

Chapter IX

GENERAL PHYSICAL HEALTH

Five general variables were used in the analyses of the general health status of the study participants. The individual's self-perception of health was obtained during questionnaire administration and reflects a personal and subjective evaluation of health. It is susceptible to varying degrees of bias, both conscious and subconscious. The physician's assessment of the presence of distress is a crude objective measure of general health status and is less biased. This assessment was made on initial observation by the examiner, prior to any direct examination. Thus, patients who appeared ill or in distress on this initial observation were generally quite ill. The examining physician also reported his assessment of the concordance between the subject's apparent age and his chronological age. Two other variables, percent body fat and the erythrocyte sedimentation rate, were also evaluated. There were 1045 Ranch Hand and 773 originally selected comparison participants included in the analyses in this chapter. Slight variations in these numbers occur occasionally due to missing data. Similar analyses were conducted using all compliant comparisons, regardless of replacement status. The results of these additional analyses were essentially no different from the results of the analyses with the originally selected comparisons presented in this chapter. Appendix IX contains representative results of these additional analyses. The relative risks and confidence intervals for the dependent variables analyzed in this chapter are included in Appendix XVIII.

1. Subjective Assessments

The results of a log-linear analysis of the self-perception of health in the Ranch Hand and comparison groups with three covariates (age, race and occupational category) are discussed in this section and are shown in Table IX-1.

Table IX-1

SELF-PERCEPTION OF HEALTH BY GROUP AND AGE

<u>Age</u>	<u>Perception</u>	<u>Ranch Hand</u>		<u>Comparisons</u>		<u>P value</u>
		<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	
<40	Excellent	129	(34.5)	91	(38.6)	P=.017*
	Good	173	(46.3)	120	(50.8)	
	Fair/Poor	72	(20.9)	25	(10.6)	
>40	Excellent	254	(39.1)	203	(38.7)	P=.025**
	Good	256	(39.4)	239	(45.5)	
	Fair/Poor	139	(21.4)	83	(15.8)	

*Relative risk ≤ 40 = 1.82; 95% Confidence Interval (1.18 to 2.10)

**Relative risk > 40 = 1.35; 95% Confidence Interval (1.05 to 1.76)

This analysis demonstrates a statistically significant difference between the two groups, with the Ranch Handers perceiving their health to be poorer than the comparisons. No significant three-factor interaction effects associated with self-perception and group were observed. However, age had a statistically significant association with health perception ($P < 0.001$) and with group membership ($P = 0.02$), thus indicating confounding by age. Race was found to have no association with either group membership or perception of health (P values of 0.94 and 0.87, respectively).

The examiner's initial assessment of the appearance of ill health or distress also paralleled the participants' self-perceptions, with more Ranch Handers appearing to be ill than comparison subjects. Although these ill-appearing individuals accounted for less than 1% of each group, there was borderline statistical significance as shown in Table IX-2.

Table IX-2

EXAMINER'S ASSESSMENT OF ILLNESS OR DISTRESS BY GROUP

Examiner's Assessment	Ranch Hand		Comparison	
	Number	Percent	Number	Percent
Ill	8	(0.8)	1	(0.1)
Well	1,033	(99.2)	769	(99.9)

$P = 0.056$

This measure is somewhat more objective than the participant's self-perception of health but is nevertheless influenced by the participant's emotional status, and bias can thus still be a factor in this result. The participants' self-perception of health appeared to be worse than the examiner's assessment in both groups; however, as demonstrated in Table IX-3, the pattern of discordance does not differ between the two groups. When the examiner's estimates of the participant's apparent ages were contrasted to their chronological ages, 976 (93.4%) of the Ranch Handers and 737 (95.6%) of the comparisons were observed to appear as old as they actually were. Fifty-one (4.9%) of the Ranch Handers and 19 (2.5%) of the comparisons appeared to be younger than their actual age while 18 (1.7%) and 15 (2.0%) respectively appeared to be older. This observation was statistically significant ($P = 0.029$) and demonstrated a tendency for the Ranch Handers to appear somewhat younger than their actual ages.

Table IX-3

DISCORDANT SELF-PERCEPTIONS OF HEALTH

	<u>Better than Examiner</u>	<u>Worse than Examiner</u>
Ranch Hand	2	205
Comparison	0	109

2. Objective Assessments

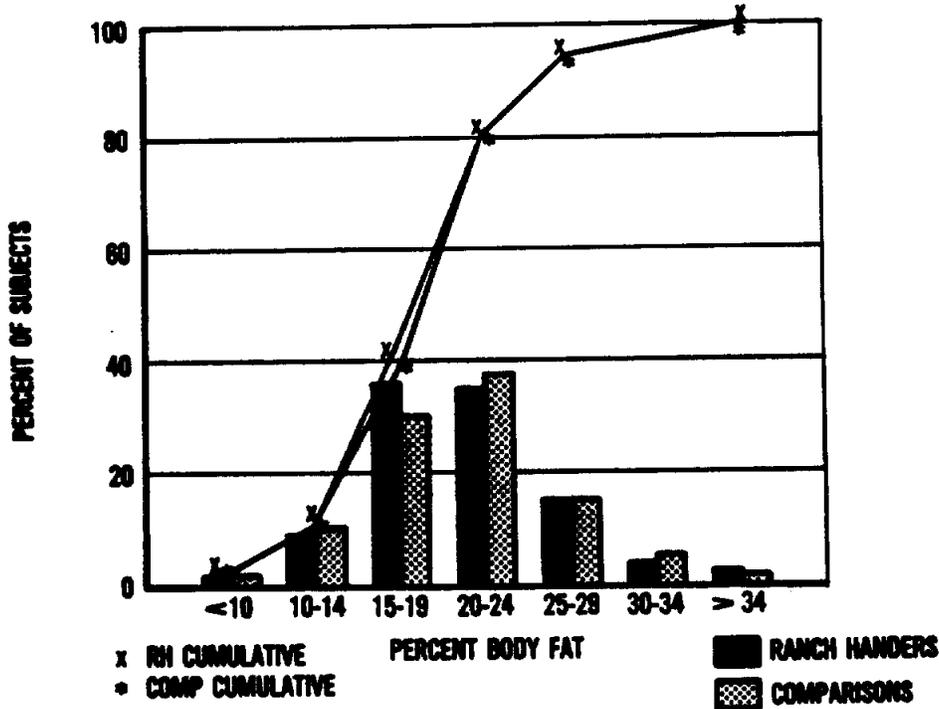
Percent body fat and erythrocyte sedimentation rate were also analyzed in the setting of general health status. While these measures are not indicative of specific diseases, they do indirectly reflect the general state of health. Body fat percentages were calculated from height (inches) and weight (lbs) measurements (Hodgdon, 1983) using the formula.

$$\% \text{ Body Fat} = (\text{weight}/\text{height}^2) (1015.724) - (17.28460).$$

Data were missing or unmeasurable (greater than 100%) for 7 participants (3 comparison and 4 Ranch Handers), and these individuals were excluded from the analysis. The distribution of these data is shown in Table IX-4 and Figure IX-1, where the percentage of participants falling in each grouping and the cumulative percentages are displayed.

Figure IX-1

PERCENT BODY FAT DISTRIBUTION



The percent of body fat appeared to be reasonably normal in its distribution. No significant differences were detected between the variances ($P = 0.34$) or the means ($P = 0.67$) of the two groups.

Table IX-4

DESCRIPTIVE STATISTICS - PERCENT BODY FAT

	<u>Number of Subjects</u>	<u>Mean</u>	<u>Std Dev</u>
Ranch Hand	1,041	21.12	5.36
Comparison	770	21.22	5.19

In an effort to assess the extremes of obesity and leanness in the two groups of participants, individuals below 10% or over 25% body fat were considered to be lean or obese, respectively. The distribution of subjects in three weight categories is shown in Table IX-5. Chi-square procedures revealed no significant differences between the Ranch Hand and comparison groups ($P=0.89$).

Table IX-5

DISTRIBUTION OF BODY FAT PERCENT

	<u>Lean (<10%)</u>		<u>Normal (10-25%)</u>		<u>Obese (>25)</u>		<u>Total</u>
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	
Ranch Hand	13	(1)	824	(79)	207	(20)	1044
Comparison	7	(1)	607	(79)	157	(20)	771

$P = 0.89$

The percent body fat and group membership relationship was further evaluated by covariance analysis using age, race and occupational category as covariates. Age and percent body fat were associated ($P = 0.02$), but this association was not affected by group membership; that is, there was no three-way interaction ($P = 0.17$). None of the sources of variation associated with race were found to be significant. Percent body fat was significantly different between the three occupational categories ($P = 0.04$), but this association was the same in both Ranch Hand and comparison groups.

Sedimentation rate values presented a right skewed distribution for both groups. Table IX-6 presents the percentile values for each group. A two-sample Kolmogorov-Smirnov test revealed no significant differences in the two unadjusted distributions (P = 0.99). The normal range of sedimentation rate for males is less than or equal to 12 mm and only 5% of each group exceeded normal.

Table IX-6

PERCENTILE DISTRIBUTION OF SEDIMENTATION RATE RESULTS

	<u>5%</u>	<u>25%</u>	<u>50%</u>	<u>75%</u>	<u>95%</u>
Ranch Hand	0	1	2	4	12
Comparison	0	1	2	4	13

Kolmogorov-Smirnov; P = 0.99

A multifactor log linear analysis of sedimentation rate by group membership, age (≤ 40 , >40), hematocrit (<42 , 42-52, or $>52\%$) and the examiner's assessment of illness or distress was performed. The interaction of sedimentation rate, group membership, and age was significant (P = 0.002) as shown in Table IX-7. Ranch Handers 40-years of age or less had significantly fewer sedimentation rate abnormalities than did their comparisons, while no group difference was noted in individuals over the age of 40.

Table IX-7

SEDIMENTATION RATE, AGE AND GROUP MEMBERSHIP

<u>Age</u>	<u>Group</u>	<u>Sedimentation Rate</u>				<u>P Value</u>
		<u>Abnormal</u>		<u>Normal</u>		
		<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	
≤ 40	Ranch Hand	2	(0.5)	372	(99.5)	0.001
	Comparison	10	(4.2)	227	(95.8)	
> 40	Ranch Hand	39	(5.8)	628	(94.2)	0.764
	Comparison	29	(5.4)	504	(94.6)	

The sedimentation rate was found to have a significant association with hematocrit, the appearance of illness or distress, and percent body fat. Table IX-8 displays these data. Since these variables were unassociated with group membership, combined data for both groups are used.

Table IX-8

SEDIMENTATION RATE HEMATOCRIT/DISTRESS/BODY FAT ASSOCIATIONS

	Sedimentation Rate				P Value
	Abnormal		Normal		
	Number	(Percent)	Number	(Percent)	
Hematocrit					
< 42%	13	(11.3)	102	(88.7)	<0.001
42-52%	66	(4.0)	1598	(96.0)	
> 52%	1	(3.1)	31	(96.9)	
Appearance of Illness or Distress					
Ill	2	(22.2)	7	(87.8)	0.009
Well	78	(4.3)	1724	(95.7)	
% Body Fat					
< 10	3	(15.0)	17	(85.0)	0.049
10-25	59	(4.1)	1372	(95.9)	
> 25	19	(5.2)	348	(94.8)	

These findings are consistent since an increasing sedimentation rate, abnormal body weight, decreasing hematocrit, and an ill appearance are all traditional indicators of illness, and therefore should be related.

The relationships between self-perception of health, sedimentation rate, and age were also explored. These significant relationships are shown in Table IX-9.

Table IX-9

SELF-PERCEPTION OF HEALTH, AGE/SEDIMENTATION RATE ASSOCIATIONS

	Self-Perception of Health			P Value
	<u>Excellent</u>	<u>Good</u>	<u>Fair/Poor</u>	
Sedimentation Rate				
Abnormal	18	35	28	<0.001
Normal	671	765	294	
Age				
≤ 40	224	294	97	0.06
> 40	465	506	225	

These relationships were independent of group membership and are not unusual since illness generally increases with advancing age.

3. Herbicide Exposure Analysis

The exposure index was applied to the variables in the general health analysis to determine whether a dose-response effect could be identified. As described in Chapter VIII, the index is expressed in equivalent-gallons of dioxin-containing herbicide potentially encountered by each individual during his Ranch Hand tour of duty. Three categories of exposure were used: low, medium, and high. The cutoff values for these categories were chosen so that statistical power could be maximized in the analyses.

The interrelationship between a Ranch Hand's self-perception of health and exposure is shown in Table IX-10. Three occupational groupings were analyzed: officers, flying enlisted, and enlisted ground personnel. Nonflying officers were included in the analysis and were assigned to the low exposure category. Their jobs were primarily administrative in nature and involved relatively lower levels of exposure than the flying officers.

Table IX-10

HEALTH PERCEPTION IN RANCH HANDERS BY OCCUPATIONAL GROUP
AND EXPOSURE CATEGORY

<u>Occupational Group</u>	<u>Perception</u>	<u>Counts Within Exposure Category</u>			<u>P Value</u>
		<u>Low</u>	<u>Med</u>	<u>High</u>	
Officer N = 361	Excellent	65	65	68	0.72
	Good	34	45	42	
	Fair/Poor	11	18	13	
Enlisted, flying N = 183	Excellent	18	18	23	0.84
	Good	29	24	29	
	Fair/Poor	12	16	14	
Enlisted, ground N = 472	Excellent	43	41	41	0.13
	Good	59	95	67	
	Fair/Poor	48	42	36	
Total: 1016					

These analyses revealed no significant association between exposure and perception of health. The P value of 0.13 among the enlisted ground personnel is of interest, but consistent trends are not seen in the data. Similarly, exposure was found to have no significant association with the examiner's assessment of distress or ill health. The occupational category analysis is shown in Table IX-11. Statistical testing of these data was not conducted due to the small number of individuals judged to be ill by the examining physician.

Table IX-11

EXAMINER'S ASSESSMENT OF HEALTH IN RANCH HANDERS
BY OCCUPATIONAL GROUP AND EXPOSURE CATEGORY

<u>Occupational Group</u>	<u>Illness or Distress</u>	<u>Counts Within Exposure Category</u>		
		<u>Low</u>	<u>Med</u>	<u>High</u>
Officer	Ill	0	1	1
	Well	111	127	124
Enlisted, flying	Ill	0	0	1
	Well	59	59	65
Enlisted, ground	Ill	2	0	3
	Well	149	178	142

Similarly, the associations between exposure and apparent age and exposure and body fat were evaluated. These data are presented in Tables IX-12 and IX-13.

Table IX-12

APPARENT AGE OF RANCH HANDERS BY OCCUPATIONAL GROUP
AND EXPOSURE CATEGORY

<u>Occupational Group</u>	<u>Apparent Age</u>	<u>Counts Within Exposure Category</u>			<u>P Value</u>
		<u>Low</u>	<u>Med</u>	<u>High</u>	
Officer	Younger	7	10	8	0.99
	Same	103	117	116	
	Older	1	1	1	
Enlisted-flying	Younger	1	5	2	0.22
	Same	57	54	64	
	Older	1	0	0	
Enlisted-ground	Younger	5	6	6	0.88
	Same	142	169	136	
	Older	4	4	6	

Table IX-13

PERCENT BODY FAT BY OCCUPATIONAL GROUP
AND EXPOSURE CATEGORY

<u>Occupational Group</u>	<u>% Body Fat</u>	<u>Counts Within Exposure Category</u>			<u>P Value</u>
		<u>Low</u>	<u>Med</u>	<u>High</u>	
Officer	≤10%	0	1	1	0.57
	10-25%	91	97	103	
	≥25%	20	30	21	
Enlisted-flying	≤10%	1	1	0	0.34
	10-15%	48	52	51	
	≥25%	10	6	15	
Enlisted-ground	≤10%	2	4	3	0.95
	10-25%	114	136	115	
	≥25%	35	39	30	

It is evident from these data that levels of exposure had no relationship to the examiner's assessment of apparent age and percent body fat regardless of occupational category.

4. Summary

Overall, the analyses of the general physical health of the study participants revealed classical associations between clinical measures of ill health such as sedimentation rate, obesity/leanness, age, hematocrit, self-perception and the appearance of distress. Statistically significant group differences between the Ranch Hand and Comparison groups were limited to the subjective measures of self-perception of health and the examiner's assessment of illness or distress. The Ranch Handers, as a group, perceived themselves to be in poorer health than did the comparison group. Similarly, the examiner felt that more Ranch Handers appeared ill than did the comparisons. However, ill appearing individuals accounted for less than 1% of both groups. The analysis of these variables against the exposure index did not reveal any dose-response effects. Overall, the available evidence does not support the presence of such an herbicide effect operating at this time.