Reasons by Military Occupation, Examination, and Group (Ranch Hands and Original Comparisons)

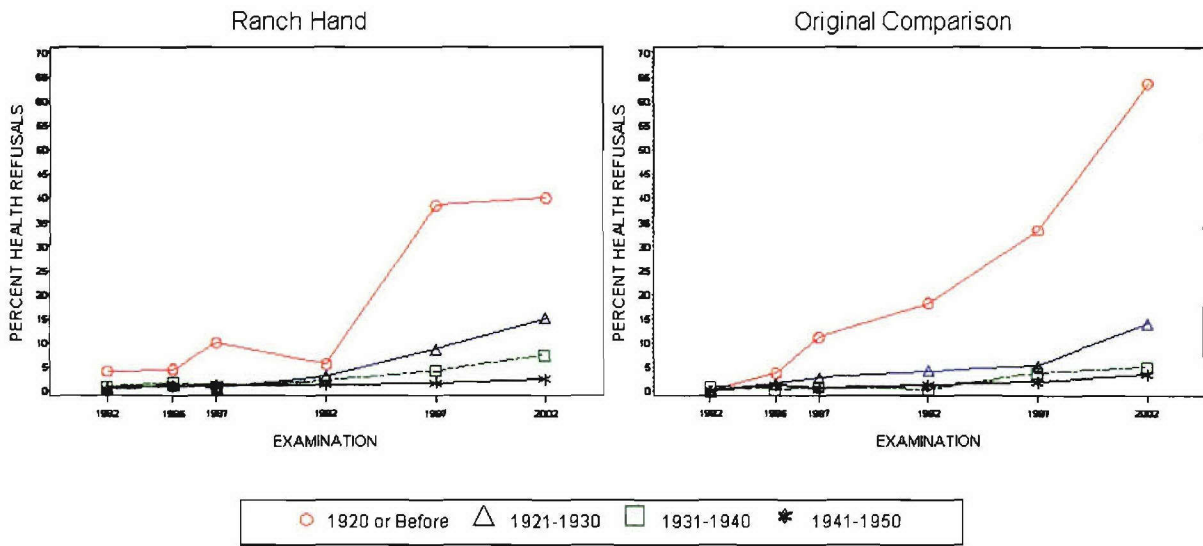


Figure 4-4. Percentage of Veterans Who Refused for Health Reasons by Year of Birth, Examination, and Group (Ranch Hands and Original Comparisons)

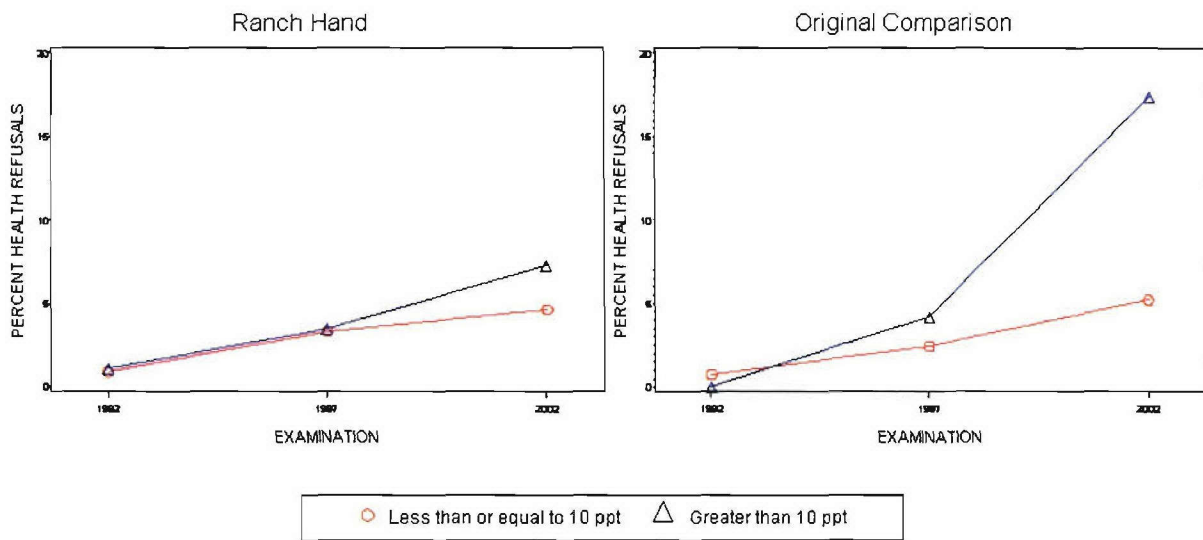
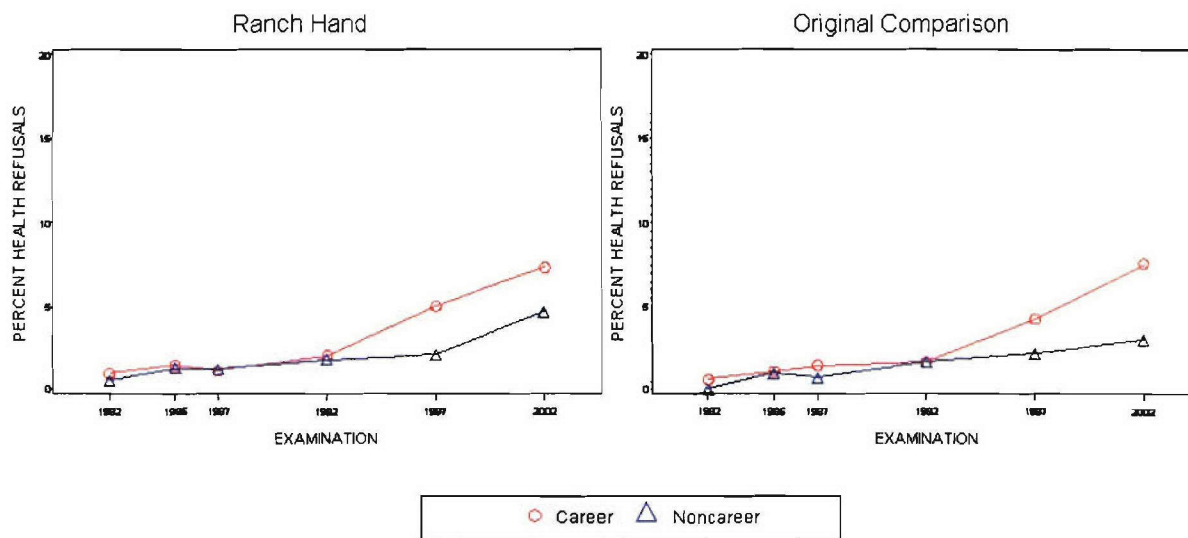


Figure 4-5. Percentage of Veterans Who Refused for Health Reasons by Dioxin Level, Examination, and Group (Ranch Hands and Original Comparisons)



**Figure 4-6. Percentage of Veterans Who Refused for Health Reasons by Military Commitment, Examination, and Group (Ranch Hands and Original Comparisons)**

Except for the interactions noted above, the patterns observed when refusal for health reasons were examined separately for Ranch Hands and original Comparisons were similar to the patterns observed when the two groups were combined. No association existed between refusal for health reasons and race for all six examinations for both groups. Military occupation was significantly associated with refusal for health reasons in 1987 for original Comparisons (Table 4-7:  $p=0.037$ ). Enlisted groundcrew were more likely to refuse for health reasons in 1992 than enlisted flyers and officers.

In the 1987 and later follow-up examinations, year of birth was significantly associated with refusal for health reasons in original Comparisons (Tables 4-6 and 4-7:  $p<0.01$  for each of these examinations for original Comparisons and Ranch Hands), except for Ranch Hands at the 1992 follow-up examination. As expected, older veterans refused more often for health reasons than did younger veterans.

As described in Section 4.3.1, dioxin level was associated with refusal for health reasons for the 2002 follow-up examination (Table 4-6:  $p=0.037$ ). This significant association is due primarily to the association between dioxin level and refusal for health reasons in original Comparisons (Table 4-7:  $p=0.040$ ). The percentage of original Comparisons who refused for health reasons and whose dioxin level was greater than 10 ppt was greater than the percentage of original Comparisons who refused for health reasons and whose dioxin level was no more than 10 ppt (Table 4-7: 17.4% vs. 5.2%, respectively).

Original Comparisons who made the military their careers refused more often for health reasons than original Comparisons who did not make the military their careers for the 2002 follow-up examination (Table 4-7:  $p=0.003$ ). As described previously, the association between military commitment and refusal for health reasons can be explained by age.

#### 4.4 REFUSAL FOR LOGISTICAL REASONS

##### 4.4.1 Ranch Hands and Original Comparisons Combined

The effects of group, race, military occupation, year of birth, dioxin level, and military commitment on refusal for logistical reasons are explored in this section. Table 4-8 presents the rates of refusal and tests for association with Ranch Hands and original Comparisons combined.

**Table 4-8. Analysis of Refusal for Logistical Reasons by Race, Military Occupation, Year of Birth, Dioxin Level, and Military Commitment (Ranch Hands and Original Comparisons Included)**

Factor/Category	Number (%) Refusing for Logistical Reasons					
	1982	1985	1987	1992	1997	2002
<b>Group</b>						
Ranch Hand	127 (10.5%)	89 (7.4%)	89 (7.5%)	75 (6.5%)	87 (7.9%)	91 (8.7%)
Original Comparison	261 (21.1%)	153 (12.4%)	141 (11.5%)	115 (9.7%)	116 (10.1%)	140 (12.8%)
p-Value <sup>a</sup>	p<0.001	p<0.001	p<0.001	p=0.007	p=0.083	p=0.003
<b>Race</b>						
Non-Black	364 (15.9%)	226 (9.9%)	217 (9.6%)	176 (8.0%)	189 (8.9%)	211 (10.5%)
Black	24 (16.2%)	16 (10.9%)	13 (8.8%)	14 (9.8%)	14 (9.9%)	20 (14.9%)
p-Value <sup>a</sup>	p=0.999	p=0.807	p=0.857	p=0.551	p=0.809	p=0.151
<b>Military Occupation</b>						
Officer	149 (16.4%)	89 (9.8%)	83 (9.3%)	58 (6.7%)	48 (5.7%)	52 (6.5%)
Enlisted Flyer	41 (10.3%)	26 (6.5%)	24 (6.0%)	21 (5.6%)	30 (8.3%)	31 (9.3%)
Enlisted Groundcrew	198 (17.4%)	127 (11.3%)	123 (11.0%)	111 (10.2%)	125 (11.9%)	148 (14.8%)
p-Value <sup>a</sup>	p=0.003	p=0.022	p=0.014	p=0.003	p<0.001	p<0.001
<b>Year of Birth</b>						
Born 1920 or Before	4 (7.7%)	3 (6.1%)	2 (4.3%)	3 (7.5%)	0 (0.0%)	0 (0.0%)
Born 1921-1930	35 (9.6%)	22 (6.2%)	21 (6.1%)	9 (2.8%)	10 (3.3%)	14 (5.2%)
Born 1931-1940	129 (13.6%)	84 (8.9%)	79 (8.4%)	62 (6.9%)	62 (7.1%)	74 (9.1%)
Born 1941-1950	220 (20.5%)	133 (12.3%)	128 (11.9%)	116 (10.8%)	131 (12.5%)	143 (13.9%)
p-Value <sup>a</sup>	p<0.001	p=0.003	p=0.002	p<0.001	p<0.001	p<0.001
<b>Dioxin Level</b>						
≤10 ppt	--	--	--	46 (3.3%)	53 (4.0%)	81 (6.4%)
>10 ppt	--	--	--	13 (2.2%)	28 (4.9%)	35 (6.6%)
p-Value <sup>a</sup>	--	--	--	p=0.237	p=0.428	p=0.973

**Table 4-8. Analysis of Refusal for Logistical Reasons by Race, Military Occupation, Year of Birth, Dioxin Level, and Military Commitment (Ranch Hands and Original Comparisons Included) (Continued)**

Factor/Category	Number (%) Refusing for Logistical Reasons					
	1982	1985	1987	1992	1997	2002
<b>Military Commitment</b>						
Career	230 (13.9%)	131 (8.1%)	134 (8.3%)	97 (6.3%)	102 (6.9%)	120 (8.7%)
Noncareer	158 (19.9%)	111 (13.8%)	96 (12.0%)	93 (11.7%)	101 (13.0%)	111 (14.7%)
p-Value <sup>a</sup>	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>	<b>p=0.005</b>	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>

<sup>a</sup>P-value based on continuity adjusted chi-square statistic when factor is divided into two categories; p-value based on Pearson's chi-square statistic when factor is divided into more than two categories.

--: Analysis was not performed because dioxin levels were not known until after the 1987 follow-up examination.

Note: The p-values appearing in bold type represent a statistically significant association (p-value<0.05).

As presented in Table 4-8, when examining refusals because of logistical reasons separately for each examination and each factor, there was no significant association between refusal for logistical reasons and race for all six examinations ( $p>0.15$  for all examinations). Dioxin level also was not significantly associated with refusal for logistical reasons for the 1992, 1997, and 2002 follow-up examinations ( $p>0.23$  for each of these examinations).

Except for the 1997 follow-up examination, original Comparisons refused more often than Ranch Hands for logistical reasons ( $p<0.01$  for all examinations except the 1997 follow-up examination, where  $p=0.083$ ). Military occupation was significantly associated with refusal for logistical reasons for all examinations ( $p<0.03$  for all examinations). Enlisted groundcrew were more likely to refuse for logistical reasons than enlisted flyers and officers in all examinations.

Year of birth was significantly associated with refusal for logistical reasons ( $p<0.01$  for each of these examinations). Refusal for logistical reasons was more prevalent in younger veterans. Veterans who did not make the military their careers refused more often for logistical reasons than veterans who made the military their careers at all examinations ( $p<0.01$  for all examinations).

To further investigate these associations, refusals because of logistical reasons were investigated, adjusting for group, race, military occupation, year of birth, and military commitment simultaneously. The association between military commitment and refusal for logistical reasons can be explained by age. Younger AFHS veterans, who refused more often for logistical reasons, were less likely to make the military their careers, whereas older AFHS veterans were more likely to have careers in the military.

#### **4.4.2 Ranch Hands and Original Comparisons Examined Separately**

Tables 4-9 and 4-10 provide the numbers and percentages of veterans who refused for logistical reasons for Ranch Hands and original Comparisons, respectively.

**Table 4-9. Analysis of Refusal for Logistical Reasons by Race, Military Occupation, Year of Birth, Dioxin Level, and Military Commitment (Ranch Hands Only)**

Factor/Category	Number (%) Refusing for Logistical Reasons					
	1982	1985	1987	1992	1997	2002
<b>Race</b>						
Non-Black	120 (10.6%)	84 (7.5%)	83 (7.4%)	72 (6.7%)	83 (8.0%)	86 (8.8%)
Black	7 (9.5%)	5 (6.9%)	6 (8.3%)	3 (4.3%)	4 (6.1%)	5 (7.8%)
p-Value <sup>a</sup>	p=0.915	p=0.999	p=0.961	p=0.614	p=0.738	p=0.966
<b>Military Occupation</b>						
Officer	52 (11.6%)	38 (8.5%)	33 (7.5%)	24 (5.6%)	20 (4.9%)	20 (5.1%)
Enlisted Flyer	11 (5.5%)	10 (5.1%)	11 (5.6%)	9 (4.8%)	15 (8.3%)	11 (6.7%)
Enlisted Groundcrew	64 (11.4%)	41 (7.4%)	45 (8.2%)	42 (7.9%)	52 (10.2%)	60 (12.4%)
p-Value <sup>a</sup>	<b>p=0.043</b>	p=0.322	p=0.502	p=0.216	<b>p=0.012</b>	<b>p&lt;0.001</b>
<b>Year of Birth</b>						
Born 1920 or Before	2 (8.3%)	2 (9.1%)	1 (5.0%)	3 (16.7%)	0 (0.0%)	0 (0.0%)
Born 1921-1930	12 (6.7%)	9 (5.2%)	8 (4.7%)	6 (3.8%)	4 (2.7%)	6 (4.5%)
Born 1931-1940	46 (9.7%)	33 (7.0%)	35 (7.5%)	22 (4.9%)	28 (6.6%)	25 (6.3%)
Born 1941-1950	67 (12.6%)	45 (8.5%)	45 (8.4%)	44 (8.3%)	55 (10.7%)	60 (12.0%)
p-Value <sup>a</sup>	p=0.132	p=0.515	p=0.435	<b>p=0.023</b>	<b>p=0.005</b>	<b>p=0.004</b>
<b>Dioxin Level</b>						
≤10 ppt	--	--	--	19 (4.3%)	14 (3.3%)	22 (5.4%)
>10 ppt	--	--	--	13 (2.3%)	27 (4.9%)	33 (6.5%)
p-Value <sup>a</sup>	--	--	--	p=0.114	p=0.278	p=0.580
<b>Military Commitment</b>						
Career	84 (10.2%)	54 (6.7%)	58 (7.3%)	41 (5.4%)	52 (7.1%)	50 (7.3%)
Noncareer	43 (11.2%)	35 (9.0%)	31 (7.9%)	34 (8.8%)	35 (9.4%)	41 (11.4%)
p-Value <sup>a</sup>	p=0.679	p=0.186	p=0.777	<b>p=0.034</b>	p=0.218	<b>p=0.035</b>

<sup>a</sup>P-value based on continuity adjusted chi-square statistic when factor is divided into two categories; p-value based on Pearson's chi-square statistic when factor is divided into more than two categories.

--: Analysis was not performed because dioxin levels were not known until after the 1987 follow-up examination.

Note: The p-values appearing in bold type represent a statistically significant association (p-value<0.05).

**Table 4-10. Analysis of Refusal for Logistical Reasons by Race, Military Occupation, Year of Birth, Dioxin Level, and Military Commitment (Ranch Hands and Original Comparisons)**

Factor/Category	Number (%) Refusing for Logistical Reasons					
	1982	1985	1987	1992	1997	2002
<b>Race</b>						
Non-Black	244 (21.0%)	142 (12.3%)	134 (11.7%)	104 (9.3%)	106 (9.9%)	125 (12.2%)
Black	17 (23.0%)	11 (14.7%)	7 (9.2%)	11 (14.9%)	10 (13.3%)	15 (21.4%)
p-Value <sup>a</sup>	p=0.800	p=0.670	p=0.638	p=0.173	p=0.441	<b>p=0.040</b>
<b>Military Occupation</b>						
Officer	97 (21.2%)	51 (11.2%)	50 (11.0%)	34 (7.7%)	28 (6.6%)	32 (7.8%)
Enlisted Flyer	30 (14.9%)	16 (7.8%)	13 (6.5%)	12 (6.3%)	15 (8.2%)	20 (11.8%)
Enlisted Groundcrew	134 (23.2%)	86 (15.1%)	78 (13.8%)	69 (12.4%)	73 (13.5%)	88 (17.0%)
p-Value <sup>a</sup>	<b>p=0.046</b>	<b>p=0.015</b>	<b>p=0.019</b>	<b>p=0.011</b>	<b>p=0.001</b>	<b>p&lt;0.001</b>
<b>Year of Birth</b>						
Born 1920 or Before	2 (7.1%)	1 (3.7%)	1 (3.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Born 1921-1930	23 (12.2%)	13 (7.2%)	13 (7.4%)	3 (1.8%)	6 (3.9%)	8 (5.9%)
Born 1931-1940	83 (17.4%)	51 (10.7%)	44 (9.3%)	40 (8.7%)	34 (7.6%)	49 (11.7%)
Born 1941-1950	153 (28.2%)	88 (16.0%)	83 (15.2%)	72 (13.2%)	76 (14.2%)	83 (15.7%)
p-Value <sup>a</sup>	<b>p&lt;0.001</b>	<b>p=0.003</b>	<b>p=0.003</b>	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>	<b>p=0.007</b>
<b>Dioxin Level</b>						
≤10 ppt	--	--	--	27 (2.9%)	39 (4.3%)	59 (6.9%)
>10 ppt	--	--	--	0 (0.0%)	1 (4.2%)	2 (8.7%)
p-Value <sup>a</sup>	--	--	--	p=0.782	p=0.999	p=0.999
<b>Military Commitment</b>						
Career	146 (17.7%)	77 (9.4%)	76 (9.4%)	56 (7.2%)	50 (6.7%)	70 (10.0%)
Noncareer	115 (28.0%)	76 (18.4%)	65 (15.8%)	59 (14.4%)	66 (16.4%)	70 (17.7%)
p-Value <sup>a</sup>	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>	<b>p=0.001</b>	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>	<b>p&lt;0.001</b>

<sup>a</sup>P-value based on continuity adjusted chi-square statistic when factor is divided into two categories; p-value based on Pearson's chi-square statistic when factor is divided into more than two categories.

--: Analysis was not performed because dioxin levels were not known until after the 1987 follow-up examination.

Note: The p-values appearing in bold type represent a statistically significant association (p-value<0.05).

The associations between refusal for logistical reasons and military occupation, year of birth, and military commitment when Ranch Hands and original Comparisons were combined were generally based on associations found within the original Comparison group. Tests of associations on original Comparisons generally parallel the tests of association in the combined Ranch Hand and original Comparisons groups. Significant tests of associations on only Ranch Hands are generally weaker and more sporadic.



Plots of the percentages of veterans who refused for logistical reasons for Ranch Hands and original Comparisons at the six AFHS examinations are shown in Figure 4-7 through Figure 4-11 for race, military occupation, year of birth, dioxin level, and military commitment, respectively.

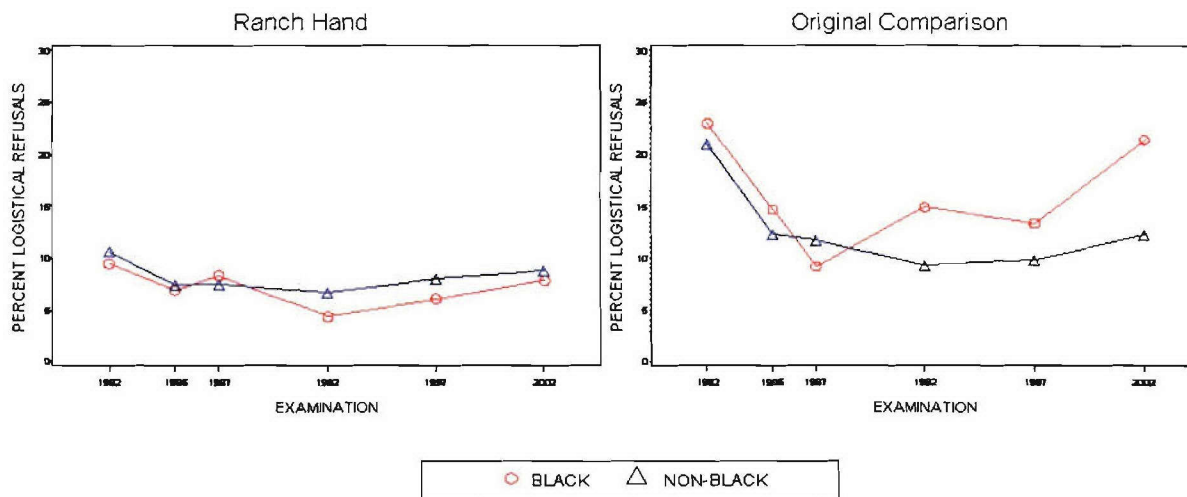


Figure 4-7. Percentage of Veterans Who Refused for Logistical Reasons by Race, Examination, and Group (Ranch Hands and Original Comparisons)

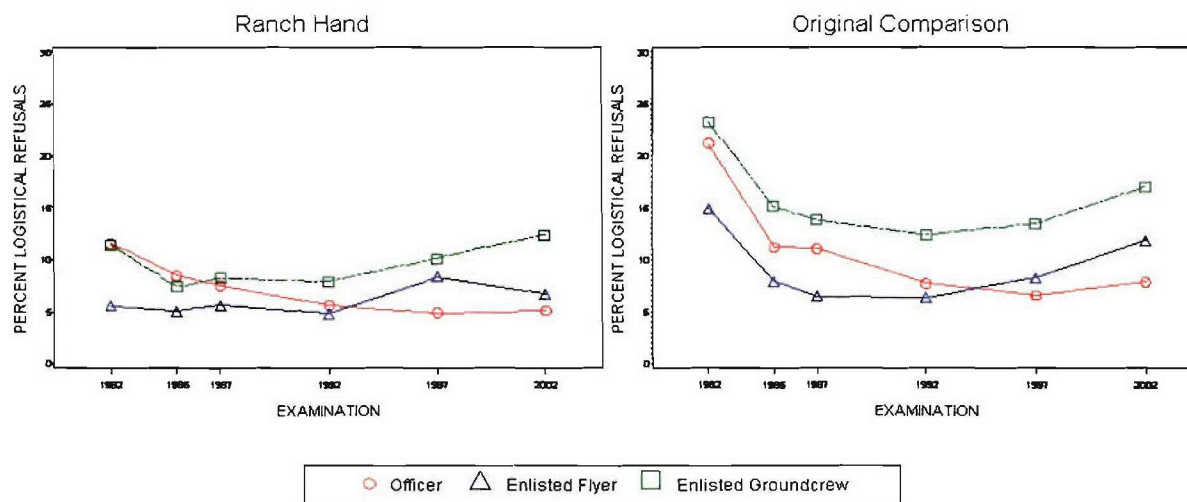


Figure 4-8. Percentage of Veterans Who Refused for Logistical Reasons by Military Occupation, Examination, and Group (Ranch Hands and Original Comparisons)

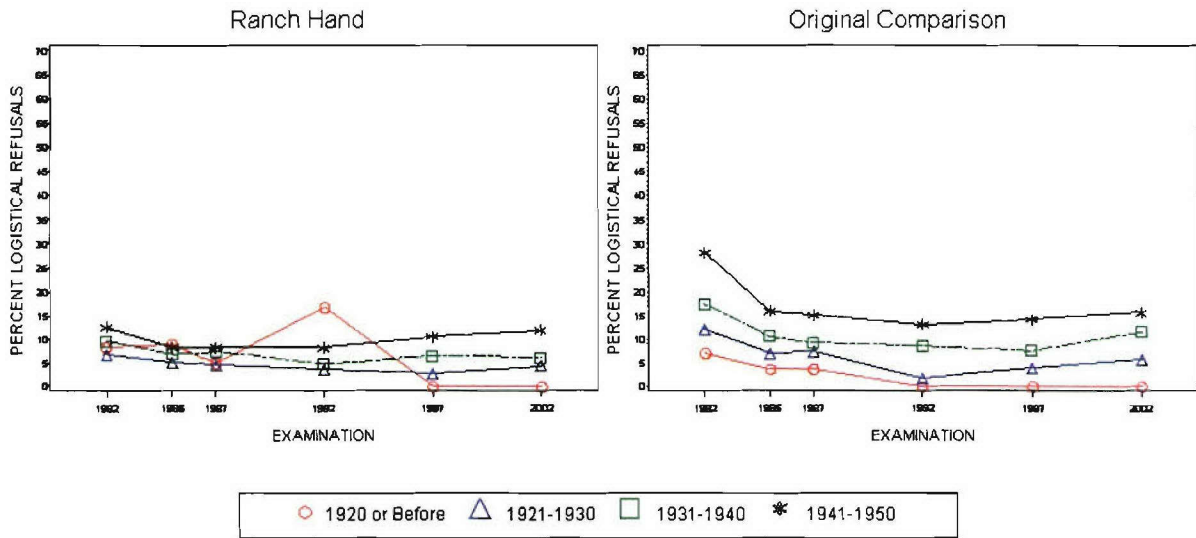


Figure 4-9. Percentage of Veterans Who Refused for Logistical Reasons by Year of Birth, Examination, and Group (Ranch Hands and Original Comparisons)

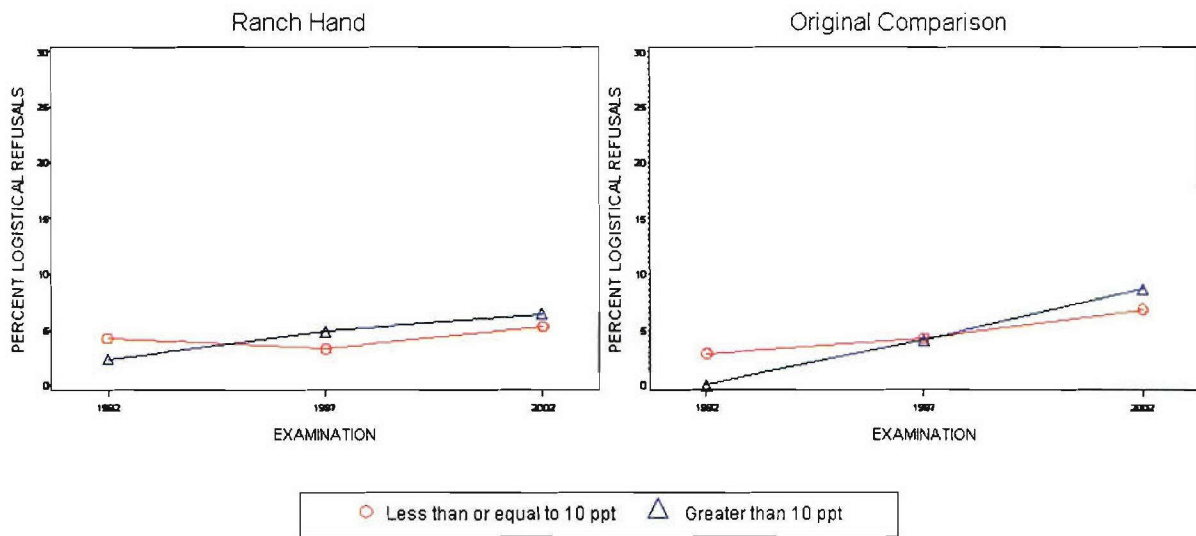
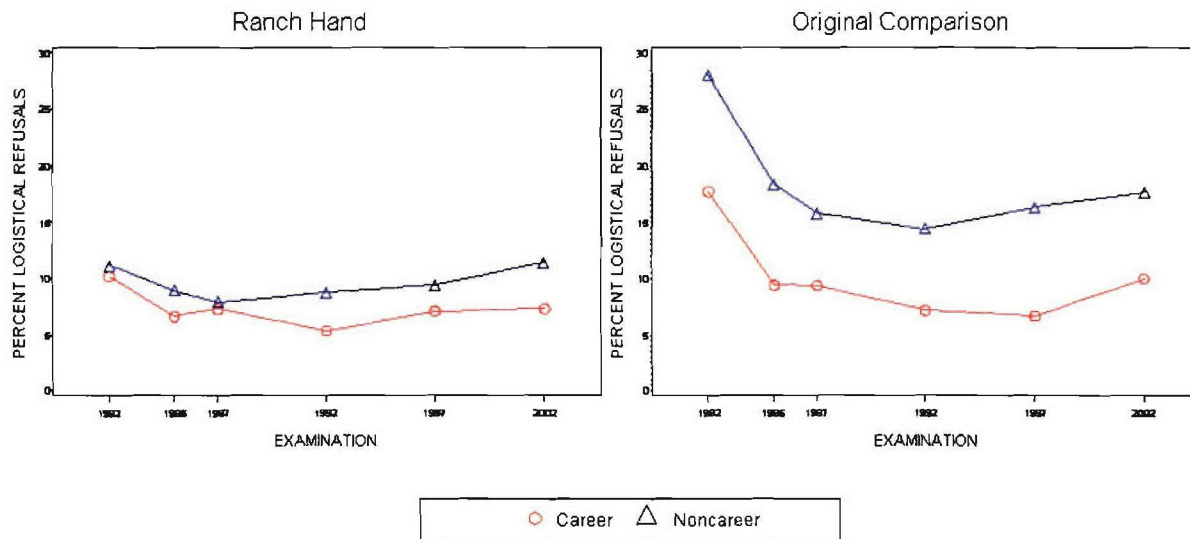


Figure 4-10. Percentage of Veterans Who Refused for Logistical Reasons by Dioxin Level, Examination, and Group (Ranch Hands and Original Comparisons)



**Figure 4-11. Percentage of Veterans Who Refused for Logistical Reasons by Military Commitment, Examination, and Group (Ranch Hands and Original Comparisons)**

**4.4.3 Ranch Hands and Original Comparisons at the 1982 Baseline Examination**

As noted in Figure 4-1 (Section 4-2), the percentage of veterans who refused for logistical reasons was increased in original Comparisons for all examinations, with a large difference between Ranch Hands and original Comparisons for the 1982 baseline examination. Logistical reasons included financial hardship, no interest or no time, job commitment, travel distance, or family concerns. Refusal for logistical reasons was the largest category of noncompliant participants at the baseline examination.

A further subcategorization of refusal for logistical reasons is given in Table 4-11, in which frequencies for Ranch Hands and original Comparisons are shown separately.

**Table 4-11. Refusal for Logistical Reasons at the 1982 Baseline Examination (Ranch Hands and Original Comparisons Included)**

Category/Subcategory	Total	Ranch Hand	Original Comparison
	n (%)	n (%)	n (%)
Refusal – Logistical Reasons	388 (15.9%)	127 (10.5%)	261 (21.1%)
<i>Financial Hardship</i>	0 (0.0%)	0 (0.0%)	0 (0.0%)
<i>No Interest or No Time</i>	239 (9.8%)	80 (6.6%)	159 (12.9%)
<i>Job Commitment</i>	94 (3.8%)	30 (2.5%)	64 (5.2%)
<i>Travel Distance, Family Concerns</i>	55 (2.3%)	17 (1.4%)	38 (3.1%)
All Other Reasons for Noncompliance	75 (3.1%)	36 (3.0%)	39 (3.2%)
Compliant	1,981 (81.1%)	1,046 (86.5%)	935 (75.7%)
<b>Total</b>	<b>2,444</b>	<b>1,209</b>	<b>1,235</b>

The increased rate of refusal for logistical reasons for the 1982 baseline examination in original Comparisons cannot be traced directly to a single one of these four subcategories. The rate of refusal for logistical reasons for original Comparisons was approximately double that of Ranch Hands. When evaluating refusal rates for each of the logistical subcategories (no interest or no time, job commitment, or travel distance and family concerns), the refusal rates for original Comparisons were approximately double the rate of refusal in Ranch Hands for each of these reasons.

#### **4.5 CONCLUSION**

This chapter discussed reasons for noncompliance and the factors that may have affected these reasons. Reasons for noncompliance included refusal for health reasons, logistical reasons, or other reasons, adamant refusals, passive refusals, and noncompliance because the veteran was unlocatable. The effects of group, race, military occupation, age, dioxin level, and military commitment on noncompliance also were examined.

The compliance rates were relatively similar for the 1982, 1985, 1987, and 1992 examinations. A larger decrease in the compliance rate was observed for the 1997 and 2002 follow-up examinations. The number of veterans who refused for health reasons and who refused for logistical reasons increased for the 1997 and 2002 follow-up examinations. The percentage of veterans who refused for health reasons and other reasons, as well as the percentage of passive refusals and veterans who were unlocatable, were similar between Ranch Hands and original Comparisons. A greater percentage of original Comparisons were adamant refusals than Ranch Hands, but the difference between the percentages was similar across the 1992, 1997, and 2002 follow-up examinations. The percentage of veterans who refused for logistical reasons was increased in original Comparisons for all examinations, with a large difference between Ranch Hands and original Comparisons for the 1982 baseline examination. A speculation for the increased refusal rate in original Comparisons at the 1982 baseline examination is that original Comparisons were less committed to the AFHS than Ranch Hands because of the difference in Agent Orange exposure histories. Once the AFHS was under way and results of the baseline examination were made available, however, original Comparisons may have developed a stronger desire to participate in the AFHS, which led to the narrowing in differences between Ranch Hands and original Comparisons in refusal rates because of logistical reasons at later examinations.

In the 1987 and later follow-up examinations, age was associated with refusal for health reasons. As expected, older veterans refused more often for health reasons than did younger veterans. Veterans who made the military their careers refused more often for health reasons than veterans who did not make the military their careers, but this association was explained by age. Older AFHS veterans, who refused more often for health reasons, were more likely to make the military their careers, whereas younger AFHS veterans were more likely to have careers outside the military. The age-adjusted refusal rate for health reasons was greater for enlisted groundcrew, the youngest occupation on average, than for enlisted flyers and officers.

Original Comparisons refused more often than Ranch Hands for logistical reasons. Enlisted groundcrew were more likely to refuse for logistical reasons than enlisted flyers and officers in all examinations. Refusal for logistical reasons was more prevalent in younger veterans. Veterans who did not make the military their careers refused more often for logistical reasons than veterans who made the military their careers at all examinations, which was explained by age. Younger AFHS veterans, who refused more often for logistical reasons, were less likely to make the military their careers, whereas older AFHS veterans were more likely to have careers in the military.

Associations between refusal for logistical reasons and military occupation, age, and military commitment were generally based on associations found within the original Comparison group. Tests of associations on original Comparisons generally parallel the tests of association in the combined Ranch Hand and original Comparisons groups. Significant tests of associations on only Ranch Hands are generally weaker and more sporadic.

The increased rate of refusal for logistical reasons for the 1982 baseline examination in original Comparisons cannot be traced directly to one or more of the four logistical reasons categories: financial hardship, no interest or no time, job commitment, and travel distance or family concerns. The rate of refusal in original Comparisons was approximately double the rate of refusal for these reasons in Ranch Hands.

## 5 ADDITIONAL ANALYSIS REGARDING COMPLIANCE AND NONCOMPLIANCE

### 5.1 INTRODUCTION

This chapter investigates other issues related to compliance and noncompliance. The number of Air Force Health Study (AFHS) examinations for which a veteran was fully compliant was examined. The number of examinations for which a veteran was fully compliant was further refined by classification according to the number of examinations for which the veteran was eligible. The relation between compliance and noncompliance at an AFHS follow-up examination with compliance at the examination immediately prior (e.g., the relation between compliance and noncompliance in 1985 with compliance and noncompliance in 1982) also was studied. Reasons for noncompliance for veterans who were compliant at an examination and noncompliant at the next examination were analyzed. Refusal because of dissatisfaction with the U.S. Air Force or the U.S. Government, the AFHS, and previous AFHS examinations was examined. Finally, reasons for noncompliance for veterans with varying degrees of compliance to the AFHS were analyzed.

### 5.2 OVERALL COMPLIANCE IN THE AFHS

Between the 1982 baseline examination and the 2002 follow-up examination, 3,502 veterans were eligible to have participated in the AFHS. This number includes 979 replacement Comparisons, the majority of whom were contacted sometime after the 1982 baseline examination was finished because of the noncompliance of an original Comparison. This population of veterans is characterized in Table 5-1 by the number of examinations for which they were fully compliant (completed the physical examination). Original and replacement Comparisons are both combined and treated separately.

Table 5-1. Compliance History of Veterans Eligible To Participate in the AFHS

Number of Examinations Fully Compliant	Total Number of Veterans	Ranch Hands	All Comparisons	Original Comparisons	Replacement Comparisons
0	744 (21.2%)	148 (11.7%)	596 (26.6%)	196 (15.5%)	400 (40.9%)
1	225 (6.4%)	52 (4.1%)	173 (7.7%)	60 (4.8%)	113 (11.6%)
2	169 (4.8%)	39 (3.1%)	130 (5.8%)	45 (3.6%)	85 (8.7%)
3	211 (6.0%)	75 (6.0%)	136 (6.1%)	78 (6.2%)	58 (5.9%)
4	266 (7.6%)	112 (8.9%)	154 (6.9%)	95 (7.5%)	59 (6.0%)
5	405 (11.6%)	166 (13.1%)	239 (10.7%)	171 (13.6%)	68 (7.0%)
6	1,482 (42.3%)	671 (53.1%)	811 (36.2%)	616 (48.9%)	195 (19.9%)
<b>Total</b>	<b>3,502</b>	<b>1,263</b>	<b>2,239</b>	<b>1,261</b>	<b>978</b>

The number of veterans who were compliant at all six AFHS examinations was the largest group (1,482 veterans, 42.3% of the total). Ranch Hands were compliant at all six examinations more often than original Comparisons (53.1% versus 48.9%). Replacement Comparisons were compliant at all six examinations 19.9 percent of the time. Replacement Comparisons were invited only, however, when an original Comparison had refused or if the replacement Comparison had been invited to a previous examination, so the percent attending all six exams is misleading. Ranch Hands were fully compliant to four, five, and six examinations more often than original Comparisons, and original Comparisons were fully compliant to zero, one, and two examinations more often than Ranch Hands. The percentages of Ranch Hands and original Comparisons who were fully compliant for three examinations were nearly

equivalent to each other. These findings are consistent with the observation that Ranch Hands were more likely to be compliant than Comparisons and original Comparisons were more likely to be compliant than replacement Comparisons, as described in Chapter 3.

These data can be analyzed further by determining the number of examinations that a veteran was eligible to attend. If a veteran was deceased at the time of an examination or had not been invited to a particular examination, he was not counted as being eligible for that examination. Replacement Comparisons often may have not been invited to the earlier examinations because the original Comparison that they were replacing was compliant. After the baseline examination, 14 Ranch Hands and 26 original Comparisons were newly identified, so they also would not have been invited to all six examinations.

The data presented in Table 5-1 were further classified and reorganized in Table 5-2. First, any veterans who were compliant for all examinations to which they were invited are shown as a group at the bottom of Table 5-2. The percentage of veterans who were compliant at every examination to which they were invited was adjusted to reflect eligibility at six examinations or less.

Second, all remaining veterans eligible for the AFHS were grouped by the number of examinations for which they were fully compliant and were further classified by the number of examinations for which they were eligible. Subtotals are provided based on the number of examinations for which the veteran was fully compliant.

**Table 5-2. Compliance History of AFHS Veterans Based on Number of Examinations Eligible for Participation**

Number of Exams Eligible	Number of Exams Fully Compliant	Total Number of Veterans	Ranch Hands	All Comparisons	Original Comparisons	Replacement Comparisons
<b>Did Not Attend an AFHS Examination</b>						
0		40 (1.1%)*	40 (3.2%)*	--	--	--
1		231 (6.6%)	9 (0.7%)	222 (9.9%)	11 (0.9%)	211 (21.6%)
2		76 (2.2%)	3 (0.2%)	73 (3.3%)	2 (0.2%)	71 (7.3%)
3	0	38 (1.1%)	3 (0.2%)	35 (1.6%)	4 (0.3%)	31 (3.2%)
4		19 (0.5%)	9 (0.7%)	10 (0.4%)	7 (0.6%)	3 (0.3%)
5		29 (0.8%)	7 (0.6%)	22 (1.0%)	8 (0.6%)	14 (1.4%)
6		311 (8.9%)	77 (6.1%)	234 (10.5%)	164 (13.0%)	70 (7.2%)
<b>Subtotal</b>		<b>744 (21.2%)</b>	<b>148 (11.7%)</b>	<b>596 (26.6%)</b>	<b>196 (15.5%)</b>	<b>400 (40.9%)</b>
<b>Compliant to at Least One Examination, but Not All Examinations, for which Eligible</b>						
2		17 (0.5%)	2 (0.2%)	15 (0.7%)	2 (0.2%)	13 (1.3%)
3		15 (0.4%)	2 (0.2%)	13 (0.6%)	5 (0.4%)	8 (0.8%)
4	1	8 (0.2%)	3 (0.2%)	5 (0.2%)	2 (0.2%)	3 (0.3%)
5		9 (0.3%)	1 (0.1%)	8 (0.4%)	4 (0.3%)	4 (0.4%)
6		83 (2.4%)	33 (2.6%)	50 (2.2%)	36 (2.9%)	14 (1.4%)
<b>Subtotal</b>		<b>132 (3.8%)</b>	<b>41 (3.2%)</b>	<b>91 (4.1%)</b>	<b>49 (3.9%)</b>	<b>42 (4.3%)</b>
3		21 (0.6%)	3 (0.2%)	18 (0.8%)	3 (0.2%)	15 (1.5%)
4		5 (0.1%)	1 (0.1%)	4 (0.2%)	2 (0.2%)	2 (0.2%)
5	2	14 (0.4%)	5 (0.4%)	9 (0.4%)	2 (0.2%)	7 (0.7%)
6		55 (1.6%)	20 (1.6%)	35 (1.6%)	25 (2.0%)	10 (1.0%)
<b>Subtotal</b>		<b>95 (2.7%)</b>	<b>29 (2.3%)</b>	<b>66 (2.9%)</b>	<b>32 (2.5%)</b>	<b>34 (3.5%)</b>

**Table 5-2. Compliance History of AFHS Veterans Based on Number of Examinations Eligible for Participation (Continued)**

Number of Exams Eligible	Number of Exams Fully Compliant	Total Number of Veterans	Ranch Hands	All Comparisons	Original Comparisons	Replacement Comparisons
4	3	20 (0.6%)	6 (0.5%)	14 (0.6%)	7 (0.6%)	7 (0.7%)
5		14 (0.4%)	4 (0.3%)	10 (0.4%)	6 (0.5%)	4 (0.4%)
6		100 (2.9%)	34 (2.7%)	66 (2.9%)	44 (3.5%)	22 (2.2%)
<b>Subtotal</b>		<b>134 (3.8%)</b>	<b>44 (3.5%)</b>	<b>90 (4.0%)</b>	<b>57 (4.5%)</b>	<b>33 (3.4%)</b>
5	4	42 (1.2%)	15 (1.2%)	27 (1.2%)	13 (1.0%)	14 (1.4%)
6		144 (4.1%)	65 (5.1%)	79 (3.5%)	54 (4.3%)	25 (2.6%)
<b>Subtotal</b>		<b>186 (5.3%)</b>	<b>80 (6.3%)</b>	<b>106 (4.7%)</b>	<b>67 (5.3%)</b>	<b>39 (4.0%)</b>
6	5	303 (8.7%)	127 (10.1%)	176 (7.9%)	131 (10.4%)	45 (4.6%)
<b>Subtotal</b>		<b>303 (8.7%)</b>	<b>127 (10.1%)</b>	<b>176 (7.9%)</b>	<b>131 (10.4%)</b>	<b>45 (4.6%)</b>
<b>Compliant to All Examinations for Which Eligible</b>						
1	1	93 (2.7%)	11 (0.9%)	82 (3.7%)	11 (0.9%)	71 (7.3%)
2	2	74 (2.1%)	10 (0.8%)	64 (2.9%)	13 (1.0%)	51 (5.2%)
3	3	77 (2.2%)	31 (2.5%)	46 (2.1%)	21 (1.7%)	25 (2.6%)
4	4	80 (2.3%)	32 (2.5%)	48 (2.1%)	28 (2.2%)	20 (2.0%)
5	5	102 (2.9%)	39 (3.1%)	63 (2.8%)	40 (3.1%)	23 (2.4%)
6	6	1,482 (42.3%)	671 (53.1%)	811 (36.2%)	616 (48.9%)	195 (19.9%)
<b>Subtotal</b>	<b>All Eligible</b>	<b>1,908 (54.5%)</b>	<b>794 (62.9%)</b>	<b>1,114 (49.8%)</b>	<b>729 (57.8%)</b>	<b>385 (39.4%)</b>
	<b>Total</b>	<b>3,502</b>	<b>1,263</b>	<b>2,239</b>	<b>1,261</b>	<b>978</b>

\*Forty Ranch Hands were deceased prior to beginning of 1982 baseline examination, but are included in these summaries to reflect the complete Ranch Hand population.

By including veterans who were compliant at every examination to which they were invited with the group of veterans who attended all six examinations, the percentage of Ranch Hands increased from 53.1 percent to 62.9 percent. Original Comparisons show a similar increase, increasing from 48.9 percent of original Comparisons who were fully compliant at all six examinations to 57.8 percent who were fully compliant to all examinations for which they were eligible. The percentage of replacement Comparisons increased from 19.9 percent of replacement Comparisons that attended all six examinations to 39.4 percent who were fully compliant to all examinations for which they were eligible. Nevertheless, the distribution of the number of examinations for which a replacement Comparison was compliant was very different from the patterns seen for Ranch Hands and original Comparisons.

Therefore, even after adjustment to reflect eligibility to participate in AFHS examinations, Ranch Hands were more likely to be compliant than Comparisons, but the difference in compliance rates was relatively constant. Original Comparisons were more likely to be compliant than replacement Comparisons, as described previously.

### 5.3 PREDICTION OF COMPLIANCE RATES AT AN AFHS EXAMINATION

In Chapter 3, factors that were thought to influence compliance were investigated. In particular, the effects of group (Ranch Hand, Comparison), race (non-Black, Black), military occupation (officer, enlisted flyer, enlisted groundcrew), year of birth, dioxin level ( $\leq 10$  parts per trillion [ppt],  $> 10$  ppt), and



military commitment (career, noncareer) were examined. Significant associations with group, year of birth, military occupation, and military commitment were found at all examinations.

In this section, the ability to predict retrospectively whether a veteran would have been compliant for an examination is investigated. Based on patterns seen earlier in this chapter, compliance at the last examination also was included as a predictor variable.

As an example, compliance and noncompliance at the 1985 examination were investigated. Noncompliance at the 1985 follow-up examination was defined as refusal for health reasons, refusal for logistical reasons, refusal for other reasons, passive refusal, adamant refusal, unlocatable, and deceased. The effects of group, race, military occupation, year of birth, dioxin level, and military commitment were used simultaneously as possible predictor variables, as was the veteran's compliance status in 1982. Noncompliance in 1982 was defined in a similar fashion to noncompliance at the 1985 examination. Veterans who were deceased at the 1982 examination were not used in the analysis because they could not have been compliant for the 1985 examination. Age at the 1985 examination was divided into four categories: 45 years old or younger in 1985, between 46 and 55 years of age in 1985, between 56 and 65 years of age in 1985, and 66 years old or older in 1985. Group was divided into three categories: Ranch Hands, original Comparisons, and replacement Comparisons. The other factors were categorized as previously stated.

A similar strategy was used to predict whether a veteran would have been compliant for the 1987 follow-up examination, except that compliance or noncompliance at the 1985 examination was used as a possible predictor variable and age was based on age in 1987. This strategy was repeated to attempt prediction of compliance at the 1992, 1997, and 2002 follow-up examinations. Age was always divided into four 10-year categories, but shifted to accommodate the increasing age of the population (see Chapter 3 for a description of the four categories used at each examination).

The results of these analyses showed that compliance at the previous examination was the most significant factor in predicting compliance at the examination under study ( $p < 0.001$  for all analyses). For the 1992, 1997, and 2002 follow-up examinations, military occupation was significantly associated with compliance, as was age at the examination. Race was significantly associated with compliance for the 1985 follow-up examination, and military commitment was significantly associated with compliance at the 1987 follow-up examination, but these factors were not associated with compliance at the other examinations. Group and dioxin level were not significantly associated with compliance status.

Table 5-3 describes the compliance rates for each of the five follow-up examinations. The statistics showed the strong effect that compliance at the previous examination has on the ability to predict compliance at the examination under study. Whereas other factors may be associated significantly with compliance, knowledge of the compliance status of the veteran at the previous examination is the most important factor. In fact, although Ranch Hands had a higher compliance rate than Comparisons at all examinations, compliance at the previous examination is far more useful in predicting whether a veteran will be compliant or noncompliant at the examination under study, and the knowledge of whether a veteran is a Ranch Hand or a Comparison is not useful for prediction after the compliance status at the previous examination is taken into account.

**Table 5-3. Analysis of Compliance and Noncompliance Rates Based on Compliance or Noncompliance at the Previous AFHS Examination**

Examination	Category	Compliant	Not Compliant	Percentage Classified Correctly**
		n (%)	n (%)	
1985	Compliant at 1982 Examination	2,110 (93.0%)	159 (7.0%)	2,558/2,875 (89.0%)
	Not Compliant at 1982 Examination*	158 (26.1%)	448 (73.9%)	
1987	Compliant at 1985 Examination	2,184 (94.6%)	125 (5.4%)	2,704/2,912 (92.9%)
	Not Compliant at 1985 Examination*	83 (13.8%)	520 (86.2%)	
1992	Compliant at 1987 Examination	2,105 (91.8%)	189 (8.2%)	2,619/2,918 (89.8%)
	Not Compliant at 1987 Examination*	110 (17.6%)	514 (82.4%)	
1997	Compliant at 1992 Examination	1,983 (88.8%)	250 (11.2%)	2,564/2,898 (88.5%)
	Not Compliant at 1992 Examination*	84 (12.6%)	581 (87.4%)	
2002	Compliant at 1997 Examination	1,829 (86.2%)	292 (13.8%)	2,578/2,930 (88.0%)
	Not Compliant at 1997 Examination*	60 (7.4%)	749 (92.6%)	

\*Includes veterans who refused and were unlocatable; deceased veterans were not eligible for participation at the subsequent examination and, thus, are not included.

\*\*Number classified correctly is determined by adding the number of veterans who were compliant at the previous examination and compliant at the examination under study and the number of veterans who were noncompliant at the previous examination and noncompliant at the examination under study; total number was determined by adding the number classified correctly to the number who were classified incorrectly (changed from compliant to noncompliant, or from noncompliant to compliant).

The statistics in Table 5-3 show that compliance or noncompliance at the previous examination correctly predicted compliance or noncompliance at the examination under study between 88 percent (for the 2002 examination) and 93 percent (for the 1987 examination) of the time. The rise in the percentage correctly classified in 1987 was probably due to the short time period between examinations. Between the 1987 and 2002 follow-up examinations, the percentage of veterans who were compliant at the examination and compliant at the previous examination decreased. Between the 1992 and 2002 follow-up examinations, the percentage of veterans who were not compliant at the examination and not compliant at the previous examination increased.

#### **5.4 COMPLIANCE AT AN AFHS EXAMINATION AND NONCOMPLIANCE AT THE NEXT EXAMINATION**

If a veteran was invited to participate in an AFHS examination, he was invited to participate in all subsequent AFHS examinations, regardless of whether he participated in a previous examination. In this section, those veterans who were fully compliant to an AFHS examination and were noncompliant to the next examination are analyzed. For example, as shown in Table 5-4, 138 veterans were fully compliant to the 1982 baseline examination, but were noncompliant to the 1985 follow-up examination. The reasons for noncompliance are presented in Table 5-4 for the five adjacent pairs of AFHS examinations. That is, the reasons for noncompliance for veterans who were fully compliant in 1982 but were noncompliant in 1985, those who were fully compliant in 1985 but were noncompliant in 1987, those who were fully compliant in 1987 but were noncompliant in 1992, those who were fully compliant in 1992 but were

noncompliant in 1997, and those who were fully compliant in 1997 but were noncompliant in 2002 are presented in Table 5-4.

**Table 5-4. Reasons for Compliance in an AFHS Examination and Noncompliance at the Next Examination (Ranch Hands and Original Comparisons Combined)**

<b>Reason for Noncompliance</b>	<b>1982=Yes, 1985=No</b>	<b>1985=Yes, 1987=No</b>	<b>1987=Yes, 1992=No</b>	<b>1992=Yes, 1997=No</b>	<b>1997=Yes, 2002=No</b>
Refusal for Health Reasons	13 (9.4%)	11 (10.8%)	18 (11.9%)	44 (20.5%)	75 (31.6%)
Refusal for Logistical Reasons	33 (23.9%)	43 (42.2%)	47 (31.1%)	58 (27.0%)	56 (23.6%)
<i>Financial Hardship</i>	3	2	0	0	3
<i>No Interest or No Time</i>	10	7	5	11	16
<i>Job Commitment</i>	18	29	27	23	15
<i>Travel Distance, Family Concerns</i>	2	5	15	24	22
Refusal for Other Reasons	15 (10.9%)	16 (15.7%)	6 (4.0%)	35 (16.3%)	19 (8.0%)
<i>Dissatisfaction with the U.S. Air Force or the U.S. Government</i>	4	6	3	4	6
<i>Dissatisfaction with the AFHS</i>	9	0	0	2	0
<i>Dissatisfaction with Previous AFHS Examinations</i>	1	0	2	7	1
<i>Fear of Physical Examination</i>	0	1	0	0	1
<i>Confidentiality Concerns, Adverse Impact on Career</i>	0	0	0	0	0
<i>Other</i>	1	9	1	22	11
Adamant Refusal	--	--	6 (4.0%)	6 (2.8%)	1 (0.4%)
Passive Refusal	1 (0.7%)	4 (3.9%)	8 (5.3%)	6 (2.8%)	8 (3.4%)
Unlocatable	55 (39.9%)	8 (7.8%)	7 (4.6%)	1 (0.5%)	3 (1.3%)
Deceased	21 (15.2%)	20 (19.6%)	59 (39.1%)	65 (30.2%)	75 (31.6%)
<b>TOTAL</b>	<b>138</b>	<b>102</b>	<b>151</b>	<b>215</b>	<b>237</b>

After the 1987 examination, the number of veterans who were fully compliant for an AFHS examination, but were noncompliant for the next AFHS examination, increased. As would be expected in an aging population, an increased number of refusals for health reasons and an increased number of deceased veterans were seen as the AFHS continued. After adamant refusals initially were identified, the rate of veterans who were adamant refusals for subsequent examinations decreased. Passive refusals, refusal for logistical reasons, and refusal for other reasons fluctuated across time. The number of veterans who were fully compliant in 1982, but unlocatable in 1985, was large. The rate of veterans who were unlocatable for an examination after participating in the previous examination, however, decreased as the AFHS continued.

The statistics shown in Table 5-4 are presented separately for Ranch Hands and original Comparisons in Tables 5-5 and 5-6, respectively. The patterns described above are generally similar for Ranch Hands and original Comparisons.

**Table 5-5. Reasons for Compliance in an AFHS Examination and Noncompliance at the Next Examination (Ranch Hands Only)**

<b>Reason for Noncompliance</b>	<b>1982=Yes, 1985=No</b>	<b>1985=Yes, 1987=No</b>	<b>1987=Yes, 1992=No</b>	<b>1992=Yes, 1997=No</b>	<b>1997=Yes, 2002=No</b>
Refusal for Health Reasons	8 (10.8%)	6 (10.9%)	10 (12.3%)	26 (23.6%)	36 (30.8%)
Refusal for Logistical Reasons	20 (27.0%)	22 (40.0%)	25 (30.9%)	31 (28.2%)	29 (24.8%)
<i>Financial Hardship</i>	3	1	0	0	2
<i>No Interest or No Time</i>	7	3	0	7	5
<i>Job Commitment</i>	8	16	19	14	11
<i>Travel Distance, Family Concerns</i>	2	2	6	10	11
Refusal for Other Reasons	8 (10.8%)	10 (18.2%)	3 (3.7%)	14 (12.7%)	10 (8.5%)
<i>Dissatisfaction with the U.S. Air Force or the U.S. Government</i>	2	4	1	1	4
<i>Dissatisfaction with the AFHS</i>	5	0	0	1	0
<i>Dissatisfaction with Previous AFHS Examinations</i>	1	0	1	3	1
<i>Fear of Physical Examination</i>	0	0	0	0	0
<i>Confidentiality Concerns, Adverse Impact on Career</i>	0	0	0	0	0
<i>Other</i>	0	6	1	9	5
Adamant Refusal	--	--	3 (3.7%)	2 (1.8%)	1 (0.9%)
Passive Refusal	1 (1.4%)	2 (3.6%)	4 (4.9%)	3 (2.7%)	2 (1.7%)
Unlocatable	27 (36.5%)	5 (9.1%)	3 (3.7%)	0 (0.0%)	1 (0.9%)
Deceased	10 (13.5%)	10 (18.2%)	33 (40.7%)	34 (30.9%)	38 (32.5%)
<b>TOTAL</b>	<b>74</b>	<b>55</b>	<b>81</b>	<b>110</b>	<b>117</b>

**Table 5-6. Reasons for Compliance in an AFHS Examination and Noncompliance at the Next Examination (Ranch Hands and Original Comparisons)**

<b>Reason for Noncompliance</b>	<b>1982=Yes, 1985=No</b>	<b>1985=Yes, 1987=No</b>	<b>1987=Yes, 1992=No</b>	<b>1992=Yes, 1997=No</b>	<b>1997=Yes, 2002=No</b>
Refusal for Health Reasons	5 (7.8%)	5 (10.6%)	8 (11.4%)	18 (17.1%)	39 (32.5%)
Refusal for Logistical Reasons	13 (20.3%)	21 (44.7%)	22 (31.4%)	27 (25.7%)	27 (22.5%)
<i>Financial Hardship</i>	0	1	0	0	1
<i>No Interest or No Time</i>	3	4	5	4	11
<i>Job Commitment</i>	10	13	8	9	4
<i>Travel Distance, Family Concerns</i>	0	3	9	14	11
Refusal for Other Reasons	7 (10.9%)	6 (12.8%)	3 (4.3%)	21 (20.0%)	9 (7.5%)
<i>Dissatisfaction with the U.S. Air Force or the U.S. Government</i>	2	2	2	3	2
<i>Dissatisfaction with the AFHS</i>	4	0	0	1	0
<i>Dissatisfaction with Previous AFHS Examinations</i>	0	0	1	4	0
<i>Fear of Physical Examination</i>	0	1	0	0	1
<i>Confidentiality Concerns, Adverse Impact on Career</i>	0	0	0	0	0
<i>Other</i>	1	3	0	13	6

**Table 5-6. Reasons for Compliance in an AFHS Examination and Noncompliance at the Next Examination (Original Comparisons Only) (Continued)**

<b>Reason for Noncompliance</b>	<b>1982=Yes, 1985=No</b>	<b>1985=Yes, 1987=No</b>	<b>1987=Yes, 1992=No</b>	<b>1992=Yes, 1997=No</b>	<b>1997=Yes, 2002=No</b>
Adamant Refusal	--	--	3 (4.3%)	4 (3.8%)	0 (0.0%)
Passive Refusal	0 (0.0%)	2 (4.3%)	4 (5.7%)	3 (2.9%)	6 (5.0%)
Unlocatable	28 (43.7%)	3 (6.4%)	4 (5.7%)	1 (1.0%)	2 (1.7%)
Deceased	11 (17.2%)	10 (21.3%)	26 (37.1%)	31 (29.5%)	37 (30.8%)
<b>TOTAL</b>	<b>64</b>	<b>47</b>	<b>70</b>	<b>105</b>	<b>120</b>

### 5.5 DISSATISFACTION WITH THE U.S. AIR FORCE, THE U.S. GOVERNMENT, THE AFHS, OR PREVIOUS AFHS EXAMINATIONS

When a veteran refused to participate, he was asked why he did not wish to participate. Three of the reasons for refusal concerned dissatisfaction: dissatisfaction with the U.S. Air Force or the U.S. Government, dissatisfaction with the AFHS, or dissatisfaction with previous AFHS examinations. The number of veterans who were dissatisfied with the U.S. Air Force or the U.S. Government, the AFHS, or previous AFHS examinations is shown in Table 5-7 for each examination. The total is further divided into the number of dissatisfied Ranch Hands, original Comparisons, and replacement Comparisons.

**Table 5-7. Reasons for Refusal Because of Dissatisfaction**

<b>Reason for Dissatisfaction</b>	<b>1982</b>	<b>1985</b>	<b>1987</b>	<b>1992</b>	<b>1997</b>	<b>2002</b>	<b>Total</b>
Dissatisfaction with the U.S. Air Force or the U.S. Government	16	20	26	21	11	26	120
<i>Ranch Hands</i>	5	4	12	9	4	11	45
<i>Original Comparisons</i>	10	13	10	8	7	8	56
<i>Replacement Comparisons</i>	1	3	4	4	0	7	19
Dissatisfaction with the AFHS	0	9	1	0	6	5	21
<i>Ranch Hands</i>	0	5	1	0	3	2	11
<i>Original Comparisons</i>	0	4	0	0	3	2	9
<i>Replacement Comparisons</i>	0	0	0	0	0	1	1
Dissatisfaction with Previous AFHS Examinations	0	2	1	7	11	3	24
<i>Ranch Hands</i>	0	2	0	3	4	2	11
<i>Original Comparisons</i>	0	0	0	3	6	1	10
<i>Replacement Comparisons</i>	0	0	1	1	1	0	3
<b>TOTAL</b>	<b>16</b>	<b>31</b>	<b>28</b>	<b>28</b>	<b>28</b>	<b>34</b>	<b>165</b>
<b>Refusal for All Reasons</b>	<b>595</b>	<b>499</b>	<b>557</b>	<b>597</b>	<b>773</b>	<b>1,030</b>	<b>4,051</b>
<b>Percentage Dissatisfied</b>	<b>2.7%</b>	<b>6.2%</b>	<b>5.0%</b>	<b>4.7%</b>	<b>3.6%</b>	<b>3.3%</b>	<b>4.1%</b>

The 165 responses for dissatisfaction presented above were based on responses from 121 individual veterans. More than 70 percent (120 of the 165 reasons) of the dissatisfaction reasons provided were based on dissatisfaction with the U.S. Air Force or the U.S. Government. Of the 121 veterans, 34 were classified as adamant refusals for the 1992 follow-up examination or later. It is possible that the number of veterans who refused because of dissatisfaction would have been higher if a reason for refusal had been obtained for veterans who were adamant refusals. Prior to the 1992 follow-up examination, 31 of the 34

veterans who were eventually classified as adamant refusals stated dissatisfaction with the U.S. Air Force or the U.S. Government and 3 of the 34 veterans stated dissatisfaction with the AFHS or previous AFHS examinations. The number of veterans who were dissatisfied at the 1992 follow-up examination or later but were classified as adamant refusals, however, is unknown.

## 5.6 REASONS FOR NONCOMPLIANCE AND LESS THAN FULL COMPLIANCE TO ALL AFHS EXAMINATIONS

### 5.6.1 Reasons for Noncompliance for Veterans Who Never Participated in the AFHS

Reasons for noncompliance in at least one AFHS examination are further examined in this section. The reason for noncompliance was taken from the first time that the veteran did not participate in the AFHS. For Ranch Hands and original Comparisons, this was generally the baseline examination in 1982, whereas replacement Comparisons may not have been invited to participate until after the baseline examination.

As seen in Tables 5-1 and 5-2, 744 veterans (148 Ranch Hands, 196 original Comparisons, and 400 replacement Comparisons) were not compliant at any AFHS examination. Of the 148 Ranch Hands, 40 were deceased prior to the 1982 physical examination.

Table 5-8 provides the reasons for noncompliance. An overall total is provided, as are frequencies for Ranch Hands and all Comparisons and for original Comparisons and replacement Comparisons. The percentages reflect the 108 Ranch Hands who were living at the baseline examination in 1982 and eligible to participate at one or more AFHS examinations, but did not.

**Table 5-8. Reasons for Noncompliance for AFHS Veterans Who Did Not Participate in Any of the Six AFHS Examinations**

<b>Reason for Noncompliance</b>	<b>Total</b>	<b>Ranch Hands</b>	<b>All Comparisons</b>	<b>Original Comparisons</b>	<b>Replacement Comparisons</b>
Refusal for Health Reasons	67 (9.5%)	10 (9.3%)	57 (9.6%)	5 (2.6%)	52 (13.0%)
Refusal for Logistical Reasons	477 (67.8%)	80 (74.1%)	397 (66.6%)	165 (84.2%)	232 (58.0%)
<i>Financial Hardship</i>	2	0	2	0	2
<i>No Interest or No Time</i>	285	51	234	111	123
<i>Job Commitment</i>	119	19	100	31	69
<i>Travel Distance, Family Concerns</i>	71	10	61	23	38
Refusal for Other Reasons	59 (8.4%)	15 (13.9%)	44 (7.4%)	21 (10.7%)	23 (5.8%)
<i>Dissatisfaction with the U.S. Air Force or the U.S. Government</i>	18	4	14	9	5
<i>Dissatisfaction with the AFHS</i>	0	0	0	0	0
<i>Dissatisfaction with Previous AFHS Examinations</i>	0	0	0	0	0
<i>Fear of Physical Examination</i>	9	4	5	3	2
<i>Confidentiality Concerns, Adverse Impact on Career</i>	20	6	14	9	5
<i>Other</i>	12	1	11	0	11

**Table 5-8. Reasons for Noncompliance for AFHS Veterans Who Did Not Participate in Any of the Six AFHS Examinations (Continued)**

<b>Reason for Noncompliance</b>	<b>Total</b>	<b>Ranch Hands</b>	<b>All Comparisons</b>	<b>Original Comparisons</b>	<b>Replacement Comparisons</b>
Adamant Refusal	14 (2.0%)	0 (0.0%)	14 (2.3%)	0 (0.0%)	14 (3.5%)
Passive Refusal	43 (6.1%)	2 (1.9%)	40 (6.7%)	3 (1.5%)	37 (9.2%)
Unlocatable	45 (6.4%)	1 (0.9%)	44 (7.4%)	2 (1.0%)	42 (10.5%)
<b>TOTAL</b>	<b>704*</b>	<b>108*</b>	<b>596</b>	<b>196</b>	<b>400</b>

\*These totals do not include the 40 Ranch Hands who were deceased prior to the beginning of the 1982 baseline examination.

Approximately twice as many original Comparisons than Ranch Hands were not compliant to any of the AFHS examinations (196 versus 108). Ranch Hands who did not attend an AFHS examination were more likely to refuse for health reasons than original Comparisons, although the number of refusals for health reasons in these two groups was small (10 for Ranch Hands, 5 for original Comparisons). Original Comparisons were more likely to refuse for logistical reasons than Ranch Hands (84.2% versus 74.1%); the reason predominately was a lack of interest or time. Replacement Comparisons were passive refusals or unlocatable more often than Ranch Hands or original Comparisons.

#### **5.6.2 Reasons for Noncompliance for Veterans Who Participated in the AFHS Only Once**

Reasons for noncompliance in the AFHS also were examined for those veterans who were compliant to only one examination. The reason for noncompliance was taken from the examination directly after the examination in which the veteran did participate. For example, if a veteran was compliant for the 1987 follow-up examination only, the reason for noncompliance was taken from the 1992 follow-up examination. This group of veterans was analyzed to determine if there may have been a reason why a veteran chose to attend only once and never again. Table 5-9 provides the reasons for noncompliance for all veterans, Ranch Hands, all Comparisons, original Comparisons, and replacement Comparisons.

**Table 5-9. Reasons for Noncompliance for AFHS Veterans Who Participated in Only One of the Six AFHS Examinations**

<b>Reason for Noncompliance</b>	<b>Total</b>	<b>Ranch Hands</b>	<b>All Comparisons</b>	<b>Original Comparisons</b>	<b>Replacement Comparisons</b>
Refusal for Health Reasons	13 (5.8%)	4 (7.7%)	9 (5.2%)	5 (8.3%)	4 (3.5%)
Refusal for Logistical Reasons	44 (19.6%)	15 (28.8%)	29 (14.5%)	16 (26.7%)	13 (11.5%)
<i>Financial Hardship</i>	4	3	1	1	0
<i>No Interest or No Time</i>	14	5	9	4	5
<i>Job Commitment</i>	21	6	15	9	6
<i>Travel Distance, Family Concerns</i>	5	1	4	2	2

**Table 5-9. Reasons for Noncompliance for AFHS Veterans Who Participated in Only One of the Six AFHS Examinations (Continued)**

<b>Reason for Noncompliance</b>	<b>Total</b>	<b>Ranch Hands</b>	<b>All Comparisons</b>	<b>Original Comparisons</b>	<b>Replacement Comparisons</b>
Refusal for Other Reasons	21 (9.3%)	8 (15.4%)	13 (7.5%)	10 (16.7%)	3 (2.7%)
<i>Dissatisfaction with the U.S. Air Force or the U.S. Government</i>	6	2	4	4	0
<i>Dissatisfaction with the AFHS</i>	5	4	1	1	0
<i>Dissatisfaction with Previous AFHS Examinations</i>	3	1	2	1	1
<i>Fear of Physical Examination</i>	2	0	2	1	1
<i>Confidentiality Concerns, Adverse Impact on Career</i>	0	0	0	0	0
<i>Other</i>	5	1	4	3	1
Adamant Refusal	1 (0.4%)	0 (0.0%)	1 (0.6%)	0 (0.0%)	1 (0.9%)
Passive Refusal	4 (1.7%)	1 (1.9%)	3 (4.0%)	1 (1.7%)	2 (1.8%)
Unlocatable	30 (13.3%)	10 (19.2%)	20 (11.6%)	15 (25.0%)	5 (4.4%)
Deceased	36 (16.0%)	10 (19.2%)	26 (15.0%)	12 (20.0%)	14 (12.4%)
First Attended 2002 Examination	76 (33.8%)	4 (7.7%)	72 (41.6%)	1 (1.7%)	71 (62.8%)
<b>TOTAL</b>	<b>225</b>	<b>52</b>	<b>173</b>	<b>60</b>	<b>113</b>

Approximately one-half of these veterans (112 out of 225 veterans) did not have an opportunity to participate in a second AFHS examination. At the time of the examination following their first participation, 36 veterans were deceased. The 2002 follow-up examination was the first participation in the AFHS for 76 veterans, predominately replacement Comparisons. The frequencies in Table 5-9 are presented again in Table 5-10, with the deceased veterans and veterans who attended their first AFHS examination in 2002 omitted. The percentages have been adjusted accordingly.

**Table 5-10. Reasons for Noncompliance for AFHS Veterans Who Participated in Only One of the Six AFHS Examinations and Were Eligible To Attend a Second Examination**

<b>Reason for Noncompliance</b>	<b>Total</b>	<b>Ranch Hands</b>	<b>All Comparisons</b>	<b>Original Comparisons</b>	<b>Replacement Comparisons</b>
Refusal for Health Reasons	13 (11.5%)	4 (10.5%)	9 (12.0%)	5 (10.6%)	4 (14.3%)
Refusal for Logistical Reasons	44 (38.9%)	15 (39.5%)	29 (38.7%)	16 (34.0%)	13 (46.4%)
<i>Financial Hardship</i>	4	3	1	1	0
<i>No Interest or No Time</i>	14	5	9	4	5
<i>Job Commitment</i>	21	6	15	9	6
<i>Travel Distance, Family Concerns</i>	5	1	4	2	2



**Table 5-10. Reasons for Noncompliance for AFHS Veterans Who Participated in Only One of the Six AFHS Examinations and Were Eligible To Attend a Second Examination (Continued)**

<b>Reason for Noncompliance</b>	<b>Total</b>	<b>Ranch Hands</b>	<b>All Comparisons</b>	<b>Original Comparisons</b>	<b>Replacement Comparisons</b>
Refusal for Other Reasons	21 (18.6%)	8 (21.1%)	13 (17.3%)	10 (21.3%)	3 (10.7%)
<i>Dissatisfaction with the U.S. Air Force or the U.S. Government</i>	6	2	4	4	0
<i>Dissatisfaction with the AFHS</i>	5	4	1	1	0
<i>Dissatisfaction with Previous AFHS Examinations</i>	3	1	2	1	1
<i>Fear of Physical Examination</i>	2	0	2	1	1
<i>Confidentiality Concerns, Adverse Impact on Career</i>	0	0	0	0	0
<i>Other</i>	5	1	4	3	1
Adamant Refusal	1 (0.9%)	0 (0.0%)	1 (1.3%)	0 (0.0%)	1 (3.6%)
Passive Refusal	4 (3.5%)	1 (2.6%)	3 (4.0%)	1 (2.1%)	2 (7.1%)
Unlocatable	30 (26.5%)	10 (26.3%)	20 (26.7%)	15 (31.9%)	5 (17.9%)
<b>TOTAL</b>	<b>113</b>	<b>38</b>	<b>75</b>	<b>47</b>	<b>28</b>

Ranch Hands and original Comparisons were generally similar in their reasons for noncompliance after participating in the AFHS once. Slightly more Ranch Hands than original Comparisons were refusals for logistical reasons, and slightly more original Comparisons than Ranch Hands were unlocatable.

### 5.6.3 Comparison of Reasons for Noncompliance for Veterans with Varying Degrees of Compliance to the AFHS

The possibility that veterans who did not participate in any AFHS examinations may have been noncompliant for different reasons than veterans who participated in only one of the AFHS examinations can be explored by comparing the tables presented in Section 5.6.1 and 5.6.2 (Table 5-8 and Table 5-10). A summary of the reasons for noncompliance for veterans who participated in no examinations or only one examination is presented in Table 5-11. In addition, a summary of the reasons for noncompliance for veterans who participated in five of the six AFHS examinations also is provided in Table 5-11. The purpose of this analysis is to determine if there are any differences in reasons for refusal between veterans who attended nearly all of the AFHS examinations and veterans who did not participate or participated only once.

**Table 5-11. Comparison of Reasons for Noncompliance among Veterans Who Participated in Zero, One, and Five of the Six AFHS Examinations**

<b>Reason for Noncompliance</b>	<b>Participated in No AFHS Examinations</b>	<b>Participated in One AFHS Examination</b>	<b>Participated in Five of Six AFHS Examinations</b>
Refusal for Health Reasons	67 (9.5%)	13 (11.5%)	78 (25.7%)
Refusal for Logistical Reasons	477 (67.8%)	44 (38.9%)	159 (52.5%)
<i>Financial Hardship</i>	2	4	4
<i>No Interest or No Time</i>	285	14	57
<i>Job Commitment</i>	119	21	60
<i>Travel Distance, Family Concerns</i>	71	5	38

**Table 5-11. Comparison of Reasons for Noncompliance among Veterans Who Participated in Zero, One, and Five of the Six AFHS Examinations (Continued)**

<b>Reason for Noncompliance</b>	<b>Participated in No AFHS Examinations</b>	<b>Participated in One AFHS Examination</b>	<b>Participated in Five of Six AFHS Examinations</b>
Refusal for Other Reasons	59 (8.4%)	21 (18.6%)	36 (11.9%)
<i>Dissatisfaction with the U.S. Air Force or the U.S. Government</i>	18	6	7
<i>Dissatisfaction with the AFHS</i>	0	5	3
<i>Dissatisfaction with Previous AFHS Examinations</i>	0	3	2
<i>Fear of Physical Examination</i>	9	2	3
<i>Confidentiality Concerns, Adverse Impact on Career</i>	20	0	6
<i>Other</i>	12	5	15
Adamant Refusal	14 (2.0%)	1 (0.9%)	0 (0.0%)
Passive Refusal	43 (6.1%)	4 (3.5%)	14 (4.6%)
Unlocatable	45 (6.4%)	30 (26.5%)	16 (5.3%)
<b>TOTAL</b>	<b>704</b>	<b>113</b>	<b>303</b>

A total of 704 veterans participated in no AFHS examinations, and 113 veterans participated in only one examination. Veterans who participated in only one examination were more likely to be unlocatable or to refuse for other reasons at the next examination than veterans who did not attend an AFHS examination. Veterans who did not attend an AFHS examination were more likely to refuse for logistical reasons than veterans who participated in only one examination.

The reasons for noncompliance may change based on the number of AFHS examinations in which a veteran participated. To examine any patterns based on the number of AFHS examinations in which a veteran participated, veterans who were eligible to participate in all six AFHS examinations and participated in five of these examinations were studied. A total of 405 veterans were fully compliant for five of the six AFHS examinations. Of these 405 veterans, however, 73 veterans had attended the first five examinations, but were deceased at the time of the 2002 follow-up examination. An additional 29 veterans were not invited until the second examination in 1985. Therefore, 303 veterans who had the opportunity were fully compliant to five of the six examinations. The reasons for refusal for the veterans who were fully compliant to five of the six examinations were provided in Table 5-11. Table 5-11 also shows that 25.7 percent (78 of 303 veterans) refused for health reasons, and this number was greater than the percentage of veterans who refused for health reasons and participated in either zero or one examination. A possible explanation of this difference is illustrated in Table 5-12, where the examination at which the veteran declined to participate is given.

**Table 5-12. Reasons for Refusal and AFHS Examination at which a Veteran Was Noncompliant for Those Veterans Who Were Fully Compliant for Five Examinations**

Reason for Noncompliance	Veteran Was Noncompliant in						Total
	1982	1985	1987	1992	1997	2002	
Refusal for Health Reasons	1	1	1	2	3	70	78
Refusal for Logistical Reasons	70	2	12	14	18	43	159
<i>Financial Hardship</i>	0	0	0	0	0	4	4
<i>No Interest or No Time</i>	42	1	2	0	2	10	57
<i>Job Commitment</i>	24	1	8	10	6	11	60
<i>Travel Distance, Family Concerns</i>	4	0	2	4	10	18	38
Refusal for Other Reasons	8	1	4	1	7	15	36
<i>Dissatisfaction with the U.S. Air Force or the U.S. Government</i>	1	0	1	0	0	5	7
<i>Dissatisfaction with the AFHS</i>	0	1	0	0	1	1	3
<i>Dissatisfaction with Previous AFHS Examinations</i>	0	0	0	0	1	1	2
<i>Fear of Physical Examination</i>	1	0	2	0	0	0	3
<i>Confidentiality Concerns, Adverse Impact on Career</i>	5	0	0	1	0	0	6
<i>Other</i>	1	0	1	0	5	8	15
Adamant Refusal	0	0	0	0	0	0	0
Passive Refusal	0	0	2	3	1	8	14
Unlocatable	2	8	3	1	0	2	16
<b>TOTAL</b>	<b>81</b>	<b>12</b>	<b>22</b>	<b>21</b>	<b>29</b>	<b>138</b>	<b>303</b>

Approximately 45 percent (138 of 303) of the veterans who missed one examination did so in 2002. Of the 78 veterans who refused for health reasons, 70 did not attend the 2002 follow-up examination. It would be expected that the majority of veterans who refused for health reasons would have been in the later phases of the AFHS examinations because of their increasing age.

## 5.7 CONCLUSION

As discussed in this chapter and in Chapter 3, Ranch Hands were more likely to be compliant than Comparisons, and original Comparisons were more likely to be compliant than replacement Comparisons.

Compliance or noncompliance at the previous examination correctly predicted compliance or noncompliance at a particular examination between 88 percent (for the 2002 examination) and 93 percent (for the 1987 examination) of the time.

After the 1987 examination, the number of veterans who were fully compliant for an AFHS examination but were noncompliant for the next AFHS examination increased. As would be expected in an aging population, an increased rate of refusal for health reasons and an increased rate of deceased veterans were seen as the AFHS continued. A large number of veterans who were fully compliant in 1982 were unlocatable in 1985, but the rate of veterans who were unlocatable for an examination after participating in the previous examination decreased as the AFHS continued.

Three reasons for refusal concerned dissatisfaction: dissatisfaction with the U.S. Air Force or the U.S. Government, dissatisfaction with the AFHS, or dissatisfaction with previous AFHS examinations. More

than 70 percent of the dissatisfaction reasons provided across all examinations (120 of the 165 reasons) were based on dissatisfaction with the U.S. Air Force or the U.S. Government. The percentage of participants who refused for reasons of dissatisfaction ranged from 2.7 percent of all refusals for the 1982 baseline examination to 6.2 percent of all refusals for the 1985 follow-up examination.

A total of 704 veterans participated in no AFHS examinations, and 113 veterans participated in only one examination. Veterans who participated in only one examination were more likely to be unlocatable at the next examination than veterans who did not attend an AFHS examination. Veterans who did not attend an AFHS examination were more likely to refuse for logistical reasons than veterans who participated in only one examination. For veterans who did not attend an AFHS examination, replacement Comparisons were passive refusals or unlocatable more often than Ranch Hands or original Comparisons. These reasons were not unexpected, as the replacement Comparisons were often not as committed to the AFHS than Ranch Hands and original Comparisons and were contacted only if an original Comparison was not compliant.

To examine any patterns based on the number of AFHS examinations in which a veteran participated, veterans who were eligible to participate in all six AFHS examinations and participated in five of these examinations were studied. The greatest increase in the percentage of veterans who were noncompliant between veterans who participated in five of six examinations and those who participated in either zero or one examination was a refusal for health reasons. Most of the veterans who participated in five of six examinations and refused for health reasons did so for the 2002 follow-up examination. It would be expected that the majority of veterans who refused for health reasons would have been in the later phases of the AFHS examinations because of their increasing ages.

## 6 CONCLUSIONS

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The purpose of the Air Force Health Study (AFHS) was to determine whether adverse health effects relative to a similar but unexposed group of Air Force veterans existed and could be attributed to occupational exposure to Agent Orange. A baseline examination and five follow-up examinations over 20 years provided a comprehensive approach to the detection of adverse health effects.

A multitude of factors may have influenced participation in the AFHS. These may be classified broadly as health, logistical, demographic, operational, or publicity factors.

The effects of group, race, military occupation, year of birth, dioxin level, and military commitment on AFHS compliance were generally consistent in all six examinations. Ranch Hands had a significantly higher compliance rate than original Comparisons. Original comparisons had a significantly higher compliance rate than replacement Comparisons. No association existed between compliance and race or between compliance and dioxin. The compliance rate was higher for enlisted flyers than enlisted groundcrew. The compliance rate for officers was similar to enlisted groundcrew at the beginning of the AFHS, but was closer to enlisted flyers by the end of the AFHS. Older veterans had a higher compliance rate than younger veterans. Veterans who made the military their careers had a significantly higher compliance rate than veterans who did not make the military their careers, but this was explainable by age. Older AFHS veterans were more likely to make the military their careers, whereas younger AFHS veterans were more likely to have careers outside of the military.

The compliance rates were relatively similar for the 1982, 1985, 1987, and 1992 examinations. A larger decrease in the compliance rate was observed for the 1997 and 2002 follow-up examinations. The number of veterans who refused for health reasons and who refused for logistical reasons increased for the 1997 and 2002 follow-up examinations. The percentage of veterans who refused for health reasons and other reasons, as well as the percentage of passive refusals and unlocatable veterans, were similar between Ranch Hands and original Comparisons. A greater percentage of original Comparisons were adamant refusals than Ranch Hands, but the difference between the percentages was similar across the 1992, 1997, and 2002 follow-up examinations. The percentage of veterans who refused for logistical reasons was increased in original Comparisons for all examinations, with a large difference between Ranch Hands and original Comparisons for the 1982 baseline examination.

In the 1987 and later follow-up examinations, age was associated with refusal for health reasons. As expected, older veterans refused more often for health reasons than did younger veterans. Veterans who made the military their career refused more often for health reasons than veterans who did not make the military their career, but this association was explained by age. The age-adjusted refusal rate for health reasons was greater for enlisted groundcrew, the youngest occupation on average, than for enlisted flyers and officers.

Original Comparisons refused more often than Ranch Hands for logistical reasons. Enlisted groundcrew were more likely to refuse for logistical reasons than enlisted flyers and officers in all examinations. Refusal for logistical reasons was more prevalent in younger veterans. Veterans who did not make the military their career refused more often for logistical reasons than veterans who made the military their career at all examinations, which was explained by age.

Associations between refusal for logistical reasons and military occupation, age, and military commitment were generally based on associations found within the original Comparison group. Tests of associations

on original Comparisons generally parallel the tests of association in the combined Ranch Hand and original Comparisons groups. Significant tests of associations on only Ranch Hands are generally weaker and more sporadic.

Compliance or noncompliance at the previous examination correctly predicted compliance or noncompliance at a particular examination between 88 percent (for the 2002 examination) and 93 percent (for the 1987 examination) of the time.

After the 1987 examination, the total number of veterans who were fully compliant for an AFHS examination but were noncompliant for the next AFHS examination increased. As would be expected in an aging population, an increased rate of refusal for health reasons and an increased rate of deceased veterans were seen as the AFHS continued. A large number of veterans who were fully compliant in 1982 were unlocatable in 1985, but the rate of veterans who were unlocatable for an examination after participating in the previous examination decreased as the AFHS continued.

Three reasons for refusal concerned dissatisfaction: dissatisfaction with the U.S. Air Force or the U.S. Government, dissatisfaction with the AFHS, or dissatisfaction with previous AFHS examinations. More than 70 percent of the dissatisfaction reasons provided across all examinations (120 of the 165 reasons) were based on dissatisfaction with the U.S. Air Force or the U.S. Government. The percentage of participants who refused for reasons of dissatisfaction ranged from 2.7 percent of all refusals for the 1982 baseline examination to 6.2 percent of all refusals for the 1985 follow-up examination.

A replacement strategy was devised to maintain participation of the Comparisons. Noncompliant Comparisons were to be replaced by Comparisons with the same values of the matching variables (age, race, and military occupation in Southeast Asia) and the same health perception. In this way, the replacement Comparisons would serve as surrogates for Comparisons who did not participate.

The loss of power because of declining participation as the AFHS progressed was expected and does not appear to have compromised the validity of the AFHS. The loss of power because of declining participation, however, generally was smaller than the loss of power that would have occurred if a replacement strategy had not been used. The replacement strategy succeeded in its attempts to prevent a large decrease in the number of Comparisons that participated in the AFHS.

## 7 GLOSSARY OF TERMS

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**Adamant refusal:** A veteran who communicated a desire not to have any contact with or from the Air Force Health Study under any circumstances was classified as an adamant refusal. A veteran who was extremely adamant in his refusal to initial scheduling contacts also was coded as an adamant refusal. Veterans were first classified as adamant refusals for the 1992 examination. Unless the veteran contacted the Air Force Health Study management team and expressed a desire to participate in a subsequent Air Force Health Study examination, attempts were not made to contact the veteran for future examinations.

**Compliant:** Veterans who were eligible to participate in an Air Force Health Study examination and completed the physical examination were considered compliant for that examination.

Two alternative definitions of compliance were examined that combined the history of participation across all six examinations. First, a veteran was defined as compliant if he attended at least one of the six Air Force Health Study examinations. A veteran was defined as compliant using a second definition of compliance if he attended all six Air Force Health Study examinations.

**Logistical reasons for refusal:** Refusal for logistical reasons for veterans who did not participate in an Air Force Health Study examination include reasons classified as financial hardship, no interest or no time, job commitment, travel distance, and family concerns.

**Noncompliant:** Veterans who were eligible to participate in an Air Force Health Study examination and did not complete the physical examination were considered noncompliant for that examination. If a veteran completed the questionnaire portion only of the examination, he was considered to be partially compliant (see definition below).

Two alternative definitions of noncompliance were examined that combined the history of participation across all six examinations. First, a veteran was defined as noncompliant if he refused or was unlocatable at all examinations for which he was eligible to participate. Second, a veteran was defined as noncompliant if he was eligible to participate in all six examinations and refused or was unlocatable in at least one examination.

**Original Comparison:** Comparisons were a group of veterans occupationally unexposed to herbicides who maintained or flew C-130 aircraft in Southeast Asia during the same time period that the Ranch Hand unit was active. A computerized selection procedure was used to identify Comparisons with similar characteristics to each Ranch Hand veteran for the Air Force Health Study. The first Comparison in each randomized matched set was identified as the original Comparison for his respective Ranch Hand. Original Comparisons found to be deceased during the baseline examination were replaced by the next live replacement in the randomized matched set. This replacement then became the original Comparison.

**Other reasons for refusal:** Refusal for other reasons for veterans who did not participate in an Air Force Health Study examination include dissatisfaction with the U.S. Air Force or the U.S. Government, dissatisfaction with the Air Force Health Study, dissatisfaction with previous Air Force Health Study examinations, fear of physical examination, confidentiality concerns, adverse career impacts, and other reasons that were not health-related or logistical and did not fit into one of these categories.

**Partially compliant:** Veterans who participated only by completing the in-home baseline questionnaire interview given at the 1982, 1985, and 1987 examinations were considered partially compliant.

**Passive refusal:** A veteran could be classified as a passive refusal in a variety of ways. For the 2002 follow-up examination, if a veteran was scheduled for a physical examination but twice canceled the appointment or failed to appear for the appointment and did not attempt to reschedule, he was classified as a passive refusal. If the scheduler did not get an answer on the telephone after eight attempts, a certified letter was sent to that individual. If there was direct evidence that the individual appeared at the post office to claim the letter, but did not contact the scheduling office, he was considered a passive refusal. Some veterans were particularly difficult to reach because of the presence of a “gatekeeper” who did not allow the schedulers to speak directly to the potential participant. A veteran was designated as a final passive refusal for the 1997 and 2002 follow-up examinations after a minimum of three contacts with a gatekeeper and failure to reach the veteran by other means. These contact methods included varying calling times, leaving messages, or sending a certified letter. Eight gatekeeper contacts were allowed in the 1992 follow-up examinations before a veteran was declared a refusal. Up to eight gatekeeper contacts were allowed for the 1997 and 2002 follow-up examinations if the scheduling supervisor decided additional attempts were still warranted. After these gatekeeper contacts had been exhausted, the individuals were designated as final passive refusals.

For the 2002 follow-up examination, the Air Force introduced a procedure to facilitate the scheduling process for those veterans who refused to participate in the 1997 follow-up examinations. All refusals from the 1997 follow-up examination were contacted by telephone or sent a letter by the Air Force 6 months prior to the beginning of the scheduling process in March 2002. Each refusal was asked by telephone or letter if he wished to participate in the 2002 follow-up examination. Individuals contacted by telephone who declined the invitation to participate in the 2002 physical examination were asked to provide a reason for their nonparticipation. Individuals contacted by letter were asked to return a card that was enclosed with the letter stating their wishes. If a veteran declined the invitation, he was asked to provide a reason for his nonparticipation. In either case, individuals were given the toll-free number and invited to contact the Air Force Health Study if they changed their mind. Individuals who did not return the card were sent a second letter. If there was no response to the second letter the individual was classified as a passive refusal.

**Power:** In statistics, a type I error is making a false conclusion that an association exists when there is no association. The other possible inference error, a type II error, is the failure to detect an association when one actually exists. The power of a statistical test is 1 minus the probability of a type II error. The power of the test is the probability that the test will reject the hypothesis of no group or dioxin effect when an effect does in fact exist.

**Replacement Comparison:** A replacement strategy was devised to maintain participation of the Comparisons. As specified in the Air Force Health Study design, noncompliant original Comparisons were to be replaced by Comparisons with the same values of the matching variables (age, race, and military occupation in Southeast Asia) and the same health perception. In this way, these replacement Comparisons would serve as surrogates for Comparisons who did not participate. If the original Comparison was noncompliant, a replacement Comparison was invited in his place. The replacement Comparisons were selected from a set of up to nine candidate Comparisons. As specified in the Air Force Health Study protocol, no replacement was made if a formerly invited Comparison in a matched set was found to be deceased. A replacement Comparison was invited to participate in an examination if he had participated or had been invited to participate in any previous examination.

**Shifted Comparison:** At the scheduling operation for the baseline examination, an event occurred that led to the identification of a shifted Comparison. Because of errors in the database regarding their unit of assignment in Southeast Asia, 212 original Comparisons were discovered to be ineligible for participation in the study. These men had not served in Southeast Asia but, because of a duplication of codes, were



mistakenly included in the Comparison population. They were deleted from the Air Force Health Study. This resulted in another Comparison in each previously randomized match set being asked to participate in the study. These new original Comparisons were called Comparisons to describe the effective movement of these Comparisons in each matched set to fill the space left by the removed ineligible original Comparison. Shifted Comparisons are more accurately referred to as shifted original Comparisons to emphasize that they are not replacement Comparisons and that they are the legitimate original Comparisons for their respective Ranch Hands. Shifted original Comparisons are not replacement Comparisons because their invitation to participate in the study was not the result of a previous refusal of another Comparison in their respective matched sets. Shifted original Comparisons were identified to reflect concern that the process by which Comparisons were determined ineligible may not have distributed ineligible Comparisons uniformly.

**APPENDIX: AIR FORCE HEALTH STUDY 2002 FOLLOW-UP EXAMINATION SCHEDULING AND  
COMPARISON REPLACEMENT ALGORITHM**

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AIR FORCE HEALTH STUDY 2002  
 FOLLOW-UP EXAMINATION  
 SCHEDULING & REPLACEMENT  
 ALGORITHM  
 31 MAY 2001

