Air Force Health Study

An Epidemiologic Investigation of Health Effects in Air Force Personnel Following Exposure to Herbicides

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STUDY SELECTION AND PARTICIPATION

INTRODUCTION

During the design phase of the Air Force Health Study (AFHS), the authors of the Protocol anticipated that loss to followup would pose the greatest threat to study validity. In particular, they expected differential compliance with relatively more Ranch Hands self-selecting into the study than Comparisons and with health differences of unknown character between refusing Ranch Hands and refusing Comparisons. As a partial correction, the study design specified that refusing Comparisons would be replaced by Comparisons with the same values of the matching variables and the same health perception. In this way, the replacement Comparisons would serve as surrogates for those Comparisons who refused to participate. This would tend to reduce bias due to refusal in the Comparison group and would have the added advantage of maintaining group size. No corresponding strategy for the Ranch Hands was possible since all Ranch Hands had been identified and invited to participate.

The first Comparison in each randomized matched set asked to participate in the Baseline questionnaire and physical examination was identified as the Original Comparison for his respective Ranch Hand (in accordance with the Protocol). If the Original Comparison was noncompliant (i.e., he refused to participate, was partially compliant, or unlocatable), he was replaced by a "replacement" Comparison. Replacement Comparisons were identified in the data base to satisfy the Protocol requirement that they be contrasted with the refusing Original Comparisons (also called refusals). In the case of an unlocatable Original Comparison, this contrast is, of course, not possible. Deceased Original Comparisons were not replaced.

The statistical contrast of replacements and refusals was to be based on responses to a telephone questionnaire administered to refusals and to their potential replacements. This questionnaire assessed self-perception of health, days lost from work due to illness, and medication use, and was to serve as the basis for the health matching required by the Protocol. Although the Protocol was not explicit on this point, it implied that the decision to include or exclude the replacements from the study would be based only on this contrast. A telephone questionnaire was administered to refusals at Baseline and 1985 followup examinations. At the 1987 followup examination, refusals were simply asked during the scheduling process for their self-perception of health. Health-matching replacements was not implemented at Baseline but was implemented at the 1985 and 1987 followup examinations. Replacement Comparisons were matched to noncompliant (refusal, partially compliant, or unlocatable) Original Comparisons with respect to age, race, rank, and occupation at all examinations.

In this chapter, the cumulative study compliance is summarized and refusing Ranch Hands and Comparisons at the 1987 followup examination are contrasted with respect to reason for refusal and reported health status. All Ranch Hands and Comparisons were contrasted on reported health with adjustment for compliance (fully compliant, refusal).

Scheduling patterns were compared by plotting cumulative compliance versus calendar time for Ranch Hands, Original Comparisons, and replacement Comparisons.

Adherence to the replacement algorithm for noncompliant Original Comparisons was investigated at the 1987 followup. Replacement Comparisons were contrasted with the Original Comparisons they replaced on reported health status. Ranch Hands and Comparisons at least partially compliant in the 1987 followup were descriptively contrasted on reported health, medication, and work loss, with adjustment for compliance status (full, partial); these data were too sparse for formal statistical analysis. Finally, Ranch Hands and Comparisons who passively refused the 1987 followup examination were contrasted with respect to reported health status.

FACTORS KNOWN OR SUSPECTED TO INFLUENCE STUDY PARTICIPATION

A multitude of factors influence self-selection. These may be broadly classified as health, logistic, operational, publicity, or demographic factors. For example, health factors are thought to include self-perception of health as well as demonstrable health indicators, such as medication use and work days lost due to illness or injury. Logistic factors include distance to the examination site, reluctance to spend time away from family or job, income, and occupation. Demographic factors include flying status, age, race, or military duty status (active, retired, separated). Operational factors include any aspect of study operation that may cause differential compliance, such as differential treatment of participants during scheduling, physical examination, interview, or debriefing procedures. Publicity factors are related to national attitudes and media presentations regarding the Agent Orange issue, the Vietnam war, veteran health care, or health care in general. Additionally, these considerations may affect people differently and, in particular, may influence Ranch Hands differently than Comparisons.

The decision to volunteer for this study or any study is admittedly 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. Instead, compliance bias was investigated at the 1987 followup as in the 1985 followup and Baseline reports, with respect to self-perception of health, medication use, and days lost from work due to illness or injury.

1987 FOLLOWUP SCHEDULING AND REPLACEMENT OPERATION

Matching replacements to noncompliant Original Comparisons on the basis of reported health status, as well as the four matching variables (age, race, rank, and occupation), was continued at the 1987 followup scheduling operation. The telephone survey data base collected at the 1985 followup was utilized to obtain self-perception of health of refusals and all potential replacement candidates who had not been contacted previously. If the replacement or refusal was not represented in the telephone survey data, he was asked at scheduling for his health status. Examination group integrity was encouraged at the 1987 followup as during the 1985 followup (the 81 groups were scheduled randomly for an examination). However, study participants were given the option to remain with their group or to reschedule their examination at a more convenient time.

1987 FOLLOWUP COMPLIANCE

Eighty-four percent (995/1,188) of the eligible Ranch Hands and 77 percent (939/1,224) of the eligible Original Comparisons participated in the 1987 followup examination and questionnaire process. Of 494 replacement Comparisons invited for the 1987 followup, 360 (73%) chose to attend the examination. These and other counts are summarized in Tables A-1 through A-4. Table A-1 provides counts for the Ranch Hands. Total Comparison group counts are shown in Table A-2. Original Comparison counts are summarized in Table A-3 and replacement Comparison counts are provided in Table A-4. Undefined categories are indicated by dashes. For example, a partially compliant participant at Baseline (completed the Baseline questionnaire) could not be partially compliant at a later examination, since partial compliance only occurred when a participant agreed to the Baseline questionnaire but refused to attend the physical examination. Ninety-two percent of living Ranch Hands and 93 percent of living Comparisons who were fully compliant at the Baseline examination returned for the 1987 followup examination.

Fourteen Ranch Hands, 17 Original Comparisons, and 42 replacement Comparisons were examined for the first time at the 1987 followup examination. Table A-5 describes these newly examined participants in terms of their compliance at the Baseline and 1985 followup studies. Nine of the 14 newly examined Ranch Hands were partially compliant at a previous study, and 2 refused both previous examinations. Three Ranch Hands were new to the study between the 1985 and 1987 followup.

Eleven Original Comparisons were partially compliant at a previous study, and two were new to the study between the 1985 and 1987 followups. Four Originals were refusals at previous studies. Eight (4+2+2) replacement Comparisons were partially compliant at Baseline or the 1985 followup, and 12 (9+3) previously had refused (Table A-5). Twenty-eight replacements were new to the study between the two followups (Table A-4). Twenty-two of these 28 replacements were newly examined at the 1987 followup (Table A-5). Six of these 28 were partially compliant at the 1987 followup.

REFUSING RANCH HANDS VERSUS REFUSING COMPARISONS

Of the 1,188 Ranch Hands and 1,731 Comparisons eligible for the 1987 followup examination, 171 Ranch Hands and 360 Comparisons chose not to attend. Their reasons for refusal are summarized in Table A-6.

A test of association between reason for refusal and group adjusted for age and rank was performed; the results are summarized in Table A-7. Due to sparse data, reason for refusal was collapsed to three categories: logistic (job commitment, no time or interest, travel distance—family, confidentiality, financial hardship); passive (passive refusal); and other (fear of physical, dissatisfaction with the U.S. Air Force [USAF], health reasons, dissatisfaction with Baseline, other). The covariates age and rank were dichotomized for the analysis (born before 1942 and born in or after 1942; officer and enlisted, respectively). Twenty-eight Blacks (8 Ranch Hands and 20 Comparisons) were deleted from this analysis due to small cell counts.

The association between reason for refusal and group adjusted for age and rank was not significant ($p=0.238$). The adjusted association between reason for refusal and age was of

TABLE A-1.

Baseline Compliance and Followup Disposition of Ranch Hands at the Baseline, 1985, and 1987 Examinations

		Baseline Compliance					
Time Period	Disposition	FC	PC	R	UNL	NS	Total
Baseline		1,045	129	32	2	0	1,208
Between Baseline and 1985 Followup	New to Study	- -	- -	- -	- -	9	9
	Died	10	9	0	0	0	19
1985 Followup	Eligible for 1985 Followup	1,035	120	32	2	9	1,198
	Contact Not Attempted	0	0	0	0	0	0
	Contact Attempted	1,035	120	32	2	9	1,198
	Subject Unlocatable	28	12	0	0	0	40
	Subject Refused	36	69	29	1	0	135
	Subject Partial Compliant	- -	- -	3	0	4	7
	Subject Fully Compliant	971	39	0	1	5	1,016
Between 1985 and 1987 Followup	New to Study	- -	- -	- -	- -	4	4
	Died	11	3	0	0	0	14
1987 Followup	Eligible for 1987 Followup	1,024	117	32	2	13	1,188
	Contact Not Attempted	0	0	0	0	0	0
	Contact Attempted	1,024	117	32	2	13	1,188
	Subject Unlocatable	9	10	2	0	0	21
	Subject Refused	71	70	26	1	3	171
	Subject Partial Compliant	- -	- -	1	0	0	1
	Subject Fully Compliant	944	37	3	1	10	995

FC = Fully Compliant at Baseline
PC = Partially Compliant at Baseline
R = Refusal at Baseline
UNL = Unlocatable at Baseline
NS = New to Study Since Baseline

TABLE A-2.

Baseline Compliance and Followup Disposition of Comparisons at the Baseline, 1985, and 1987 Examinations

Time Period	Disposition	Baseline Compliance FC	PC	R	UNL	NS	Total
Baseline		1,224	07	128	9	0	1,668*
Between Baseline and 1985 Followup	New to Study	--	- -	--	--	3	73**
	Died	16	9	1	0	0	26
1985 Followup	Eligible for 1985 Followup	1,208	298	127	9	73	1,715
	Contact Not Attempted	0	0	0	0	0	0
	Contact Attempted	1,208	298	127	9	73	1,715
	Subject Unlocatable	39	27	0	0	1	67
	Subject Refused	30	175	87	5	0	327
	Subject Partial Compliant	- -	- -	22	0	6	28
	Subject Fully Compliant	1,139	96	18	4	36	1,293
Between 1985 and 1987 Followup	New to Study	- -	- -	--	--	32	32
	Died	14	1	1	0	0	16
1987 Followup	Eligible for 1987 Followup	1,194	297	26	9	105	1,731
	Contact Not Attempted	0	0	0	0	2	2
	Contact Attempted	1,194	297	26	9	103	1,729
	Subject Unlocatable	8	21	8	3	3	43
	Subject Refused	73	180	87	3	17	360
	Subject Partial Compliant	--	--	13	0	14	27
	Subject Fully Compliant	1,113	96	18	3	69	1,299

*The Baseline Report total count of 1,669 listed in the Baseline Report should be 1,668 due to the inclusion of 1 ineligible Comparison.

**Twenty-one of these 73 were actually identified as eligible for the study during Baseline but the contract ended before they could be located by the contractor.

FC = Fully Compliant at Baseline
PC = Partially Compliant at Baseline
R = Refusal at Baseline
UNL = Unlocatable at Baseline
NS = New to Study Since Baseline

TABLE A-3.

Baseline Compliance and Followup Disposition of Original Comparisons at the Baseline, 1985, and 1987 Examinations

Time Period	Disposition	Baseline Compliance					
		FC	PC	R	UNL	NS	Total
Baseline		936	220	78	3	--	1,237
Between Baseline and 1985 Followup	New to Study	--	--	--	--	17	17
	Died	11	9	1	0	0	21
1985 Followup	Eligible for 1985 Followup	925	211	77	3	17	1,233
	Contact Not Attempted	0	0	0	0	0	0
	Contact Attempted	925	211	77	3	17	1,233
	Subject Unlocatable	29	20	0	0	1	50
	Subject Refused	24	129	61	2	4	220
	Subject Partial Compliant	--	--	7	0	1	8
	Subject Fully Compliant	872	62	9	1	11	955
Between 1985 and 1987 Followup	New to Study	--	--	--	--	4	4
	Died	12	1	0	0	0	13
1987 Followup	Eligible for 1987 Followup	913	210	77	3	21	1,224
	Contact Not Attempted	0	0	0	0	0	0
	Contact Attempted	913	210	77	3	21	1,224
	Subject Unlocatable	7	14	8	2	1	32
	Subject Refused	51	132	52	1	6	242
	Subject Partial Compliant	--	--	11	0	0	11
	Subject Fully Compliant	855	64	6	0	14	939

FC = Fully Compliant at Baseline
PC = Partially Compliant at Baseline
R = Refusal at Baseline
UNL = Unlocatable at Baseline
NS = New to Study Since Baseline

TABLE A-4.

Baseline Compliance and Followup Disposition of Replacement Comparisons at the Baseline, 1985, and 1987 Examination

Time Period	Disposition	Baseline Compliance FC	PC	R	UNL	NS	Total
Baseline		288	87	50	6	- -	431
Between Baseline and 1985 Followup	New to Study	- -	--	- -	- -	56	56
	Died	5	0	0	0	0	5
1985 Followup	Eligible for 1985 Followup	283	87	50	6	56	482
	Contact Not Attempted	0	0	0	0	0	0
	Contact Attempted	283	87	50	6	56	482
	Subject Unlocatable	10	7	0	0	0	17
	Subject Refused	6	46	26	3	26	107
	Subject Partial Compliant	- -	- -	15	0	5	20
	Subject Fully Compliant	267	34	9	3	25	338
Between 1985 and 1987 Followup	New to Study	- -	- -	- -	- -	28	28
	Died	2	0	1	0	0	3
1987 Followup	Eligible for 1987 Followup	281	87	49	6	84	507
	Contact Not Attempted	0	0	0	0	2	2*
	Contact Attempted	281	87	49	6	82	505
	Subject Unlocatable	1	7	0	1	2	11
	Subject Refused	22	48	35	2	11	118
	Subject Partial Compliant	--	- -	2	0	14	16
	Subject Fully Compliant	258	32	12	3	55	360

*Records indicate that the contractor failed to recognize these two individuals and consequently did not attempt to schedule them.

FC = Fully Compliant at Baseline
PC = Partially Compliant at Baseline
R = Refusal at Baseline
UNL = Unlocatable at Baseline
NS = New to Study Since Baseline

TABLE A-5.

New Fully Compliant Participants at the 1987 Followup by Group and Previous Compliance

Previous Compliance		Group		
Baseline	1985 Followup	Ranch Hand	Original Comparison	Replacement Comparison
Partially Compliant	Refusal	5	9	4
	Unlocatable	1	2	0
Refusal	Partially Compliant	1	0	2
	Refusal	2	2	3
New to Study	Partially Compliant	2	0	2
	Refusal	0	2	9
	New to Study	3	2	22
Total		14	17	42

TABLE A-6.

Reason for Refusal by Group*

	Group			
	Ranch Hand		Comparison	
Reason	Number	Percent	Number	Percent
Fear of Physical	1	0.6	4	1.1
Job Commitment	32	18.7	61	17.0
Dissatisfaction with USAF	10	5.8	11	3.1
No Time or Interest	28	16.4	79	22.1
Travel Distance, Family	5	2.9	17	4.7
Confidentiality	1	0.6	4	1.1
Health Reasons	11	6.4	16	4.5
Passive Refusal	40	23.4	78	21.8
Dissatisfaction With Baseline	0	0.0	1	0.3
Financial Hardship	1	0.6	1	0.3
Other (unspecified)	42	24.6	86	24.0
Total	171		358	

*Data on two Comparisons were missing.

TABLE A-7.

Reason for Refusal versus Group Adjusted for Age and Rank Among Non-Blacks

			Reason for Refusal						
			Logistic		Passive		Other		
Age	Rank	Group	Number	Percent	Number	Percent	Number	Percent	Total
<1942	Officer	RH	17	42.5	7	17.5	16	40.0	40
		Comp	36	45.6	13	16.4	30	38.0	79
	Enlisted	RH	18	36.7	9	18.4	22	44.9	49
		Comp	30	44.1	14	20.6	24	35.3	68
≤1942	Officer	RH	8	42.1	7	36.8	4	21.1	19
		Comp	24	33.3	19	26.4	29	40.3	72
	Enlisted	RH	20	36.4	15	27.3	20	36.4	55
		Comp	66	55.5	27	22.7	26	21.8	119

RH = Ranch Hand
Comp = Comparison

borderline significance (p=0.063); a greater percentage of men born in or after 1942 were passive refusals (26%) than men born before 1942 (18%). There were no significant higher order interactions.

Of the 531 refusals, reported health status was available on 150 (88%) of 171 refusing Ranch Hands and 324 (90%) of 360 refusing Comparisons. Data sources included AFHS questionnaires at the 1985 followup and at Baseline, the telephone survey at the 1985 followup, and the noncompliant telephone questionnaire administered at Baseline. Their responses are presented in Table A-8. Among the 474 refusals responding to the health status question, there was a borderline significant association between group (Ranch Hand, Comparison) and reported health (p=0.080); a greater percentage of refusing Comparisons (47%) reported excellent health than refusing Ranch Hands (40%), and a greater percentage of refusing Ranch Hands (11%) reported fair health than Comparisons (5%).

At the 1985 followup, the reported health status of 35 refusing Ranch Hands was not associated with that of 42 refusing Comparisons (p=0.720). The large difference in significance levels between these two analyses appears due to a much larger sample size at the 1987 followup. In addition, the direction and magnitude of the difference between the groups in the good and fair categories changed between the 1985 and 1987 followups.

TABLE A-8.

Reported Health Status of Refusals at the 1987 Followup

Reported Health Status	Group			
	Ranch Hand		Comparison	
	Number	Percent	Number	Percent
Excellent	60	0.0	153	47.2
Good	65	43.3	143	44.1
Fair	16	10.7	17	5.2
Poor	9	6.0	11	3.4
Total	150		324	

Ideally, compliance bias between the groups should be assessed by comparing the health of refusing and fully compliant participants with adjustment for the matching variables. The only data available on the refusing participants, however, are their responses to the health status question at the 1987 followup and previous studies. A test of association between reported health status and group adjusted for compliance, age, and rank was performed. The results are summarized in Table A-9. Due to sparse data, reported health status was collapsed to two categories: excellent/good and fair/poor. The covariates age and rank were dichotomized (born before 1942 and born in or after 1942; officer and enlisted, respectively). The covariate occupation (flying or ground duty) could not be accommodated. Blacks (n=166) were excluded from the analysis due to small cell counts.

The association between reported health status and group adjusted for compliance, age, and rank was not significant (p=0.310). The adjusted association between reported health status and compliance was statistically significant (p<0.001) for both groups combined. As can be seen in the percentages in Table A-9, refusing participants report poorer health more often than their fully compliant counterparts, except for officer Comparisons born in or after 1942. It is of interest that, among refusals, Ranch Hands consistently reported poorer health more often than Comparisons. The interaction of reported health status, group, and compliance was borderline significant (p=0.084).

SCHEDULING AT 1985 AND 1987 FOLLOWUP

During the 1985 followup scheduling period, the schedulers were required to find and schedule a willing health-matched replacement within 5 working days of a confirmed refusal to correct differences in the pattern of group scheduling experienced at Baseline. This constraint proved impractical to implement since Comparisons would often vacillate, forcing a series of repeated telephone calls. Rather than terminate the process at 5 days, as required by the contract, the Air Force directed the schedulers to continue their recruiting attempts, sometimes for several months. Hence, new health-matched replacements were brought into

TABLE A-9.
Reported Health Status versus Group Adjusted for Compliance, Age, and Rank Among Non-Blacks

Compliance	Birth Year	Rank	Group	Reported Health Status: Excellent/Good Number	Excellent/Good Percent	Fair/Poor Number	Fair/Poor Percent	Total
Fully Compliant	<1942	Officer	RH	281	94.6	16	5.4	297
			Comp	359	95.7	16	4.3	375
		Enlisted	RH	238	89.5	28	10.5	266
			Comp	299	89.0	37	11.0	336
	≥1942	Officer	RH	73	97.3	2	2.7	75
			Comp	110	98.2	2	1.8	112
		Enlisted	RH	282	94.3	17	5.7	299
			Comp	369	93.4	26	6.6	395
Refusal	<1942	Officer	RH	31	88.6	4	11.4	35
			Comp	63	94.0	4	6.0	67
		Enlisted	RH	37	80.4	9	19.6	46
			Comp	54	81.8	12	18.2	66
	≥1942	Officer	RH	14	87.5	2	12.5	16
			Comp	64	98.5	1	1.5	65
		Enlisted	RH	38	80.9	9	19.1	47
			Comp	101	91.0	10	9.0	111

RH = Ranch Hand
Comp = Comparison

the study much later than other participants. At the 1987 followup, the Air Force required that schedulers attempt to schedule health-matched replacements within 15 working days of identifying a refusal.

At the 1987 followup, the 15-day scheduling constraint also proved impractical due to the Comparisons' hesitancy to schedule. The Air Force directed schedulers to extend their recruiting attempts in an effort to provide maximum opportunity for Comparisons to participate. The percent completing the physical examination by calendar date is plotted in Figure A-1 for Ranch Hands, Original Comparisons, replacement Comparisons, and all Comparisons. These patterns are similar to those seen at 1985 followup.

REPLACEMENT COMPARISONS VERSUS THE NONCOMPLIANT ORIGINAL COMPARISONS THEY REPLACED

A contrast of refusing Original Comparisons and their replacements based on reported health status was not accomplished at Baseline since the necessary data were not available at the time. At the 1985 followup, a short noncompliance questionnaire similar to the telephone survey questionnaire was used to elicit reported health status of refusing Comparisons.

Of 288 Comparisons replaced at Baseline, only 57 responded to the short noncompliance telephone questionnaire. These 57 comprised 38 Original Comparisons and 19 replacements. Replacements were statistically contrasted with the refusing Comparisons they replaced based on their reported health status. This contrast was summarized in Table A-9 of the 1985 followup report. There was no statistical difference in reported health patterns between refusing Original Comparisons and their replacements. It is noteworthy that 53 percent of Original refusing Comparisons were matched, by chance, perfectly to their replacements, on reported health status.

In April 1985, all previously uncontacted living Comparisons were identified for telephone contact to assess their current health. This health status information was necessary for matching replacements to refusing Original Comparisons. From 9,982 available Comparisons, 7,963 (80%) were identified for the telephone survey. The remaining 2,019 Comparisons included 360 verified as being deceased and 1,659 who previously had been contacted. The group of 1,659 previously contacted Comparisons was comprised of Comparisons who were fully compliant, partially compliant, or refusals at Baseline. Of the 7,963 identified for the telephone survey, responses were obtained from 7,411 Comparisons. These counts correct corresponding figures cited on page 5-7 of the 1985 followup final report (1).

The survey questionnaire asked the respondent for his self-perception of health, current prescribed medication use, work days lost due to illness or injury, special health care needs, and income.

As initiated at the 1985 followup, matching replacements to refusing Original Comparisons on the basis of health status as well as age, race, rank, and occupation was maintained at the 1987 followup. The reported health status of new replacements for refusing Original Comparisons was obtained from the telephone survey at the 1985 followup. If a

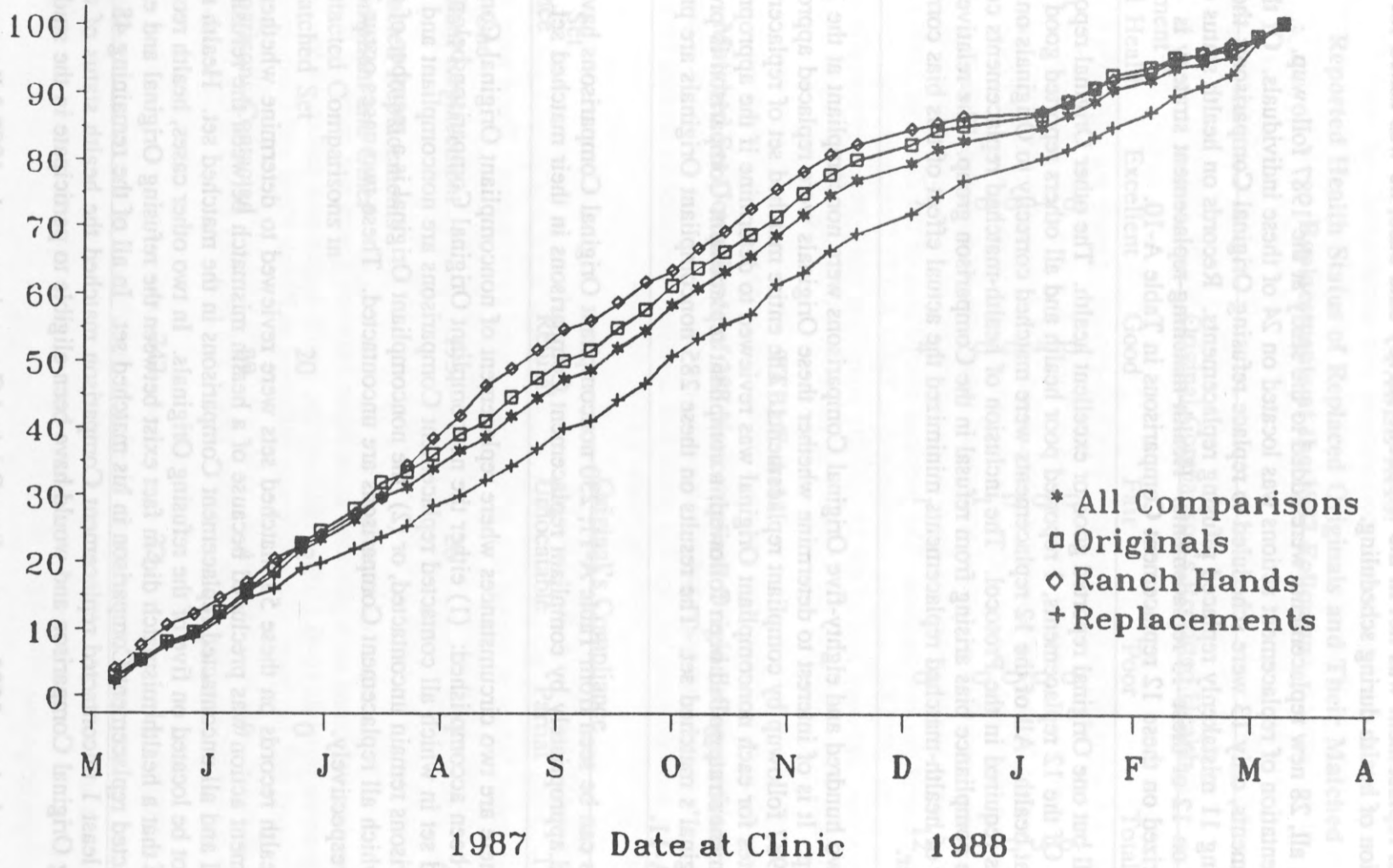

FIGURE A-1. Percent Completed Physical Examination by Calendar Date

potential replacement was not in the telephone survey data base, he was asked for his self-perception of health during scheduling.

In all, 28 new replacements were added to the study at the 1987 followup. Documentation of replacement actions was located on 24 of these individuals. Of these 24 replacements, only 13 were scheduled to replace refusing Original Comparisons; the remaining 11 mistakenly replaced refusing replacements. Records on health status could be located on 12 of these 13 replacements. Health-matching replacement strategy is summarized on these 12 replacement Comparisons in Table A-10.

All but one Original reported good or excellent health. The other Original reported fair health. Of the 12 replacements, 1 reported poor health and all others reported good or excellent health. All of the 12 replacements were matched correctly to Originals on health status as required in the Protocol. The inclusion of health-matched replacements corrects possible compliance bias arising from refusal in the Comparison group. The relatively small number of health-matched replacements minimized the actual effect of this bias correction, however.

Two hundred and eighty-five Original Comparisons were noncompliant at the 1987 followup. It is of interest to determine whether these Originals were replaced appropriately at the 1987 followup by compliant replacements. The entire matched set of replacement candidates for each noncompliant Original was reviewed to determine if the appropriate replacement strategy had been followed; a compliant replacement Comparison is present in the Original's matched set. The results on these 285 noncompliant Originals are presented in Table A-11.

As can be seen from Table A-11, 230 noncompliant Original Comparisons have been replaced appropriately by compliant replacement Comparisons in their matched set.

There are two circumstances where replacement of noncompliant Original Comparisons has not been accomplished: (1) either the noncompliant Original Comparison belongs to a matched set in which all contacted replacement Comparisons are noncompliant and some Comparisons remain uncontacted, or (2) the noncompliant Original is a member of a matched set in which all replacement Comparisons are uncontacted. These two cases occur 22 and 33 times, respectively.

Health records on these 55 matched sets were reviewed to determine whether replacement action was precluded because of a health mismatch between the refusing Original and all uncontacted replacement Comparisons in the matched set. Health records could not be located on five of the refusing Originals. In two other cases, health records indicate that a health mismatch did in fact exist between the refusing Original and each uncontacted replacement Comparison in his matched set. In all of the remaining 48 matched sets, at least 1 uncontacted replacement Comparison matched the health status of the refusing Original Comparison and would have been eligible to participate in the study.

In conclusion, of 285 noncompliant Original Comparisons at the 1987 followup, all but 55 were members of matched sets having at least 1 other compliant replacement Comparison. Thirty-three of the 55 were noncompliant Original Comparisons whose replacements were

TABLE A-10.

Reported Health Status of Replaced Originals and Their Matched Replacements at the 1987 Followup

Replacement's Reported Health	Original Comparison's Reported Health				
	Excellent	Good	Fair	Poor	Total
Excellent	6	0	0	0	6
Good	1	4	0	0	5
Fair	0	0	0	0	0
Poor	0	0	1	0	1
Total	7	4	1	0	12

TABLE A-11.

Matched Set Compliance of 285 Noncompliant Original Comparisons

Matched Set Compliance	Original's Compliance			
	Refusal	Unlocatable	Partial	Total
At Least One Compliant Replacement	193	26	11	230
All Contacted Replacements Noncompliant and Other Uncontacted Comparisons in the Matched Set	20	2	0	22
No Comparisons Contacted	29	4	0	33
Total	242	32	11	285

never contacted, and 22 were members of matched sets in which all contacted replacements are noncompliant and at least 1 other replacement was uncontacted. Of these 55 noncompliant Original Comparisons, 48 belonged to matched sets containing at least 1 uncontacted replacement matched on health status to the refusing Original Comparison. Thus, 48 noncompliant Original Comparisons appeared not to have been replaced as required by the Protocol. The Air Force intended that additional replacements be contacted in a matched set until a health-matched compliant replacement is found. The effect of these oversights is considered negligible and these oversights will be corrected at the next examination.

PARTIALLY COMPLIANT VERSUS FULLY COMPLIANT PARTICIPANTS

In addition to the analyses summarized in Tables A-8 and A-9, a contrast of partially compliant versus fully compliant participants at the 1987 followup is presented. However, only 1 Ranch Hand and 27 Comparisons were partially compliant at the 1987 followup (Tables A-1 and A-2), precluding statistical analysis of these data for group differences. These individuals were administered the Baseline questionnaire in their homes but subsequently refused to attend the examination. The previous compliance of the 28 participants partially compliant at the 1987 followup is summarized in Table A-12. Data on health status, medication use, and work loss of the 28 partially compliant and 2,294 fully compliant participants at 1987 followup are reported in Tables A-13 through A-15, respectively.

These data were sparse and were not considered supportive or nonsupportive of the compliance bias calculations presented in the Baseline report. The Baseline report conclusions regarding the potential effects of differential compliance should be regarded as conservative overestimates of bias but worthy of consideration until more data become available.

ANALYSIS OF PASSIVE REFUSALS

One of the reasons for refusal summarized in Table A-16 was passive refusal. Passive refusal included failure to appear at a scheduled physical examination. There were 40 Ranch Hand, 53 Original Comparison, and 25 replacement Comparison passive refusals at the 1987 followup. Ranch Hand and Comparison passive refusals were contrasted with respect to reported health status. These data are summarized in Table A-16.

The data indicated no significant association between group and reported health status among passive refusals ($p=0.170$). Additionally, health status was collapsed to excellent/good and fair/poor, and group was collapsed to Ranch Hand and Comparison because of sparse data in the full table. Analysis of the data from the collapsed table revealed no significant association between group and reported health status ($p=0.220$).

CONCLUSIONS

These compliance analysis results suggested that there has been no change in the way replacements self-selected for entry into this study from the Baseline and 1985 followup examinations. As stated in the two previous reports, there appears to be little selection bias due to nonparticipation.

TABLE A-12.

Previous Compliance Status of 28 Partially Compliant Participants at the 1987 Followup

Previous Compliance	Group		
	Ranch Hand	Original Comparison	Replacement Comparison
Refusal at Baseline and 1985 Followup	1	11	2
New to Study at 1985 Followup and Refusal at 1985 Followup	0	0	8
New to Study at 1987 Followup	0	0	6
Total	1	11	16

TABLE A-13.

Reported Health of Partially and Fully Compliant Participants at the 1987 Followup

Followup Compliance	Health	Group				
		Ranch Hand		Comparison		
		Number	Percent	Number	Percent	Total
Full	Excellent	474	47.6	651	50.2	1,125
	Good	454	45.6	560	43.1	1,014
	Fair	51	5.1	75	5.8	126
	Poor	16	1.6	12	0.9	28
Total		995		1,298*		2,293
Partial	Excellent	0	0.0	17	63.0	17
	Good	1	100.0	10	37.0	11
	Fair	0	0.0	0	0.0	0
	Poor	0	0.0	0	0.0	0
Total		1		27		28

*One participant answered "Don't know."

TABLE A-14.

Reported Medication Use of Partially and Fully Compliant Participants at the 1987 Followup

1987 Followup Compliance	Medication Use	Group: Ranch Hand Number	Ranch Hand Percent	Comparison Number	Comparison Percent	Total
Full	Yes	253	25.4	332	25.6	585
	No	742	74.6	967	74.4	1,709
Total		995		1,299		2,294
Partial	Yes	0	0.0	2	7.4	2
	No	1	100.0	25	92.6	26
Total		1		27		28

TABLE A-15.

Reported Work Loss of Partially and Fully Compliant Participants at the 1987 Followup

1987 Followup Compliance	Work Loss	Group: Ranch Hand Number	Ranch Hand Percent	Comparison Number	Comparison Percent	Total
Full	Yes	136	16.7	190	18.0	326
	No	675	83.2	867	82.0	1,542
Total		811		1,057		1,868*
Partial	Yes	0	0.0	2	7.7	2
	No	1	100.0	24	92.3	25
Total		1		26		27*

*One partially compliant and 426 fully compliant participants skipped this question.

TABLE A-16.

Reported Health Status of Passive Refusals

Reported Health Status	Group: Ranch Hand Number	Ranch Hand Percent	Original Comparison Number	Original Comparison Percent	Replacement Comparison Number	Replacement Comparison Percent	Total
Excellent	16	40.0	28	52.8	15	60.0	59
Good	21	52.5	24	45.3	9	36.0	54
Fair	3	7.5	1	1.9	0	0.0	4
Poor	0	0.0	0	0.0	1	4.0	1
Total	40		53		25		118

Forty-eight of 285 noncompliant (refusing, partially compliant, or unlocatable) Original Comparisons were not replaced as required in the Protocol. The biasing effect of this omission is not known but is considered negligible.

APPENDIX A

REFERENCES

1. Lathrop, G.D., S.G. Machado, T.G. Karrison, W.D. Grubbs, W.F. Thomas, W.H. Wolfe, J.E. Michalek, J.C. Miner, M.R. Peterson, and R.W. Ogershok. 1987. Epidemiologic investigation of health effects in Air Force personnel following exposure to herbicides: First followup examination results, NTIS: AD A 188 262. USAF School of Aerospace Medicine, Brooks Air Force Base, Texas.

Appendix B-1
Dioxin Assay

POLICIES & PROCEDURES

Scripps Clinic

DEPARTMENT NAME: CLINICAL PATHOLOGY	P. P. NUMBER	ISSUE DATE:
TITLE: AIR FORCE HEALTH STUDY - DIOXIN BLOOD COLLECTION	REVISION DATE: 8/5/87	PAGE 1

1.0 PURPOSE

To collect blood samples for dioxin testing in accordance with Center for Disease Control standards.

2.0 SCOPE

Applies to all Air Force Health Study participants.

3.0 MATERIALS

3.1 Blood-pack unit without anticoagulant - 600 ml

3.2 Alcohol swabs

3.3 Sepps

3.4 Sterile gauze

3.5 Adhesive tape

3.6 Balance

3.7 Coban

3.8 Unit holders

4.0 PROCEDURE

4.1 On the second day of the study, blood is drawn from patient with a 15 gauge needle into a blood pack unit without anti-coagulant.

4.1.1 Blood pack units have been previously tested by the CDC for Dioxin contamination.

4.2 Patients who have immunology studies have 250 ml of blood drawn. Patients not having immunology studies have 350 ml of blood drawn.

4.3 Select site for venipuncture.

4.3.1 On patients who have not yet had their physical exam, the dominant arm is preferred.

4.4 Prepare site for venipuncture in accordance with CDC standards.

4.5 Perform venipuncture and securely tape needle and tubing to arm.

4.6 Blood is collected into unit bag.

4.6.1 Amount of blood collected is determined by weighing sample on a balance.

4.6.2 For 280 ml of blood, set balance at 320 gms
For 350 ml of blood, set balance at 390 gms

4.6.3 When amount needed is obtained clamp tubing with hemostat.

4.7 Remove needle from vein

4.8 Have patient apply pressure to site for several minutes.

4.9 Apply pressure bandage to site using gauge and Coban.

4.9.1 Instruct patient not to remove bandage for at least 30 - 45 minutes.

4.10 Clamp tubing twice with hand sealer and clips.

4.10.1 Cut tubing and discard

4.10.2 Dispose of needle in needle container

4.11 Label unit bag with pre-printed label.

4.11.1 Write time drawn and initials on label

4.11.2 Place label on plastic portion of unit pack

4.12 Place unit bag upright in vertical holder.

4.12.1 Vertical holders are numbered 1-37.

4.12.2 Units are placed in holders according to order of draw.

4.12.3 Units are to remain upright at room temperature and allowed to clot for at least 7 hours.

5.0 SHORT DRAWS

5.1 In the event of a short draw, unit pack is to be weighed and the amount of blood noted on the unit label. "Short draw" should also be written on label in large letters.

6.0 MUTIPLE VENIPUNCTURES

6.1 If unable to collect sample with one venipuncture, ask patient if he is willing to be drawn again. If patient is willing start procedure from beginning.

6.2 If patient is unwilling to be redrawn, notify the nurse coordinator and Air Force monitor.

6.2.1 Save labels and have test credited.

7.0 MAILING OF SAMPLES

7.1 Frozen samples are mailed twice weekly to Brooks AFB, TX via Airborne Overnight Service.

7.2 Mailing boxes are placed in styrofoam shipping tape.

7.2.1 10 - 15 lbs of dry ice is packed around mailing boxes.

7.3 CDC shipping list is placed on top of styrofoam lid and beneath cardboard box lid.

7.4 Cardboard box is sealed with strapping tape.

7.5 Address label, dry ice label and "this side up" label are placed on box.

7.6 Mailing requisition is filled out and taken with shippers to shipping department.

c:\afhs\dioxcoll.bld

DEPARTMENT NAME: CLINICAL PATHOLOGY	P. P. NUMBER	ISSUE DATE:
TITLE: AIR FORCE HEALTH STUDY - DIOXIN BLOOD PROCESSING	REVISION DATE: 8/4/87	PAGE 1 OF

1.0 PURPOSE:

To process blood samples for dioxin testing using Center for Disease Control standards as a guideline.

2.0 SCOPE:

Applies to Clinical Pathology Medical Technicians involved in processing dioxin samples.

3.0 MATERIALS:

3.1 transfer pack units = 300 ml

3.2 plasma transfer set

3.3 plasma extractor

3.4 vertical holders

3.5 vertical holder boxes

3.6 teflon lined lids

3.7 teflon stoppers

3.8 aluminum sealing caps

3.9 aluminum cap sealer

3.10 centrifuge bags

3.11 hand sealer/stripper

3.12 shipping list

3.13 Wheaton bottles

3.13.1 5 ml, 10 ml, 120 ml

3.14 white storage bags

3.15 styrofoam mailing boxes

3.16 dry ice

4.0 PROCEDURE:

4.1 Shipping list

4.1.1 The shipping list is a modified version of the list provided by CDC.

4.1.2 Shipping list is prepared as follows; remove top left section of patients label from unit bag and place sequentially on shipping list.

4.1.3 Specify any deviations from collection, storage and shipment protocols, and date of occurrence.

4.2 Centrifuging of unit bags

4.2.1 Centrifuges are refrigerated at 4-10°C.

4.2.2 Unit bags are centrifuged in the order that they are drawn.

4.2.3 Unit bags are placed inside centrifuge bags and then in centrifuge cups.

4.2.3.1 Centrifuge cups are then balanced.

4.2.4 Centrifuge cups are placed in centrifuge and spun for 15 minutes at 4500 rpm.

4.2.5 Balance next group of 10 unit bags for centrifuging.

4.3 Transfer of serum from unit bags to transfer packs.

4.3.1 Label transfer packs with patients aliquot label.

4.3.2 Labeled transfer packs are placed in vertical holders in the sequence they are to be transferred.

4.3.3 Serum is transferred from spun unit bag to the transfer pack by plasma extractor.

4.3.3.1 Place unit bag on plasma extractor with side not containing manufacters label toward you.

4.3.3.2 Remove coupler cover of transfer pack unit.

4.3.3.3 Expose outlet port of blood pack unit.

4.3.3.4 Insert coupler into outlet port.

4.3.3.5 Release handle of plasma extractor and express desired amount of serum into transfer pack unit.

4.3.3.6 Apply clips and hand sealer to transfer tubing and severe tubing between seals.

4.3.4 Transfer packs containing serum and any unit bags that need to be respun are placed in unsequential vertical holders, that are placed in boxes 2A and/or 2B.

4.3.5 20 transfer packs are spun at a time.

4.3.5.1 Transfer packs spin for 15 min. at 4500 rpm.

4.4 Transfer of serum from transfer packs to Wheaton bottles.

4.4.1 Wheaton bottles are labeled with patient aliquot labels

4 oz Wheaton bottle	S1 Serum Dioxin
5 ml Wheaton bottle	S3 Lipid Profile
10 ml Wheaton bottle	S4 Serum Reserve
4 oz Wheaton bottle	S2 Serum Dioxin

4.4.1.1 Insert the sharp end into one of the outlet ports in top of the bag.

4.4.1.2 Close tubing with thumb roller on tubing.

4.4.1.3 Press bag with "Plasma Extractor".

4.4.1.4 Hold open end of tubing over pre-labeled Wheaton bottles.

4.4.1.5 Open tubing and put 5 ml in "S3" bottle, 10 ml in "S4" bottle and divide the rest into the 4 oz bottles.

4.4.1.6 Extract only the serum being careful that cells do not enter the bottle. Recap and tighten.

4.4.1.7 Log in the serum samples and store at -20°C or less until shipment.

4.4.1.7.1 Serum samples are stored in white cardboard boxes provided by C.D.C.

Appendix B-2

Exposure Index Information

TABLE B-2-1.

Herbicide Orange Equivalent Gallons and Ranch Hand Manning by Month

Mo./Yr.	Gallons Sprayed	Officer-Pilot (Occ. 1)	Officer-Navigator (Occ. 2)	Officer-Nonflying (Occ. 3)	Enlisted Flyer (Occ. 4)	Enlisted Groundcrew (Occ. 5)
10/61	0	0	0	0	0	0
11/61	0	5	11	1	6	14
12/61	0	9	2	1	7	20
01/62	191,426	14	2	1	7	23
02/62	324,216	14	2	1	7	23
03/62	191,426	15	2	1	7	20
04/62	0	16	2	1	6	14
05/62	0	15	3	1	6	13
06/62	0	12	2	0	5	7
07/62	0	13	2	0	5	4
08/62	0	11	2	0	5	5
09/62	334,126	12	2	0	5	6
10/62	334,126	9	1	0	5	6
11/62	0	10	0	0	5	5
12/62	90,879	8	0	0	4	5
01/63	0	9	0	0	5	4
02/63	0	7	1	0	5	4
03/63	0	12	1	0	5	6
04/63	0	12	1	0	5	6
05/63	0	10	1	0	5	7
06/63	174,024	10	1	0	4	7
07/63	259,150	11	1	0	8	6
08/63	0	8	0	0	8	4
09/63	0	10	1	1	9	4
10/63	339,588	7	1	1	9	6
11/63	377,172	6	1	1	10	6
12/63	942,630	5	1	1	6	6
01/64	121,454	7	1	1	7	5
02/64	363,758	5	1	0	7	4
03/64	755,312	8	1	0	5	4
04/64	56,799	9	1	0	6	2
05/64	152,271	10	2	0	5	2
06/64	612,709	7	3	0	5	2
07/64	282,789	9	3	0	6	3
08/64	777,669	9	3	0	5	3
09/64	1,413,945	8	3	0	4	2
10/64	1,413,945	9	3	0	4	2
11/64	1,413,945	11	3	0	4	1
12/64	1,413,945	10	3	0	6	1

TABLE B-2-1. (Continued)

Herbicide Orange Equivalent Gallons and Ranch Hand Manning by Month

Mo./Yr.	Gallons Sprayed	Officer-Pilot (Occ. 1)	Officer-Navigator (Occ. 2)	Officer-Nonflying (Occ. 3)	Enlisted Flyer (Occ. 4)	Enlisted Groundcrew (Occ. 5)
01/65	1,296,116	11	4	0	6	1
02/65	1,437,510	12	5	0	6	1
03/65	730,538	13	4	1	6	1
04/65	659,841	14	3	1	6	2
05/65	1,767,431	15	4	1	6	2
06/65	0	16	4	1	7	4
07/65	942,630	19	4	1	7	3
08/65	26,500	19	4	1	7	3
09/65	44,650	22	4	1	6	3
10/65	78,850	23	4	1	6	6
11/65	106,900	24	6	1	10	12
12/65	148,525	23	5	1	11	12
01/66	152,450	21	6	1	10	16
02/66	129,150	22	6	1	10	26
03/66	135,600	21	4	2	10	32
04/66	141,050	22	5	2	10	37
05/66	183,900	21	6	2	9	38
06/66	191,830	20	6	2	10	41
07/66	112,300	21	8	2	9	45
08/66	192,050	26	8	2	11	46
09/66	213,970	28	9	2	12	62
10/66	122,040	34	8	3	16	85
11/66	164,800	41	8	4	18	104
12/66	212,100	45	9	5	28	123
01/67	202,360	49	9	5	28	123
02/67	363,830	59	13	5	28	116
03/67	285,400	51	13	4	28	114
04/67	208,300	50	14	4	33	108
05/67	251,320	53	15	4	34	101
06/67	335,860	55	13	3	36	105
07/67	253,884	51	15	3	37	163
08/67	162,895	63	13	4	32	160
09/67	298,615	60	18	5	33	161
10/67	265,335	55	19	5	36	149
11/67	372,425	55	17	6	33	145
12/67	383,605	58	18	6	34	129
01/68	333,595	54	19	6	33	127
02/68	27,450	65	19	6	35	141
03/68	48,200	69	20	5	34	160

TABLE B-2-1. (Continued)

Herbicide Orange Equivalent Gallons and Ranch Hand Manning by Month

Mo./Yr.	Gallons Sprayed	Officer-Pilot (Occ. 1)	Officer-Navigator (Occ. 2)	Officer-Nonflying (Occ. 3)	Enlisted Flyer (Occ. 4)	Enlisted Groundcrew (Occ. 5)
04/68	307,740	72	20	6	36	161
05/68	336,300	75	18	6	32	160
06/68	226,325	77	18	6	37	164
07/68	258,100	84	19	7	42	187
08/68	289,160	91	18	9	45	192
09/68	216,300	89	22	8	44	147
10/68	72,250	89	20	8	49	155
11/68	189,100	101	17	7	53	153
12/68	218,750	94	17	8	51	154
01/69	264,450	98	19	7	51	154
02/69	197,450	91	18	5	51	166
03/69	356,500	90	17	5	53	172
04/69	339,800	94	20	6	54	161
05/69	353,800	93	19	6	54	151
06/69	383,533	88	19	7	57	155
07/69	287,425	91	16	6	55	152
08/69	299,100	85	16	6	55	155
09/69	206,800	83	15	6	61	142
10/69	181,000	83	17	6	61	122
11/69	205,100	90	16	6	60	118
12/69	276,900	76	16	5	52	114
01/70	186,350	66	15	5	54	116
02/70	152,100	58	15	5	41	122
03/70	153,730	59	13	5	39	125
04/70	45,700	54	13	5	37	109
05/70	0	51	14	5	29	94
06/70	0	47	14	3	18	84
07/70	0	44	11	2	16	74
08/70	0	40	9	1	14	63
09/70	0	40	7	1	13	43
10/70	0	34	6	1	14	37
11/70	0	30	5	1	15	35
12/70	0	25	4	1	13	30
01/71	0	23	4	1	14	28
02/71	0	23	4	1	14	28
03/71	0	23	4	1	14	28
04/71	0	23	4	1	14	28
05/71	0	23	4	1	14	28
06/71	0	28	4	1	14	28

TABLE B-2-1. (Continued)

Herbicide Orange Equivalent Gallons and Ranch Hand Manning by Month

Mo./Yr.	Gallons Sprayed	Officer-Pilot (Occ. 1)	Officer-Navigator (Occ. 2)	Officer-Nonflying (Occ. 3)	Enlisted Flyer (Occ. 4)	Enlisted Groundcrew (Occ. 5)
07/71	0	29	4	1	14	28
08/71	0	29	4	1	14	28
09/71	0	29	4	1	14	28
10/71	0	29	4	1	14	28

Source: Baseline Morbidity Report, 24 February 1984.

Appendix C

Statistical Methods

TABLE C-1.

Summary of Statistical Analysis Situations by Dependent Variable Form, Serum Dioxin Estimate, Analysis Type, and Analysis Cohort

Dependent Variable Form	Serum Dioxin Estimate	Analysis Type	Analysis Cohort	Statistical Method	Independent Variables
Continuous	Log_2 (Initial)	Unadjusted	Minimal Maximal	Simple Linear Regression	Log_2 (Initial)
		Adjusted	Minimal Maximal	Multiple Linear Regression	Log_2 (Initial); Cov; Log_2 (Initial) x Cov; Cov x Cov
		Longitudinal*	Minimal Maximal	Simple Linear Regression	Log_2 (Initial)
Continuous	Log_2 (Current) and Time	Unadjusted	Minimal Maximal	Multiple Linear Regression	Log_2 (Current); Time; Log_2 (Current) x Time
		Adjusted	Minimal Maximal	Multiple Linear Regression	Log_2 (Current); Time; Log_2 (Current) x Time; Cov; Log_2 (Current) x Cov; Time x Cov; Cov x Cov; Log_2 (Current) x Time x Cov
		Longitudinal*	Minimal Maximal	Multiple Linear Regression	Log_2 (Current); Time; Log_2 (Current) x Time

TABLE C-1. (Continued)

Summary of Statistical Analysis Situations by Dependent Variable Form, Serum Dioxin Estimate, Analysis Type, and Analysis Cohort

Dependent Variable Form	Serum Dioxin Estimate	Analysis Type	Analysis Cohort	Statistical Method	Independent Variables
Continuous	Categorized Current Dioxin	Unadjusted	Ranch Hands and Comparisons	One-Way Analysis of Variance	DXCAT
		Adjusted	Ranch Hands and Comparisons	Multiple Linear Regression	DXCAT; Cov; DXCAT x Cov; Cov x Cov
		Longitudinal*	Ranch Hands and Comparisons	One-Way Analysis of Variance	DXCAT
Discrete	Log_2 (Initial)	Unadjusted	Minimal Maximal	Logistic Regression or Log-Linear Analysis	Log_2 (Initial)
		Adjusted	Minimal Maximal	Logistic Regression or Log-Linear Analysis	Log_2 (Initial); Cov; Log_2 (Initial) x Cov; Cov x Cov
		Longitudinal**	Minimal Maximal	Logistic Regression	Log_2 (Initial)

TABLE C-1. (Continued)

Summary of Statistical Analysis Situations by Dependent Variable Form, Serum Dioxin Estimate, Analysis Type, and Analysis Cohort

Dependent Variable Form	Serum Dioxin Estimate	Analysis Type	Analysis Cohort	Statistical Method	Independent Variables
Discrete	Log_2 (Current) and Time	Unadjusted	Minimal Maximal	Logistic Regression or Log-linear Analysis	Log_2 (Current); Time; Log_2 (Current) x Time
		Adjusted	Minimal Maximal	Logistic Regression or Log-Linear Analysis	Log_2 (Current); Time; Log_2 (Current) x Time; Cov; Log_2 (Current) x Cov; Time x Cov; Cov x Cov; Log_2 (Current) x Time x Cov
		Longitudinal**	Minimal Maximal	Logistic Regression	Log_2 (Current); Time; Log_2 (Current) x Time
Discrete	Categorized Current Dioxin	Unadjusted	Ranch Hands and Comparisons	Logistic Regression, Chi-square, Fisher's Exact Test	DXCAT
		Adjusted	Ranch Hands and Comparisons	Logistic Regression or Log-linear Analysis	DXCAT; Cov; DXCAT x Cov; Cov x Cov
		Longitudinal**	Ranch Hands and Comparisons	Logistic Regression	DXCAT

TABLE C-1. (Continued)

Summary of Statistical Analysis Situations by Dependent Variable Form, Serum Dioxin Estimate, Analysis Type, and Analysis Cohort

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Note: *Dependent variable usually paired difference score of (1987 to 1982) dependent variable values. For some clinical areas, paired difference scores will be (1987 to 1985) differences.

**Analysis performed subject to the constraint that participant was normal at the 1982 Baseline (or 1985) examination.

Log_2 (Initial) = Logarithm (base 2) of estimated initial dioxin level.

Log_2 (Current) = Logarithm (base 2) of measured current dioxin level.

Time = Time since SEA tour.

DXCAT = Categorized current dioxin (incorporating group membership).

Cov = Relevant covariates.

Appendix D

Covariate Associations

APPENDIX D

Data Displays for the Covariate Associations

The following figures graphically display relationships between the dependent variables and measures of dioxin for the covariate associations. The panels are arranged as follows:

Panel	Group	Assumption	Dioxin Measure
a	Ranch Hand	Minimal	Initial
b	Ranch Hand	Maximal	Initial
c	Comparison	--	Current
d	Ranch Hand	--	Current

Dioxin measures are presented in original units, but spacing of intervals is based on the logarithm (base 2) scale, similar to the statistical analysis. The dependent variable is also presented in original units. For presentation purposes, spacing for the alcohol variables (current alcohol use, lifetime alcohol history, current wine use, and lifetime wine history) is based on the square root scale. For continuous variables, current dioxin values of 0.0 ppt are displayed as 0.3 ppt. For these variables, the reference line, which spans the range of dioxin, indicates the general relationship between the (transform of the) dependent variable and $\log_2$ dioxin.

For discrete variables with two levels, back-to-back histograms are presented for the two covariate strata. Table 5-1 provides sample sizes for each histogram. Dioxin values given on the vertical axis represent the midpoints of the dioxin intervals (e.g., the dioxin value of 64 ppt represents the interval 32.0 ppt to 128.0 ppt). For discrete variables with more than two levels, histograms for each covariate category are presented along the same axis. Different patterns represent separate covariate strata. Table 5-1 provides sample sizes for each histogram. Dioxin values given on the horizontal axis represent the midpoints of the dioxin intervals, similar to the dichotomous discrete variable case.

Figure		Page
D-61	Blood Type versus Dioxin	D-64
D-62	Presence of Pre-SEA Acne versus Dioxin	D-65
D-63	Personality Type versus Dioxin	D-66

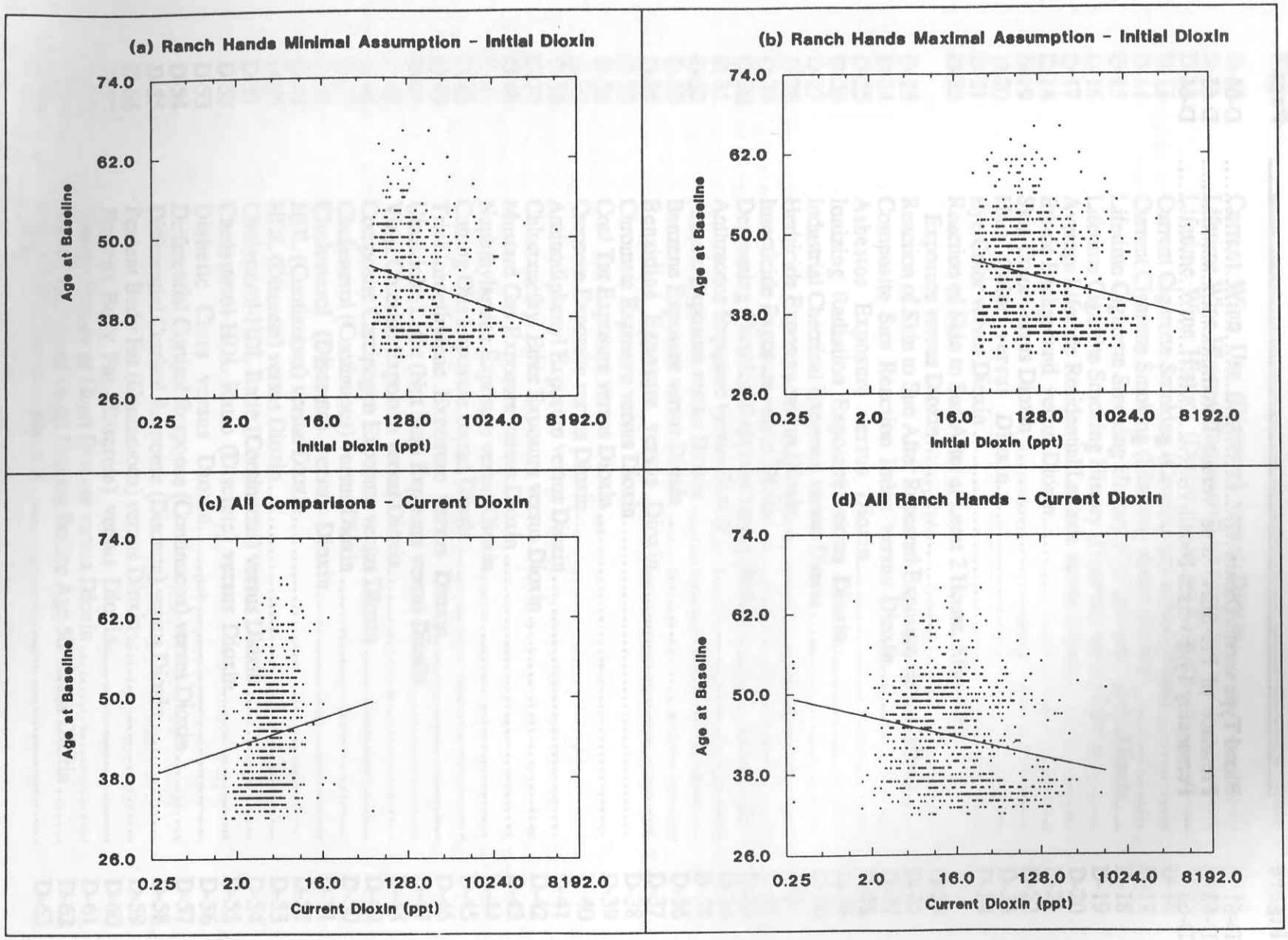

FIGURE D-1. Age (Continuous) versus Dioxin