TABLE 15-1. (continued)

Statistical Analysis for the Cardiovascular Evaluation

Covariates

Variable (Abbreviation)	Data Source	Data Form	Cutpoints
Age (AGE)	MIL	D/C	Born >1942 Born 1923-1941 Born ≤1922
Race (RACE)	MIL	D	Nonblack Black
Occupation (OCC)	MIL	D	Officer Enlisted Flyer Enlisted Groundcrew
Lifetime Cigarette Smoking History (PACKYR) (pack-years)	Q-SR	D/C	0 >0-10 >10
Current Cigarette Smoking (CSMOK) (cigarettes/day)	Q-SR	D/C	0-Never 0-Former >0-20 >20
Lifetime Alcohol History (DRKYR) (drink-years)	Q-SR	D/C	0 >0-40 >40
Current Alcohol Use (ALC) (drinks/day)	Q-SR	D/C	0-1 >1-4 >4
Cholesterol (CHOL) (mg/dl)	LAB	D/C	<200 ≥200-230 >230
High Density Lipoprotein (HDL) (mg/dl)	LAB	D/C	<40 ≥40-50 >50
Cholesterol-HDL Ratio (CHOL/HDL)	LAB	D/C	<4.2 ≥4.2-5.5 >5.5
Percent Body Fat (%BFAT)	PE	D/C	Lean: <10% Normal: 10-25% Obese: >25%

TABLE 15-1. (continued)

Statistical Analysis for the Cardiovascular Evaluation

Covariates

Variable (Abbreviation)	Data Source	Data Form	Cutpoints
Personality Type (PERS)	PE (1985)	D/C	A Direction B Direction
Differential Cortisol Response (DIFCORT)	LAB (1985)	D/C	≤0.6 >0.6-4.0 >4.0
Family History of Heart Disease (HRTDIS)	Q-SR	D	Yes No
Family History of Heart Disease Before Age 50 (HRTDIS50)	Q-SR	D	Yes No

Abbreviations:

Data Source:
LAB--1987 SCRF laboratory results
LAB (1985)--1985 SCRF laboratory results
MIL--Air Force military records
PE--1987 SCRF physical exam
PE (1985)--1985 SCRF physical exam
Q-V--1987 NORC questionnaire (verified)

Data Form:
D--Discrete analysis only
D/C--Discrete and continuous analyses for dependent variables; appropriate form for analysis (either discrete or continuous) for covariates.

Statistical Analyses:
UC--Unadjusted core analyses
AC--Adjusted core analyses
CA--Dependent variable-covariate associations
UE--Unadjusted exposure index analyses
AE--Adjusted exposure index analyses
L--Longitudinal analyses

Statistical Methods:
CC--Pearson's product moment correlation coefficient
CS--Pearson's chi-square test
FT--Fisher's exact test
GLM--General linear models analysis
LR--Logistic regression analysis
OR--Chi-square test on the odds ratio
TT--Two-sample t-test

TABLE 15-2.

Number of Participants Excluded and With Missing Data for the Cardiovascular Evaluation by Group

Variable	Analysis Use	Group		
		Ranch Hand	Comparison	Total
Verified History of Diabetes or 2-Hour Postprandial Glucose ≥200 mg/dl	EXC	98	121	219
Pre-SEA Verified Essential Hypertension or Heart Disease	EXC	20	34	54
Pitting and Nonpitting Edema	EXC[a]	22	30	52
Personality Type (1985)	COV	39	78	117
Differential Cortisol Response (1985)	COV	35	76	111
Corticosteroids (1985)	EXC[b]	5	9	14
Cholesterol	COV	1	2	3
HDL	COV	1	2	3
Cholesterol-HDL Ratio	COV	1	2	3
Temperature ≥100°F at Laboratory Examination	EXC[c]	1	3	4
Positive Hepatitis B Surface Antigen	EXC[c]	7	8	15
Femoral Pulses	DEP	1	1	2
Dorsalis Pulses	DEP	1	1	2
Posterior Pulses	DEP	1	2	3
Leg Pulses	DEP	2	1	3
Peripheral Pulses	DEP	2	1	3
All Pulses	DEP	4	3	7

Abbreviations: EXC--Exclusion
COV--Covariate (missing data)
DEP--Dependent variable (missing data)

[a]Exclusion from analyses of peripheral pulses only.
[b]Exclusion from analyses adjusted for differential cortisol response.
[c]Exclusion from analyses adjusted for cholesterol, HDL, or cholesterol-HDL ratio.

RESULTS

Ranch Hand and Comparison Group Contrasts

Questionnaire Variables

Table 15-3 contains the results of the unadjusted analyses for reported and verified essential hypertension, reported and verified heart disease, and reported and verified myocardial infarction. These tables give the percentage of individuals experiencing and not experiencing these events in each group, along with the estimated relative risks, 95 percent confidence intervals, and p-values. Table L-1, Appendix L, contains the results from examination of the pairwise associations between each of these variables and the covariates. Table 15-4 gives the results of the adjusted group comparisons.

Reported and Verified Essential Hypertension

All of the reported cases of essential hypertension were verified upon medical records review; thus, analyses based upon reported and verified events were identical. Approximately one-third of the individuals in each group had essential hypertension, with an unadjusted relative risk not significantly different from 1 ($p=0.457$).

Essential hypertension was significantly associated with age ($p<0.001$), lifetime cigarette smoking ($p=0.024$), current cigarette smoking ($p=0.001$), lifetime alcohol history ($p<0.001$), current alcohol use ($p<0.001$), cholesterol ($p=0.001$), cholesterol-HDL ratio ($p=0.012$), percent body fat ($p<0.001$), and family history of heart disease ($p=0.001$). The percentages of individuals with essential hypertension increased with age (25.5% for those born in or after 1942, 37.8% for those born between 1923 and 1941, and 55.2% for those born in or before 1922); cholesterol (27.8% for those with cholesterol levels <200 mg/dl, 34.3% for those with cholesterol levels 200-230 mg/dl, and 37.0% for those with cholesterol levels >230 mg/dl); cholesterol-HDL ratio (29.2%, 33.4%, and 36.9% for individuals with ratios ≤4.2, 4.2-5.5, and >5.5, respectively); and percent body fat (0.0% for lean individuals, 28.2% for normal individuals, and 55.3% for obese individuals). Moderate lifetime smokers had the lowest percentage of hypertension (28.4%), compared to nonsmokers and heavy lifetime smokers (34.2% and 35.0%, respectively). Nonsmokers and former smokers had a higher frequency of hypertension (34.1% and 36.9%, respectively) than moderate current smokers and heavy current smokers (26.0% and 28.7%, respectively). Heavy lifetime drinkers had a higher percentage with hypertension (42.6%) than moderate lifetime drinkers and nondrinkers (29.9% and 32.2%, respectively). The percentage with hypertension was greatest in moderate current drinkers (44.6%), intermediate in heavy current drinkers (40.3%), and lowest in light current drinkers (30.1%). Individuals with a family history of heart disease were also more likely to have hypertension than those without a family history of heart disease (39.4% vs. 31.1%).

Comparisons between the two groups adjusted for covariates detected significant effects of age ($p<0.001$), lifetime alcohol history ($p=0.002$),

TABLE 15-3.

Unadjusted Analysis for Cardiovascular Variables by Group (Questionnaire Data)

Variable	Statistic	Group				Est. Relative Risk (95% C.I.)	p-Value
		Ranch Hand		Comparison			
Reported/Verified Essential Hypertension*	n	878		1,150			
	Number/%						
	Yes	297	33.8%	371	32.3%	1.07 (0.89,1.29)	0.457
	No	581	66.2%	779	67.7%		
Reported Heart Disease (Excluding Hypertension)	n	878		1,150			
	Number/%						
	Yes	340	38.7%	428	37.2%	1.07 (0.89,1.28)	0.488
	No	538	61.3%	722	62.8%		
Verified Heart Disease (Excluding Hypertension)	n	878		1,150			
	Number/%						
	Yes	337	38.4%	427	37.1%	1.06 (0.88,1.26)	0.564
	No	541	61.6%	723	62.9%		
Reported/Verified Myocardial Infarction*	n	878		1,150			
	Number/%						
	Yes	39	4.4%	53	4.6%	0.96 (0.63,1.47)	0.859
	No	839	95.6%	1,097	95.4%		

*No conditions reported that were not verified; therefore, reported and verified analyses are the same.

TABLE 15-4.

Adjusted Analysis for Cardiovascular Variables by Group (Questionnaire Data)

Variable	Statistic	Group		Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
		Ranch Hand	Comparison			
Reported/Verified Essential Hypertension*	n	862	1,136	1.09 (0.90,1.33)	0.382	AGE (p<0.001) DRKYR (p=0.002) CHOL (p=0.004) %BFAT (p<0.001)
Reported Heart Disease (Excluding Hypertension)	n	878	1,150	1.08 (0.90,1.30)	0.402	AGE (p<0.001) RACE (p=0.008) CSMOK (p=0.004)
Verified Heart Disease (Excluding Hypertension)	n	878	1,150	1.07 (0.89,1.29)	0.464	AGE (p<0.001) RACE (p=0.007) CSMOK (p=0.002)
Reported/Verified Myocardial Infarction*	n	872	1,139	0.92 (0.59,1.43)**	0.702**	GRP*HRDIS (p=0.042) AGE (p<0.001) PACKYR (p=0.001) CHOL/HDL (p<0.001)

*No conditions reported that were not verified; therefore, reported and verified analyses are the same.

**Group-by-covariate interaction (0.01<p<0.05)—adjusted relative risk, confidence interval, and p-value derived from a model fitted after deletion of this interaction.

GRP: Group (Ranch Hand, Comparison).

cholesterol (p=0.004), and percent body fat (p<0.001), but the adjusted relative risk was not significant (p=0.382).

Reported and Verified Heart Disease

All but four of the reported cases of heart disease were verified (three Ranch Hands and one Comparison). Consequently, analyses based upon reported and verified events gave very similar results. The percentage of individuals with reported and verified heart disease was similar in the Ranch Hand and Comparison groups in the unadjusted analyses (p=0.488 and p=0.564, respectively).

Both reported and verified heart disease were significantly associated with age (p<0.001 in each case); occupation (p=0.002 and p=0.001, respectively); current cigarette smoking (p=0.008 and p=0.003, respectively); and family history of heart disease (p=0.024 and p=0.033, respectively). In addition, the association between verified heart disease and race was also statistically significant (p=0.047). (The association between reported heart disease and race was borderline significant [p=0.053].) Reported heart disease increased with age (32.6% for those born in or after 1942, 41.0% for those born between 1923 and 1941, and 58.2% for those born in or before 1922). Blacks had a higher rate than nonblacks (46.9% vs. 37.3%); officers had a higher rate than enlisted flyers, who had a slightly higher rate than enlisted groundcrew (42.6%, 36.6%, and 34.4%, respectively). Former smokers had the highest rate of reported heart disease (40.9%), followed by nonsmokers (38.8%), moderate current smokers (36.6%), and heavy current smokers (30.2%). Individuals with a family history of heart disease had a higher rate than those without a family history of heart disease (42.5% vs. 36.5%). As noted above, these figures are nearly identical to those for verified heart disease.

Adjusted analyses of reported heart disease detected significant effects of age (p<0.001), race (p=0.008), and current cigarette smoking (p=0.004), but the relative risk for the two groups was near 1 (p=0.402). Results from the adjusted analysis of verified heart disease were essentially the same (p=0.464) as that of reported heart disease.

Reported and Verified Myocardial Infarction

All of the reported cases were verified upon medical records review. The percentage of individuals with myocardial infarction was slightly less in the Ranch Hand group than in the Comparison group, but not significant (unadjusted p=0.859).

Myocardial infarction was significantly associated with age (p<0.001), lifetime cigarette smoking (p<0.001), current cigarette smoking (p=0.015), cholesterol (p=0.007), HDL (p<0.001), cholesterol-HDL ratio (p<0.001), and family history of heart disease (p<0.001). The percentage of individuals with infarction increased with age (1.4% for those born in or after 1942, 6.1% for those born between 1923 and 1941, and 20.9% for those born in or before 1922) and lifetime cigarette smoking (2.3% for nonsmokers, 3.3% for moderate lifetime smokers, and 6.8% for heavy lifetime smokers). In terms of current cigarette smoking, the lowest frequency was among nonsmokers (2.3%) and the

highest frequency was among former smokers (6.0%); moderate and heavy current smokers had intermediate values (4.7% and 4.9%, respectively). The percentage of individuals with myocardial infarction increased with increasing cholesterol levels (3.0% for those with cholesterol levels <200 mg/dl, 4.2% for those with levels 200-230 mg/dl, and 6.5% for those with levels 230 mg/dl); decreased with increasing HDL levels (8.2% for those with HDL levels <40 mg/dl, 3.5% for those with levels 40-50 mg/dl, and 2.6% for those with levels >50 mg/dl); and increased with increasing cholesterol-HDL ratios (2.9% for those with ratios ≤4.2, 3.5% for those with ratios 4.2-5.5, and 8.0% for those with ratios >5.5). Individuals with a family history of heart disease had more than double the rate of myocardial infarction than those without a history (7.8% vs. 3.6%).

In the adjusted analysis of myocardial infarction, a statistically significant group-by-family history of heart disease interaction was detected (p=0.042), as well as significant age (p<0.001), lifetime cigarette smoking (p=0.001), and cholesterol-HDL ratio (p<0.001) effects. This interaction is explored more fully in Appendix L, Table L-2, where the frequency distribution and adjusted relative risks stratified by family history of heart disease are provided. Of the Ranch Hands with a positive family history, 9.4 percent had disease, while only 6.6 percent of the Comparisons with a comparable history had disease. Of those men without a positive family history, 3.0 percent of the Ranch Hands and 4.1 percent of the Comparisons had disease. Neither of these within-stratum differences was statistically significant (p=0.278 and p=0.130, respectively). However, since the significance level was between 0.01 and 0.05, Table 15-4 also gives the results after deleting the interaction term from the model. For this model, the adjusted relative risk was not statistically significant (p=0.702).

Physical Examination Variables: Central Cardiac Function

Table 15-5 gives the results of the unadjusted analyses for the variables related to central cardiac function: systolic blood pressure, heart sounds, overall ECG abnormalities, RBBB, LBBB, nonspecific T-waves, bradycardia, tachycardia, arrhythmia, and other ECG diagnoses. The table gives the percentage of individuals with abnormal and normal findings, estimated relative risks, 95 percent confidence intervals, and p-values. For systolic blood pressure, results of a continuous analysis are also presented. Appendix L, Table L-1, gives the dependent variable-covariate associations, and Table 15-6 gives the results of the adjusted analyses.

Systolic Blood Pressure

The unadjusted mean systolic blood pressure was not significantly different in the two groups (p=0.809), nor was the percent with abnormal systolic blood pressure different (p=0.518).

Systolic blood pressure was significantly associated with age (p<0.001 for both continuous and discrete analyses); lifetime cigarette smoking (p=0.022, continuous); current cigarette smoking (p<0.001, continuous and p=0.002, discrete); lifetime alcohol history (p=0.016, continuous and p=0.006, discrete); current alcohol use (p=0.002, continuous and p=0.010, discrete);

TABLE 15-5.

Unadjusted Analysis for Cardiovascular Variables by Group (Central Cardiac Function)

Variable	Statistic	Group: Ranch Hand	Group: Comparison	Est. Relative Risk (95% C.I.)	p-Value
Systolic Blood Pressure	n	878	1,150		
	Mean	127.06	126.87	—	0.809
	95% C.I.	(125.90,128.22)	(125.85,127.89)		
	Number/%				
	Abnormal	170 19.4%	236 20.5%	0.93 (0.75,1.16)	0.518
	Normal	708 80.6%	914 79.5%		
Heart Sounds	n	878	1,150		
	Number/%				
	Abnormal	35 4.0%	53 4.6%	0.86 (0.56,1.33)	0.494
	Normal	843 96.0%	1,097 95.4%		
ECG-Overall	n	878	1,150		
	Number/%				
	Abnormal	138 15.7%	205 17.8%	0.86 (0.68,1.09)	0.208
	Normal	740 84.3%	945 82.2%		
RBBB	n	878	1,150		
	Number/%				
	Abnormal	4 0.5%	8 0.7%	0.65 (0.20,2.18)	0.479
	Normal	874 99.5%	1,142 99.3%		

TABLE 15-5. (continued)

Unadjusted Analysis for Cardiovascular Variables by Group (Central Cardiac Function)

Variable	Statistic	Group				Est. Relative Risk (95% C.I.)	p-Value
		Ranch Hand		Comparison			
LBBB	n	878		1,150			
	Number/%						
	Abnormal	1	0.1%	4	0.4%	0.33 (0.04,2.93)	0.271
	Normal	877	99.9%	1,146	99.6%		
Nonspecific T-Waves	n	878		1,150			
	Number/%						
	Abnormal	93	10.6%	130	11.3%	0.93 (0.70,1.23)	0.611
	Normal	785	89.4%	1,020	88.7%		
Bradycardia	n	878		1,150			
	Number/%						
	Abnormal	37	4.2%	71	6.2%	0.67 (0.44,1.00)	0.049
	Normal	841	95.8%	1,079	93.8%		
Tachycardia	n	878		1,150			
	Number/%						
	Abnormal	0	0.0%	1	0.1%	—	0.999
	Normal	878	100.0%	1,149	99.9%		
Arrhythmia	n	878		1,150			
	Number/%						
	Abnormal	41	4.7%	39	3.4%	1.40 (0.89,2.18)	0.145
	Normal	837	95.3%	1,111	96.6%		

TABLE 15-5. (continued)

Unadjusted Analysis for Cardiovascular Variables by Group (Central Cardiac Function)

Variable	Statistic	Group				Est. Relative Risk (95% C.I.)	p-Value
		Ranch Hand		Comparison			
ECG-Other Diagnosis	n	878		1,150			
	Number/%						
	Abnormal	158	18.0%	219	19.0%	0.93 (0.74,1.17)	0.548
	Normal	720	82.0%	931	81.0%		

—Estimated relative risk not applicable for continuous analysis of a variable; estimated relative risk/confidence interval not given due to cells with zero frequency.

TABLE 15-6.

Adjusted Analysis for Cardiovascular Variables by Group (Central Cardiac Function)

Variable	Statistic	Group		Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
		Ranch Hand	Comparison			
Systolic Blood Pressure	n	873	1,149	—	0.579	AGE (p<0.001) RACE (p=0.039) OCC (p=0.015) ALC (p<0.001) %BFAT (p<0.001)
	Adj. Mean 95% C.I.	128.60 (126.74,130.45)	128.18 (126.42,129.94)			
	n	834	1,064	0.94 (0.75,1.19)**	0.607**	GRP*CHOL/HDL (p=0.020) AGE (p<0.001) ALC (p=0.012) %BFAT (p<0.001) PERS (p=0.005)
Heart Sounds	n	878	1,150	0.86 (0.56,1.34)	0.503	AGE (p<0.001)
ECG-Overall	n	878	1,150	0.86 (0.67,1.09)	0.212	AGE (p<0.001) RACE (p=0.008) PACKYR (p=0.019) %BFAT (p=0.027)
RBBB	n	878	1,150	0.66 (0.20,2.21)	0.493[a]	AGE (p=0.008)
Nonspecific T-Waves	n	878	1,150	****	****	GRP*PACKYR (p=0.004) AGE (p<0.001) %BFAT (p<0.001)

TABLE 15-6. (continued)

Adjusted Analysis for Cardiovascular Variables by Group (Central Cardiac Function)

Variable	Statistic	Group		Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
		Ranch Hand	Comparison			
Bradycardia	n	872	1,139	0.69 (0.46,1.04)	0.068	CSMOK ($p<0.001$) CHOL/HDL ($p=0.006$) %BFAT ($p=0.004$)
Arrhythmia	n	842	1,070	1.56 (0.98,2.49)	0.062	AGE ($p<0.001$) DIFCORT ($p=0.010$)
ECG-Other Diagnoses	n	878	1,150	0.93 (0.74,1.17)	0.539	AGE ($p<0.001$)

—Adjusted relative risk not applicable for continuous analysis of a variable.

[a]Adjusted for age only.

**Group-by-covariate interaction ($0.01<p\leq0.05$)—adjusted relative risk, confidence interval, and p-value derived from a model fitted after deletion of this interaction.

****Group-by-covariate interaction ($p\leq0.01$)—adjusted relative risk, confidence interval, and p-value not presented.

cholesterol ($p<0.001$, continuous and $p=0.006$, discrete); cholesterol-HDL ratio ($p=0.007$, continuous); percent body fat ($p<0.001$, continuous and discrete); and personality type ($p=0.047$, continuous and $p=0.026$, discrete). Systolic blood pressure increased with age ($r=0.187$), with 14.2 percent abnormal among those born in or after 1942, 23.6 percent abnormal among those born between 1923 and 1941, and 41.8 percent abnormal among those born in or before 1922.

Systolic blood pressure was also positively associated with lifetime cigarette smoking, although the correlation was quite small ($r=0.051$). The association between systolic blood pressure and current cigarette smoking, however, was negative ($r=-0.102$). The greatest percent abnormal was among former smokers (24.2%), with nonsmokers, moderate current smokers, and heavy current smokers having 18.1 percent, 17.5 percent, and 15.9 percent abnormal, respectively.

Heavy lifetime drinkers had the highest percent abnormal (25.5%), compared to nondrinkers (19.2%) and moderate drinkers (18.5%). The correlation coefficient was 0.054. Systolic blood pressure was positively associated with current alcohol use ($r=0.070$), with 18.7 percent of light current drinkers exhibiting abnormalities, 24.6 percent of moderate current drinkers, and 28.4 percent of heavy current drinkers.

The associations with cholesterol and cholesterol-HDL ratio were both positive but slight ($r=0.097$ and $r=0.060$, respectively); 16.9 percent of individuals with cholesterol levels less than or equal to 200 mg/dl were abnormal, compared to 19.7 percent for individuals with levels between 200 and 230 mg/dl and 23.8 percent for individuals with levels greater than 230 mg/dl. Systolic blood pressure was positively associated with percent body fat ($r=0.234$); 12.5 percent of lean individuals were abnormal, 17.3 percent of normal individuals, and 32.6 percent of obese individuals. Finally, the association between systolic blood pressure and personality type was slightly negative ($r=-0.045$), with 18.2 percent of Type A personalities abnormal, as compared to 22.4 percent of Type Bs.

Adjusted continuous analyses detected significant effects of age ($p<0.001$), race ($p=0.039$), occupation ($p=0.015$), current alcohol use ($p<0.001$), and percent body fat ($p<0.001$), but the adjusted group means were not significantly different ($p=0.579$).

Adjusted discrete analyses detected significant effects of age ($p<0.001$), current alcohol use ($p=0.012$), percent body fat ($p<0.001$), and personality type ($p=0.005$), and a significant group-by-cholesterol-HDL ratio interaction ($p=0.020$). This interaction is explored in Appendix L, Table L-2. After stratification by levels of the cholesterol-HDL ratio, the adjusted relative risk was less than 1 for those with cholesterol-HDL ratios less than or equal to 4.2 or between 4.2 and 5.5, whereas the adjusted relative risk was greater than 1 for those with cholesterol-HDL ratios greater than 5.5. None of the within-stratum relative risks was statistically significant ($p=0.266$, $p=0.188$, and $p=0.111$, respectively). The adjusted relative risk was not significant when the interaction term was deleted from the model ($p=0.607$).

Heart Sounds

The percentage of individuals with abnormal heart sounds was not significantly different in the two groups ($p=0.494$) for the unadjusted contrast.

Significant associations were detected between abnormal heart sounds and age ($p<0.001$), current cigarette smoking ($p=0.013$), cholesterol-HDL ratio ($p=0.020$), and family history of heart disease ($p=0.009$). Abnormal heart sounds increased with age, with 2.7 percent abnormal among those born in or after 1942, 5.2 percent abnormal among those born between 1923 and 1941, and 13.4 percent abnormal among those born in or before 1922. Former smokers had the highest percent abnormal (5.8%), followed by moderate current smokers (4.4%), nonsmokers (3.9%), and heavy current smokers (1.5%). Individuals with cholesterol-HDL ratios less than or equal to 4.2 and those with ratios greater than 5.5 had a higher percent abnormal than those with ratios between 4.2 and 5.5 (4.6% and 5.9%, respectively, vs. 2.8%). The percent with abnormal heart sounds among individuals with a family history of heart disease was 6.7 percent, compared to 3.7 percent in those without a family history of heart disease.

Adjusted analyses detected a significant effect of age ($p<0.001$); the adjusted relative risk between the Ranch Hand and Comparison groups was not significant ($p=0.503$).

Overall ECG Findings

The Ranch Hands exhibited fewer overall abnormal ECG findings than the Comparisons--this unadjusted difference was not statistically significant ($p=0.208$).

Overall ECG findings were significantly associated with age ($p<0.001$), occupation ($p=0.047$), lifetime cigarette smoking ($p=0.002$), current cigarette smoking ($p=0.003$), cholesterol ($p=0.045$), and percent body fat ($p=0.023$). Abnormal findings increased with age (10.8%, 20.1%, and 47.8% abnormal in those born in or after 1942, between 1923 and 1941, and in or before 1922, respectively). Officers and enlisted flyers had a higher percent abnormal (18.5% and 19.3%, respectively) than enlisted groundcrew (14.7%). The percent with abnormal ECGs was greater in heavy lifetime smokers (20.3%) than nonsmokers or moderate lifetime smokers (14.2% and 14.4%, respectively). Former smokers had the greatest percent abnormal (20.5%), followed by heavy current smokers (16.8%), nonsmokers (14.2%), and moderate current smokers (13.2%). The percent abnormal increased with increasing cholesterol levels (15.2%, 16.0%, and 19.9% for those with cholesterol levels $\leq$200 mg/dl, 200-230 mg/dl, and 230 mg/dl, respectively). Both lean and obese individuals had a higher percent abnormal than normal individuals (25.0%, 21.6%, and 15.8%, respectively).

Adjusted analyses detected significant covariate effects of age ($p<0.001$), race ($p=0.008$), lifetime cigarette smoking ($p=0.019$), and percent body fat ($p=0.027$). The adjusted relative risk between the Ranch Hand and Comparison groups was not statistically significant ($p=0.212$).

RBBB

Only 12 individuals exhibited RBBB, 4 from the Ranch Hand group and 8 from the Comparison group; this unadjusted difference was not statistically significant (p=0.479).

RBBB was positively associated with age (p=0.011), with RBBB detected in 0.2 percent of those born in or after 1942, 0.8 percent of those born between 1923 and 1941, and 3.0 percent of those born in or before 1922.

Due to the small number of abnormalities, further analyses were conducted adjusting only for age. The age covariate from the analyses was statistically significant (p=0.008), but the adjusted relative risk was not significant (p=0.493).

LBBB

Five individuals exhibited LBBB: one from the Ranch Hand group and four from the Comparison group; this unadjusted difference was not statistically significant (p=0.271). No significant associations were detected with any of the covariates. The small number of abnormalities precluded adjusted analyses.

Nonspecific T-Waves

The percentage of individuals with nonspecific T-waves was not significantly different in the Ranch Hand and Comparison groups in the unadjusted analysis (p=0.611).

Significant covariate effects included age (p<0.001), lifetime cigarette smoking (p=0.002), current cigarette smoking (p=0.013), cholesterol (p=0.046), and percent body fat (p<0.001). T-wave findings increased with age (6.7%, 13.6%, and 26.9% in those born in or after 1942, between 1923 and 1941, and in or before 1922, respectively) and lifetime cigarette smoking (8.8%, 9.0%, and 13.7% in nonsmokers, moderate lifetime smokers, and heavy lifetime smokers, respectively). Moderate and heavy current smokers also had a higher percent abnormal (9.4% and 9.8%, respectively) than nonsmokers (8.8%); former smokers had the highest percent abnormal (13.8%). The percentages of abnormalities also increased with increasing cholesterol levels (9.0%, 11.1%, and 13.2% in those with cholesterol levels $\leq$200 mg/dl, 200-230 mg/dl, and >230 mg/dl, respectively). Lean and obese individuals had a higher percentage abnormal than normal weight subjects (25.0% and 17.0%, respectively, vs. 9.6%).

Adjusted analyses detected a significant group-by-lifetime cigarette smoking history interaction (p=0.004) in addition to age (p<0.001) and percent body fat effects (p<0.001). Appendix L, Table L-2, gives the results of this contrast stratified by lifetime cigarette smoking history. For nonsmokers and moderate lifetime cigarette smokers, the relative risk was less than 1, but for heavy lifetime cigarette smokers, the relative risk was greater than 1. None of these within-stratum relative risks reached statistical significance, although for nonsmokers the difference was borderline significant (p=0.052).

Bradycardia

In the unadjusted analysis, significantly fewer Ranch Hands than Comparisons had bradycardia: 4.2 percent versus 6.2 percent (Est. RR: 0.67, 95% C.I.: [0.44,1.00], p=0.049).

Bradycardia was significantly associated with lifetime cigarette smoking history (p=0.002), current cigarette smoking (p=0.002), HDL (p=0.002), cholesterol-HDL ratio (p<0.001), and family history of heart disease (p=0.038). Bradycardia decreased with lifetime smoking, from 7.2 percent in nonsmokers to 6.5 percent in moderate lifetime smokers and 3.4 percent in heavy lifetime smokers. An inverse relationship was also observed between bradycardia and current cigarette smoking: 7.2 percent in nonsmokers, 5.7 percent in former smokers, 5.3 percent in moderate current smokers, and 1.2 percent in heavy current smokers. The percent of individuals with bradycardia increased with increasing HDL levels (2.7% in those with HDL $\leq$40 mg/dl, 5.9% in those with HDL 40-50 mg/dl, and 7.1% in those with HDL >50 mg/dl) and decreased with increasing cholesterol-HDL ratio (8.5% in individuals with ratios $\leq$4.2, 4.3% in individuals with ratios 4.2-5.5, and 2.8% in individuals with ratios >5.5). Individuals with a family history of heart disease had a lower prevalence of bradycardia than those without a family history of heart disease (3.3% vs. 5.9%).

The adjusted model included significant effects of current cigarette smoking (p<0.001), cholesterol-HDL ratio (p=0.006), and percent body fat (p=0.004). The adjusted relative risk was of borderline statistical significance (Adj. RR: 0.69, 95% C.I.: [0.46,1.04], p=0.068).

Tachycardia

Only one individual, a member of the Comparison group, was found to have tachycardia; this unadjusted group difference was not statistically significant (p=0.999). Adjusted analyses were not performed on this variable.

Arrhythmia

A slightly higher percentage of Ranch Hands (4.7%) than Comparisons (3.4%) had arrhythmias, but the unadjusted difference was not statistically significant (p=0.145).

The occurrence of arrhythmia was significantly associated with age (p<0.001) and family history of heart disease (p=0.020). Arrhythmias were detected in only 2.0 percent of those born in or after 1942, compared to 4.5 percent of those born between 1923 and 1941 and 20.9 percent of those born in or before 1922. Six percent of the participants with a family history of heart disease had arrhythmias, compared to 3.4 percent in those without a family history of heart disease.

The adjusted analysis found a significant effect of age (p<0.001) and differential cortisol (p=0.010), and a borderline significant group effect (Adj. RR: 1.56, 95% C.I.: [0.98,2.49], p=0.062).

ECG-Other Diagnoses

Without adjustment for covariates, other ECG findings were not significantly different in the two groups (p=0.548).

Age, lifetime cigarette smoking, current alcohol use, and percent body fat were all significantly associated with other ECG abnormalities (p<0.001, p=0.008, p=0.044, and p=0.005, respectively). Occupation and current cigarette smoking had borderline significant associations (p=0.053 and p=0.051, respectively). The percent with abnormal findings increased with age (14.6%, 20.9%, and 34.3% in those born in or after 1942, between 1923 and 1941, and in or before 1922, respectively) and lifetime cigarette smoking history (15.3%, 17.4%, and 21.5% in nonsmokers, moderate lifetime smokers, and heavy lifetime smokers, respectively). Other ECG diagnoses were greater in moderate current drinkers than in light and heavy current drinkers (23.1% vs. 17.5% and 20.9%, respectively). Although the numbers were small, five of the eight lean individuals (62.5%) had abnormal findings, compared to 18.2 percent and 19.4 percent of normal and obese individuals, respectively. Officers and enlisted flyers had a higher percent abnormal than enlisted groundcrew (20.7%, 19.9%, and 16.3%, respectively). Former smokers and heavy current smokers had relatively more abnormalities than nonsmokers and moderate current smokers (20.5% and 21.0%, respectively, vs. 15.3% and 17.2%, respectively).

In the adjusted analysis, a significant age effect was detected (p<0.001), but the adjusted relative risk was essentially unchanged from the unadjusted value and not significantly different from 1 (p=0.539).

Physical Examination Variables: Peripheral Vascular Function

The results of the unadjusted analyses for the variables related to peripheral vascular function are presented in Table 15-7: diastolic blood pressure, funduscopic examination, carotid bruits, radial pulses, femoral pulses, popliteal pulses, dorsalis pedis pulses, posterior tibial pulses, and the three pulse aggregates (leg pulses, peripheral pulses, and all pulses). Appendix L, Table L-1 gives the dependent variable-covariate associations, and Table 15-8 gives the results of the adjusted analyses.

Diastolic Blood Pressure

The mean diastolic blood pressure was slightly greater in the Ranch Hand group than in the Comparison group; the unadjusted difference was marginally significant (75.18 mm Hg vs. 74.50 mm Hg, p=0.099). The percent with abnormal values was not significantly different in the two groups (p=0.496), based on the unadjusted analysis.

Diastolic blood pressure was significantly associated with age (p=0.001, continuous); lifetime cigarette smoking history (p=0.022, discrete); current cigarette smoking (p=0.005, continuous); lifetime alcohol history (p=0.010, continuous); current alcohol use (p=0.008, continuous and p<0.001, discrete); cholesterol and cholesterol-HDL ratio (p<0.001, continuous); percent body fat (p<0.001, continuous and p=0.028, discrete); and differential cortisol (p=0.012, continuous). Diastolic blood pressure was weakly correlated with

TABLE 15-7.

Unadjusted Analysis for Cardiovascular Variables by Group (Peripheral Vascular Function)

Variable	Statistic	Group: Ranch Hand		Group: Comparison		Est. Relative Risk (95% C.I.)	p-Value
Diastolic Blood Pressure	n	878		1,150			
	Mean	75.18		74.50		—	0.099
	95% C.I.	(74.80,75.80)		(73.98,75.02)			
	Number/%						
	Abnormal	43	4.9%	49	4.3%	1.16 (0.76,1.76)	0.496
	Normal	835	95.1%	1,101	95.7%		
Funduscopic Examination	n	878		1,150			
	Number/%						
	Abnormal	6	0.7%	9	0.8%	0.87 (0.31,2.46)	0.795
	Normal	872	99.3%	1,141	99.2%		
Carotid Bruits	n	878		1,150			
	Number/%						
	Abnormal	9	1.0%	4	0.4%	2.97 (0.91,9.67)	0.058
	Normal	869	99.0%	1,146	99.6%		
Radial Pulses	n	865		1,130			
	Number/%						
	Abnormal	2	0.2%	9	0.8%	0.29 (0.06,1.34)	0.076
	Normal	863	99.8%	1,121	99.2%		

TABLE 15-7. (continued)

Unadjusted Analysis for Cardiovascular Variables by Group (Peripheral Vascular Function)

Variable	Statistic	Group: Ranch Hand		Group: Comparison		Est. Relative Risk (95% C.I.)	p-Value
Femoral Pulses	n	865		1,130			
	Number/%						
	Abnormal	19	2.2%	10	0.9%	2.52 (1.16,5.44)	0.016
	Normal	846	97.8%	1,120	99.1%		
Popliteal Pulses	n	865		1,129			
	Number/%						
	Abnormal	29	3.4%	29	2.6%	1.32 (0.78,2.22)	0.304
	Normal	836	96.6%	1,100	97.4%		
Dorsalis Pedis Pulses	n	864		1,129			
	Number/%						
	Abnormal	107	12.4%	111	9.8%	1.30 (0.98,1.72)	0.071
	Normal	757	87.6%	1,018	90.2%		
Posterior Tibial Pulses	n	864		1,129			
	Number/%						
	Abnormal	30	3.5%	29	2.6%	1.18 (0.81,2.29)	0.240
	Normal	834	96.5%	1,100	97.4%		
Leg Pulses	n	864		1,129			
	Number/%						
	Abnormal	132	15.3%	138	12.2%	1.30 (1.00,1.67)	0.049
	Normal	732	84.7%	991	87.8%		

TABLE 15-7. (continued)

Unadjusted Analysis for Cardiovascular Variables by Group (Peripheral Vascular Function)

Variable	Statistic	Group: Ranch Hand		Group: Comparison		Est. Relative Risk (95% C.I.)	p-Value
Peripheral Pulses	n	864		1,129			
	Number/%						
	Abnormal	133	15.4%	143	12.7%	1.26 (0.97,1.62)	0.082
	Normal	731	84.6%	986	87.3%		
All Pulses	n	863		1,128			
	Number/%						
	Abnormal	133	15.4%	143	12.7%	1.26 (0.97,1.62)	0.081
	Normal	730	84.6%	985	87.3%		

—Estimated relative risk not applicable for continuous analysis of a variable.

TABLE 15-8.

Adjusted Analysis for Cardiovascular Variables by Group (Peripheral Vascular Function)

Variable	Statistic	Group		Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
		Ranch Hand	Comparison			
Diastolic Blood Pressure	n	837	1,069	—	0.100**	GRP*AGE (p=0.028) ALC (p=0.006) %BFAT (p<0.001) DIFCORT (p=0.044)
	Adj. Mean**	75.19	74.51			
	95% C.I.**	(74.58,75.80)	(73.97,75.05)			
	n	872	1,139	1.12 (0.74,1.72)**	0.586**	GRP*HRIDLS50 (p=0.043) HDL (p<0.001) %BFAT (p=0.002)
Femoral Pulses	n	831	1,055	2.52 (1.15,5.56)	0.018	AGE (p<0.001) %BFAT (p=0.006) PERS (p=0.003)
Popliteal Pulses	n	831	1,054	1.24 (0.73,2.11)	0.433	AGE (p=0.005) PACKYR (p=0.004) PERS (p=0.003)
Dorsalis Pedis Pulses	n	864	1,129	1.29 (0.97,1.72)	0.078	AGE (p<0.001) OCC (p<0.001)
Posterior Tibial Pulses	n	824	1,048	****	****	GRP*DIFCORT (p=0.004) AGE (p<0.001) RACE (p=0.037) CSMOK (p=0.021) %BFAT (p=0.002) PERS (p=0.028)

TABLE 15-8. (continued)

Adjusted Analysis for Cardiovascular Variables by Group (Peripheral Vascular Function)

Variable	Statistic	Group		Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
		Ranch Hand	Comparison			
Leg Pulses	n	830	1,054	1.27 (0.97,1.66)	0.079	AGE (p<0.001) OCC (p<0.001) PERS (p=0.030)
Peripheral Pulses	n	830	1,054	1.23 (0.94,1.60)	0.129	AGE (p<0.001) OCC (p<0.001) PERS (p=0.035)
All Pulses	n	829	1,053	1.23 (0.94,1.60)	0.130	AGE (p<0.001) OCC (p<0.001) PERS (p=0.035)

--Adjusted relative risk not applicable for continuous analysis of a variable.

**Group-by-covariate interaction (0.01<p<0.05)--adjusted relative risk/mean, confidence interval, and p-value derived from a model fitted after deletion of this interaction.

***Group-by-covariate interaction (p<0.01)--adjusted relative risk, confidence interval, and p-value not presented.

age (r=0.071). Six percent of heavy lifetime cigarette smokers had abnormal values, compared to 3.7 percent of nonsmokers and 3.2 percent of moderate lifetime smokers. There was a small negative correlation with current cigarette smoking (r=-0.062). There were small positive correlations between diastolic blood pressure and lifetime and current alcohol use (r=0.057 and r=0.059, respectively). Moderate and heavy current drinkers had a higher percentage of abnormal blood pressure readings than light current drinkers (8.3% and 9.0%, respectively, vs. 3.6%). The correlation between diastolic blood pressure and cholesterol level was 0.111, and the correlation between diastolic blood pressure and cholesterol-HDL ratio was 0.077. Diastolic blood pressure increased with increasing percent body fat (r=0.196); with 0.0 percent, 4.0 percent, and 7.1 percent of lean, normal, and obese individuals exhibiting abnormal values, respectively. There was a small negative correlation with differential cortisol (r=-0.057).

In the adjusted continuous analysis, there were significant effects of current alcohol use (p=0.006), percent body fat (p<0.001), and differential cortisol (p=0.044), as well as a statistically significant group-by-age interaction (p=0.028). This interaction is explored in Appendix L, Table L-2, where adjusted group means (adjusted for current alcohol use, percent body fat, and differential cortisol) are compared in the two groups for each of the three age strata. In those born in or after 1942, the Ranch Hand adjusted mean was significantly greater than the Comparison adjusted mean (74.91 mm Hg vs. 73.56 mm Hg, p=0.026). In the middle and older age groups, the adjusted means were not significantly different (p=0.760 and p=0.996, respectively). Since the significance level of the group-by-age interaction did not reach the 1 percent level, Table 15-8 also gives the results of the group contrast comparison after deleting the interaction term from the model. The adjusted Ranch Hand (75.19 mm Hg) mean was marginally significantly greater (p=0.100) than the adjusted Comparison mean (74.51 mm Hg).

Adjusted discrete analyses detected significant effects of HDL (p<0.001) and percent body fat (p=0.002) and a significant interaction between group and family history of heart disease before age 50 (p=0.043). This interaction is also explored more fully in Appendix L, Table L-2, where, among individuals with a positive family history, a higher percentage of Ranch Hands than Comparisons exhibited abnormal values, with nearly equal percentage in the two groups in those without such a history. The former was of borderline significance (p=0.057), but based on very small numbers (5 of 26 Ranch Hands versus 1 of 30 Comparisons). After deletion of the interaction term from the model (Table 15-8), the adjusted relative risk between the two groups was not statistically significant (p=0.586).

Funduscopic Examination

Funduscopic abnormalities were detected in 0.7 percent of the Ranch Hands and 0.8 percent of the Comparisons; this unadjusted difference was not statistically significant (p=0.795).

Age, current cigarette smoking, and current alcohol use were significantly associated with funduscopic abnormalities (p=0.029, p=0.039, and p=0.006, respectively). In those born in or after 1942, 0.2 percent were abnormal, compared to 1.2 percent in those born between 1923 and 1941 and

0.0 percent in those born in or before 1922. Moderate and heavy current cigarette smokers had more abnormalities (1.8% and 1.2%, respectively) than nonsmokers and former smokers (0.4% in each case). Similarly, moderate and current drinkers had more abnormalities (2.0% and 1.5%, respectively) than light current drinkers (0.4%). Adjusted group comparisons were not performed due to the small number of abnormalities.

Carotid Bruits

Carotid bruits were also relatively rare, although here the group difference was of borderline significance, with 1.0 percent of the Ranch Hands exhibiting abnormalities, compared to 0.4 percent of the Comparisons (p=0.058). No significant covariate associations were found and adjusted analyses were not performed due to the small numbers.

Radial Pulses

Two (0.2%) Ranch Hands were found to have abnormal radial pulses, compared to nine (0.8%) Comparisons; this unadjusted difference was not statistically significant (p=0.076). Once again, no statistically significant associations were detected with any of the covariates, and adjusted analyses were not performed due to the small number of abnormalities.

Femoral Pulses

Based on the unadjusted analysis, a significantly greater percentage of Ranch Hands than Comparisons had femoral pulse abnormalities (Est. RR: 2.52, 95% C.I.: [1.16, 5.44], p=0.016). Of the Ranch Hands, 2.2 percent had a femoral pulse abnormality, as compared to 0.9 percent of the Comparisons.

Abnormalities increased with age (p=0.001); 0.4 percent of those born in or after 1942 were abnormal, 2.1 percent of those born between 1923 and 1941, and 4.9 percent of those born in or before 1922. A significant association (p=0.007) was also detected between femoral pulse abnormalities and cholesterol-HDL ratio (0.6% of the individuals with ratios <4.2 were abnormal, compared to 2.5% of the individuals with ratios 4.2-5.5, and 1.2% of the individuals with ratios >5.5). Type B personalities also had significantly more abnormalities than Type A personalities (2.2% vs. 0.6%, p=0.008).

The relative risk remained statistically significant after adjustment for covariates (Adj. RR: 2.52, 95% C.I.: [1.15,5.56], p=0.018). Significant covariate effects in the adjusted model were age (p<0.001), percent body fat (p=0.006), and personality type (p=0.003).

Popliteal Pulses

There was no statistically significant difference between the two groups in the presence of popliteal pulses (p=0.304), based on the unadjusted analysis.

Significant covariate associations included age (p=0.003), lifetime cigarette smoking history (p<0.001), current cigarette smoking (p<0.001), lifetime alcohol history (p=0.011), percent body fat (p<0.001), and personality type (p=0.004). The percent with abnormal popliteal pulses increased with age (1.8%, 3.5%, and 8.2% in those born in or after 1942, between 1923 and 1941, and in or before 1922, respectively) and lifetime cigarette smoking history (0.4%, 2.5%, and 4.8% in nonsmokers, moderate lifetime smokers, and heavy lifetime smokers, respectively). Former smokers, moderate current smokers, and heavy current smokers all had a higher percent abnormal than nonsmokers (3.5%, 4.8%, and 4.0%, respectively, vs. 0.4%). The percent abnormal also increased with lifetime alcohol history (0.6%, 2.5%, and 4.7% in nondrinkers, moderate lifetime drinkers, and heavy lifetime drinkers, respectively). Two of seven (28.6%) lean individuals were abnormal, compared to 2.6 percent and 3.7 percent in normal and obese individuals, respectively. Type B individuals had a greater percent abnormal than Type A individuals (4.1% vs. 1.7%).

Adjusted analysis of the popliteal pulses detected significant age (p=0.005), lifetime cigarette smoking (p=0.004), and personality type (p=0.003) effects, but no significant group difference (p=0.433).

Dorsalis Pedis Pulses

There was a borderline significant difference between the Ranch Hand and Comparison groups in the percentage of participants with abnormal dorsalis pedis pulses, based on the unadjusted analysis (Ranch Hands: 12.4% vs. Comparisons: 9.8%, Est. RR: 1.30, 95% C.I.: [0.98,1.72], p=0.071).

Dorsalis pedis pulse abnormalities were significantly associated with age (p=0.001) and occupation (p=0.001). Abnormalities increased with age (8.6% in those born in or after 1942, 12.4% in those born between 1923 and 1941, and 21.3% in those born in or before 1922). Enlisted flyers had the highest percent abnormal (16.4%), followed by enlisted groundcrew (10.7%) and officers (8.8%).

Adjusted analysis revealed significant age (p<0.001) and occupation (p<0.001) effects; the adjusted relative risk was similar to the unadjusted value and remained borderline significant (Adj. RR: 1.29, 95% C.I.: [0.97,1.72], p=0.078).

Posterior Tibial Pulses

Without adjustment for covariates, the percentage of individuals with abnormal posterior tibial pulses was not significantly different in the two groups (p=0.240).

Significant covariate associations included age (p<0.001), lifetime cigarette smoking history (p=0.007), current cigarette smoking (p=0.005), lifetime alcohol history (p=0.011), percent body fat (p=0.009), and personality type (p=0.028). The prevalence of abnormalities increased with age (1.5% in those born in or after 1942, 3.6% in those born between 1923 and 1941, and 13.1% in those born in or before 1922) and lifetime cigarette

smoking history (1.4% in nonsmokers, 2.5% in moderate lifetime cigarette smokers, and 4.2% in heavy lifetime cigarette smokers). Moderate current smokers had the highest percent abnormal (5.4%), followed by heavy current smokers (4.0%), former smokers (2.6%), and nonsmokers (1.4%). Abnormalities increased with lifetime alcohol history (1.2% in nondrinkers, 2.4% in moderate lifetime drinkers, and 4.9% in heavy lifetime drinkers). Abnormalities were detected in 14.3 percent of lean individuals and 3.4 percent of normal individuals, but in only 0.8 percent of obese individuals. Type B personalities had a higher percent abnormal than Type A personalities (3.9% vs. 2.0%).

The adjusted analyses detected a highly significant group-by-differential cortisol interaction ($p=0.004$), as well as significant age ($p<0.001$), race ($p=0.037$), current cigarette smoking ($p=0.021$), percent body fat ($p=0.002$), and personality type ($p=0.028$) effects. Upon stratification by differential cortisol (Appendix L, Table L-2), there was little difference between the Ranch Hand and Comparison groups in those with differential cortisol response of less than or equal to 0.6, but a significantly higher risk was found in those with differential cortisol of between 0.6 and 4.0 (Adj. RR: 3.04, 95% C.I.: [1.06,8.68], $p=0.030$). The relative risk was less than 1 (not statistically significant) in those with differential cortisol response of greater than 4.0.

Leg Pulses

Based on the unadjusted analysis, the Ranch Hands had significantly more aggregate leg pulse abnormalities (15.3%) than the Comparisons (12.2%) (Est. RR: 1.30, 95% C.I.: [1.00,1.67], $p=0.049$).

Leg pulse abnormalities were significantly associated with age ($p<0.001$), occupation ($p=0.001$), lifetime cigarette smoking history ($p=0.012$), current cigarette smoking ($p=0.033$), cholesterol-HDL ratio ($p=0.045$), and personality type ($p=0.007$). The percent abnormal increased with age (10.2%, 14.4%, and 29.5% in those born in or after 1942, born between 1923 and 1941, and born in or before 1922, respectively). Enlisted flyers had the highest percent abnormal (19.6%), followed by enlisted groundcrew (13.4%) and officers (11.1%). The percent abnormal increased with lifetime cigarette smoking history (10.5%, 12.9%, and 15.9% in nonsmokers, moderate lifetime smokers, and heavy lifetime smokers, respectively). Moderate current smokers had the highest percent abnormal (17.4%), heavy current smokers the second highest (14.5%), former smokers the third highest (13.7%), and nonsmokers the lowest (10.5%) percent abnormal. Abnormalities also increased with increasing cholesterol-HDL ratio (11.1%, 14.6%, and 15.6% in participants with ratios ≤ 4.2, 4.2-5.5, and >5.5, respectively). Type B personalities had a higher percent abnormal than Type A personalities (15.8% vs. 11.4%).

The adjusted analysis detected significant age ($p<0.001$), occupation ($p<0.001$), and personality type effects ($p=0.030$). The adjusted relative risk was of borderline significance (Adj. RR: 1.27, 95% C.I.: [0.97,1.66], $p=0.079$).

Peripheral Pulses

The Ranch Hands had a higher percentage of aggregate peripheral pulse abnormalities (15.4%) than the Comparisons (12.7%); the unadjusted relative risk was of borderline significance (Est. RR: 1.26, 95% C.I.: [0.97,1.62], p=0.082).

Significant covariate effects included age (p<0.001), occupation (p=0.001), lifetime cigarette smoking history (p=0.008), current cigarette smoking (p=0.023), cholesterol-HDL ratio (p=0.044), and personality type (p=0.009). Peripheral pulse abnormalities increased with age (10.4%, 15.9%, and 29.5% in those born in or after 1942, born between 1923 and 1941, and born in or before 1922, respectively). Enlisted flyers had the highest percent abnormal (19.9%), followed by enlisted groundcrew (13.7%) and officers (11.4%). Abnormalities increased with lifetime cigarette smoking history (10.7%, 13.0%, and 16.4% in nonsmokers, moderate lifetime smokers, and heavy lifetime smokers, respectively). Moderate current cigarette smokers had the highest percent abnormal (18.0%), followed by heavy current cigarette smokers (14.5%), former smokers (14.1%), and nonsmokers (10.7%). The percent abnormal increased with cholesterol-HDL ratio (11.4%, 14.8%, and 15.9% in individuals with ratios $\leq$4.2, 4.2-5.5, and >5.5, respectively). Type B personalities had a higher percent abnormal than Type A personalities (16.1% vs. 11.8%).

The adjusted analysis detected significant age (p<0.001), occupation (p<0.001), and personality type (p=0.035) effects, but the adjusted relative risk was not statistically significant (p=0.129).

All Pulses

The number of individuals with abnormal pulses of any kind was the same as that for peripheral pulses. The results of analyses of all pulses differed from that of peripheral pulse only as a result of missing values in two cases. Thus, the unadjusted relative risk was also of borderline significance here (p=0.081); the same covariate effects were detected as in the peripheral pulse analysis (in the same directions); and the adjusted relative risk was not statistically significant (p=0.130).

Association Between Cardiovascular Examination Findings and Verified Essential Hypertension, Verified Heart Disease, and Verified Myocardial Infarction

The major central and peripheral physical examination findings were cross-tabulated with the verified cardiovascular disease endpoints to assess the degree of correlation between the fifth-year followup physical examination and the past medical history. The results are shown in Table L-3 of Appendix L.

There were highly statistically significant associations between verified essential hypertension and systolic blood pressure (p<0.001), diastolic blood pressure (p<0.001), overall ECG findings (p<0.001), heart sounds (p<0.001), funduscopic abnormalities (p<0.001), and peripheral pulses (p=0.001); and a borderline significant association with carotid bruits (p=0.064). These were all in a positive direction, i.e., individuals with abnormal physical findings

were more likely to have had a history of essential hypertension than those with normal physical findings.

Verified heart disease was significantly and positively associated with overall ECG findings ($p<0.001$), heart sounds ($p<0.001$), and carotid bruits ($p=0.010$). No significant association was detected between verified heart disease and systolic or diastolic blood pressure, funduscopic abnormalities, or peripheral pulses.

Finally, the verified occurrence of myocardial infarction was significantly associated with systolic blood pressure ($p=0.003$), ECG abnormalities ($p<0.001$), abnormal heart sounds ($p<0.001$), carotid bruits ($p=0.004$), and peripheral pulses ($p=0.002$). Again, these associations were all positive, i.e., the percent of individuals with a verified myocardial infarction was greater in those with abnormal physical examination findings than in those with normal physical parameters. The association between verified myocardial infarction and diastolic blood pressure was not statistically significant, nor was the association between verified myocardial infarction and funduscopic abnormalities.

The consistency between the physical examination findings and the past medical history exhibited by these associations supports the validity of the cardiovascular measurements, whether by medical records, physician assessments (e.g., heart sounds), or objective determinations (e.g., ECG).

Exposure Index Analyses

The frequency distributions for each cardiovascular variable at each level of the exposure index (low, medium, and high) within the Ranch Hand group are presented in Table 15-9. For systolic and diastolic blood pressure, means and 95 percent confidence intervals are also given for each exposure level. Separate analyses were performed within each occupational stratum (officers, enlisted flyers, and enlisted groundcrew). A p-value for testing the overall hypothesis of equal frequency distributions (or means) across the three exposure levels is included, as well as estimated relative risks and p-values for medium versus low ("M vs. L") and high versus low ("H vs. L") contrasts, respectively.

The results of adjusted exposure index analyses for all variables are presented in Table 15-10. Covariates examined included those from the core analyses; however, when data were sparse, fewer covariates were considered.

The final interpretation of the exposure index data must await the reanalysis of the clinical data using the results of the serum dioxin assay. This report is expected in 1991.

Questionnaire Variables

Reported and Verified Essential Hypertension

Although the percentage of individuals with essential hypertension (all reported events were verified) was greatest in the high exposure-level

TABLE 15-9.

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index: Low		Medium		High		Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
Reported/ Verified Essential Hypertension*	Officer	n	113		111		106		Overall		0.446
		Number/%									
		Yes	33	29.2%	34	30.6%	39	36.8%	M vs. L	1.07 (0.60,1.90)	0.818
		No	80	70.8%	77	69.4%	67	63.2%	H vs. L	1.41 (0.80,2.49)	0.234
	Enlisted Flyer	n	52		53		51		Overall		0.247
		Number/%									
		Yes	19	36.5%	18	34.0%	25	49.0%	M vs. L	0.89 (0.40,1.99)	0.779
		No	33	63.5%	35	66.0%	26	51.0%	H vs. L	1.67 (0.76,3.68)	0.201
	Enlisted Groundcrew	n	133		140		119		Overall		0.977
		Number/%									
		Yes	43	32.3%	46	32.9%	40	33.6%	M vs. L	1.02 (0.62,1.70)	0.327
		No	90	67.7%	94	67.1%	79	66.4%	H vs. L	1.06 (0.63,1.70)	0.347
Reported Heart Disease (Excluding Hypertension)	Officer	n	113		111		106		Overall		0.145
		Number/%									
		Yes	57	50.4%	43	38.7%	42	39.6%	M vs. L	0.62 (0.36,1.06)	0.078
		No	56	49.6%	68	61.3%	64	60.4%	H vs. L	0.64 (0.38,1.10)	0.121
	Enlisted Flyer	n	52		53		51		Overall		0.941
		Number/%									
		Yes	22	42.3%	21	39.6%	20	39.2%	M vs. L	0.89 (0.41,1.95)	0.779
		No	30	57.7%	32	60.4%	31	60.8%	H vs. L	0.88 (0.40,1.93)	0.749
	Enlisted Groundcrew	n	133		140		119		Overall		0.371
		Number/%									
		Yes	48	36.1%	42	30.0%	45	37.8%	M vs. L	0.76 (0.46,1.26)	0.285
		No	85	63.9%	98	70.0%	74	62.2%	H vs. L	1.08 (0.64,1.80)	0.779

TABLE 15-9. (continued)

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index: Low		Exposure Index: Medium		Exposure Index: High		Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
Verified Heart Disease (Excluding Hypertension)	Officer	n	113		111		106		Overall		0.145
		Number/%									
		Yes	57	50.4%	43	38.7%	42	39.6%	M vs. L	0.62 (0.36,1.06)	0.078
		No	56	49.6%	68	61.3%	64	60.4%	H vs. L	0.64 (0.38,1.10)	0.121
	Enlisted Flyer	n	52		53		51		Overall		0.941
		Number/%									
		Yes	22	42.3%	21	39.6%	20	39.2%	M vs. L	0.89 (0.41,1.95)	0.779
		No	30	57.7%	32	60.4%	31	60.8%	H vs. L	0.88 (0.40,1.93)	0.749
	Enlisted Groundcrew	n	133		140		119		Overall		0.278
		Number/%									
		Yes	48	36.1%	40	28.6%	44	37.0%	M vs. L	0.71 (0.43,1.18)	0.184
		No	85	63.9%	100	71.4%	75	63.0%	H vs. L	1.04 (0.62,1.74)	0.881
Reported/ Verified Myocardial Infarction*	Officer	n	113		111		106		Overall		0.568[a]
		Number/%									
		Yes	3	2.6%	6	5.4%	4	3.8%	M vs. L	2.10 (0.51,8.59)	0.303
		No	110	97.4%	105	94.6%	102	96.2%	H vs. L	1.44 (0.31,6.58)	0.638
	Enlisted Flyer	n	52		53		51		Overall		0.676[a]
		Number/%									
		Yes	4	7.7%	4	7.6%	2	3.9%	M vs. L	0.98 (0.23,4.14)	0.984
		No	48	92.3%	49	92.4%	49	96.1%	H vs. L	0.49 (0.09,2.80)	0.424
	Enlisted Groundcrew	n	133		140		119		Overall		0.644
		Number/%									
		Yes	6	4.5%	4	2.9%	6	5.0%	M vs. L	0.62 (0.17,2.26)	0.472
		No	127	95.5%	136	97.1%	113	95.0%	H vs. L	1.12 (0.35,3.58)	0.841

TABLE 15-9. (continued)

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index: Low	Exposure Index: Medium	Exposure Index: High	Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
Systolic Blood Pressure	Officer	n	113	111	106	Overall		0.735
		Mean	125.46	127.25	126.02	M vs. L	—	0.443
		95% C.I.	(122.63, 128.29)	(123.92, 130.58)	(122.40, 129.64)	H vs. L	—	0.813
		Number/%				Overall		0.743
		Abnormal	18 15.9%	19 17.1%	21 19.8%	M vs. L	1.09 (0.54,2.21)	0.810
		Normal	95 84.1%	92 82.9%	85 80.2%	H vs. L	1.30 (0.65,2.61)	0.453
	Enlisted Flyer	n	52	53	51	Overall		0.037
		Mean	124.14	128.79	133.55	M vs. L	—	0.197
		95% C.I.	(119.13, 129.14)	(124.75, 132.84)	(127.69, 139.41)	H vs. L	—	0.010
		Number/%				Overall		0.132
		Abnormal	9 17.3%	11 20.8%	17 33.3%	M vs. L	1.25 (0.47,3.33)	0.653
		Normal	43 82.7%	42 79.2%	34 66.7%	H vs. L	2.39 (0.95,6.02)	0.064
	Enlisted Groundcrew	n	133	140	119	Overall		0.752
		Mean	126.23	127.79	127.14	M vs. L	—	0.453
		95% C.I.	(123.48, 128.97)	(124.74, 130.83)	(124.15, 130.14)	H vs. L	—	0.672
		Number/%				Overall		0.802
		Abnormal	23 17.3%	28 20.0%	24 20.2%	M vs. L	1.20 (0.65,2.20)	0.569
		Normal	110 82.7%	112 80.0%	95 79.8%	H vs. L	1.21 (0.64,2.28)	0.562

TABLE 1 (continued)

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index Low		Exposure Index Medium		Exposure Index High		Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
Heart Sounds	Officer	n	113		111		106		Overall		0.568[a]
		Number/%									
		Abnormal	5	4.4%	4	3.6%	2	1.9%	M vs. L	0.81 (0.21,3.09)	0.757
		Normal	108	95.6%	107	96.4%	104	98.1%	H vs. L	0.42 (0.08,2.19)	0.298
	Enlisted Flyer	n	52		53		51		Overall		0.114[a]
		Number/%									
		Abnormal	4	7.7%	0	0.0%	4	7.8%	M vs. L	—	0.114
		Normal	48	92.3%	53	100.0%	47	92.2%	H vs. L	1.02 (0.24,4.32)	0.976
	Enlisted Groundcrew	n	133		140		119		Overall		0.137[a]
		Number/%									
		Abnormal	7	5.3%	2	1.4%	7	5.9%	M vs. L	0.26 (0.05,1.28)	0.097
		Normal	126	94.7%	138	98.6%	112	94.1%	H vs. L	1.12 (0.38,3.31)	0.834
ECG-Overall	Officer	n	113		111		106		Overall		0.798
		Number/%									
		Abnormal	18	15.9%	21	18.9%	17	16.0%	M vs. L	1.23 (0.62,2.46)	0.555
		Normal	95	84.1%	90	81.1%	89	84.0%	H vs. L	1.01 (0.49,2.08)	0.984
	Enlisted Flyer	n	52		53		51		Overall		0.659
		Number/%									
		Abnormal	10	19.2%	13	24.5%	9	17.6%	M vs. L	1.36 (0.54,3.46)	0.516
		Normal	42	80.8%	40	75.5%	42	82.4%	H vs. L	0.90 (0.33,2.44)	0.834
	Enlisted Groundcrew	n	133		140		119		Overall		0.842
		Number/%									
		Abnormal	18	13.5%	16	11.4%	16	13.4%	M vs. L	0.82 (0.40,1.69)	0.596
		Normal	115	86.5%	124	88.6%	103	86.6%	h vs. L	0.99 (0.48,2.05)	0.984

TABLE 15-9. (continued)

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index Low		Exposure Index Medium		Exposure Index High		Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
RBBB	Officer	n	113		111		106		Overall		0.372[a]
		Number/%									
		Abnormal	0	0.0%	1	0.9%	0	0.0%	M vs. L	—	0.991
		Normal	113	100.0%	110	99.1%	106	100.0%	H vs. L	—	—
	Enlisted Flyer	n	52		53		51		Overall		0.594[a]
		Number/%									
		Abnormal	1	1.9%	0	0.0%	1	2.0%	M vs. L	—	0.990[a]
		Normal	51	98.1%	53	100.0%	50	98.0%	H vs. L	1.02 (0.06,16.76)	0.992
	Enlisted Groundcrew	n	133		140		119		Overall		0.317[a]
		Number/%									
		Abnormal	0	0.0%	0	0.0%	1	0.8%	M vs. L	—	—
		Normal	133	100.0%	140	100.0%	118	99.2%	H vs. L	—	0.944
LBBB	Officer	n	113		111		106		Overall		0.372[a]
		Number/%									
		Abnormal	0	0.0%	1	0.9%	0	0.0%	M vs. L	—	0.991
		Normal	113	100.0%	110	99.1%	106	100.0%	H vs. L	—	—
	Enlisted Flyer	n	52		53		51		Overall		—
		Number/%									
		Abnormal	0	0.0%	0	0.0%	0	0.0%	M vs. L	—	—
		Normal	52	100.0%	53	100.0%	51	100.0%	H vs. L	—	—
	Enlisted Groundcrew	n	133		140		119		Overall		—
		Number/%									
		Abnormal	0	0.0%	0	0.0%	0	0.0%	M vs. L	—	—
		Normal	133	100.0%	140	100.0%	119	100.0%	H vs. L	—	—

TABLE 15-9. (continued)

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index Low		Exposure Index Medium		Exposure Index High		Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
Nonspecific T-Waves	Officer	n	113		111		106		Overall		0.655
		Number/%									
		Abnormal	10	8.8%	14	12.6%	11	10.4%	M vs. L	1.49 (0.63,3.50)	0.363
		Normal	103	91.2%	97	87.4%	95	89.6%	H vs. L	1.19 (0.48,2.94)	0.704
	Enlisted Flyer	n	52		53		51		Overall		0.075
		Number/%									
		Abnormal	4	7.7%	12	22.6%	6	11.8%	M vs. L	3.51 (1.05,11.73)	0.041
		Normal	48	92.3%	41	77.4%	45	88.2%	H vs. L	1.60 (0.42,6.04)	0.490
	Enlisted Groundcrew	n	133		140		119		Overall		0.792
		Number/%									
		Abnormal	13	9.8%	11	7.9%	12	10.1%	M vs. L	0.79 (0.34,1.82)	0.575
		Normal	120	90.2%	129	92.1%	107	89.9%	H vs. L	1.04 (0.45,2.37)	0.936
Bradycardia	Officer	n	113		111		106		Overall		0.082
		Number/%									
		Abnormal	11	9.7%	4	3.6%	4	3.8%	M vs. L	0.35 (0.11,1.12)	0.077
		Normal	102	90.3%	107	96.4%	102	96.2%	H vs. L	0.36 (0.11,1.18)	0.093
	Enlisted Flyer	n	52		53		51		Overall		0.569[a]
		Number/%									
		Abnormal	3	5.8%	3	5.7%	1	2.0%	M vs. L	0.98 (0.19,5.09)	0.984
		Normal	49	94.2%	50	94.3%	50	98.0%	H vs. L	0.33 (0.03,3.25)	0.342
	Enlisted Groundcrew	n	133		140		119		Overall		0.333[a]
		Number/%									
		Abnormal	6	4.5%	3	2.1%	2	1.7%	M vs. L	0.46 (0.11,1.89)	0.285
		Normal	127	95.5%	137	97.9%	117	98.3%	H vs. L	0.36 (0.07,1.83)	0.219

TABLE 15-9. (continued)

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index: Low		Exposure Index: Medium		Exposure Index: High		Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
Tachycardia	Officer	n	113		111		106		Overall		—
		Number/%									
		Abnormal	0	0.0%	0	0.0%	0	0.0%	M vs. L	—	—
		Normal	113	100.0%	111	100.0%	106	100.0%	H vs. L	—	—
	Enlisted Flyer	n	52		53		51		Overall		—
		Number/%									
		Abnormal	0	0.0%	0	0.0%	0	0.0%	M vs. L	—	—
		Normal	52	100.0%	53	100.0%	51	100.0%	H vs. L	—	—
	Enlisted Groundcrew	n	133		140		119		Overall		—
		Number/%									
		Abnormal	0	0.0%	0	0.0%	0	0.0%	M vs. L	—	—
		Normal	133	100.0%	140	100.0%	119	100.0%	H vs. L	—	—
Arrhythmia	Officer	n	113		111		106		Overall		0.427
		Number/%									
		Abnormal	7	6.2%	3	2.7%	6	5.7%	M vs. L	0.42 (0.11,1.67)	0.219
		Normal	106	93.8%	108	97.3%	100	94.3%	H vs. L	0.91 (0.30,2.80)	0.865
	Enlisted Flyer	n	52		53		51		Overall		0.002[a]
		Number/%									
		Abnormal	0	0.0%	0	0.0%	6	11.8%	M vs. L	—	—
		Normal	52	100.0%	53	100.0%	45	88.2%	H vs. L	—	0.025
	Enlisted Groundcrew	n	133		140		119		Overall		0.664
		Number/%									
		Abnormal	7	5.3%	5	3.6%	7	5.9%	M vs. L	0.67 (0.21,2.15)	0.497
		Normal	126	94.7%	135	96.4%	112	94.1%	H vs. L	1.12 (0.38,3.31)	0.834

TABLE 15-9. (continued)

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index: Low		Exposure Index: Medium		Exposure Index: High		Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
EOG-Other Diagnoses	Officer	n	113		111		106		Overall		0.359
		Number/%									
		Abnormal	25	22.1%	26	23.4%	17	16.0%	M vs. L	1.08 (0.58,2.01)	0.818
		Normal	88	77.9%	85	76.6%	89	84.0%	H vs. L	0.67 (0.34,1.33)	0.254
	Enlisted Flyer	n	52		53		51		Overall		0.233
		Number/%									
		Abnormal	11	21.2%	13	24.5%	6	11.8%	M vs. L	1.21 (0.49,3.02)	0.682
		Normal	41	78.8%	40	75.5%	45	88.2%	H vs. L	0.50 (0.17,1.46)	0.204
	Enlisted Groundcrew	n	133		140		119		Overall		0.787
		Number/%									
		Abnormal	21	15.8%	23	16.4%	16	13.4%	M vs. L	1.05 (0.55,2.00)	0.889
		Normal	112	84.2%	117	83.6%	103	86.6%	H vs. L	0.83 (0.41,1.67)	0.603

TABLE 15-9. (continued)

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index: Low	Exposure Index: Medium	Exposure Index: High	Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
Diastolic Blood Pressure	Officer	n	113	111	106	Overall		0.553
		Mean	74.82	74.20	75.58	M vs. L	—	0.619
		95% C.I.	(73.14,76.51)	(72.59,75.81)	(73.62,77.55)	H vs. L	—	0.549
		Number/%				Overall		0.014[a]
		Abnormal	2 1.8%	2 1.8%	9 8.5%	M vs. L	1.02 (0.14,7.36)	0.984
		Normal	111 98.2%	109 98.2%	97 91.5%	H vs. L	5.15 (1.09,24.42)	0.039
	Enlisted Flyer	n	52	53	51	Overall		0.498
		Mean	74.94	77.30	75.78	M vs. L	—	0.245
		95% C.I.	(72.49,77.39)	(74.32,80.28)	(72.81,78.76)	H vs. L	—	0.680
		Number/%				Overall		0.356[a]
		Abnormal	2 3.8%	6 11.3%	4 7.8%	M vs. L	3.19 (0.61,16.60)	0.168
		Normal	50 96.2%	47 88.7%	47 92.2%	H vs. L	2.13 (0.37,12.16)	0.395
	Enlisted Groundcrew	n	133	140	119	Overall		0.266
		Mean	74.86	76.05	74.29	M vs. L	—	0.273
		95% C.I.	(73.45,76.28)	(74.61,77.49)	(72.54,76.05)	H vs. L	—	0.612
		Number/%				Overall		0.285
		Abnormal	3 2.3%	8 5.7%	7 5.9%	M vs. L	2.63 (0.68,10.12)	0.162
		Normal	130 97.7%	132 94.3%	112 94.1%	H vs. L	2.71 (0.68,10.72)	0.156

TABLE 9. (continued)

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index: Low		Exposure Index: Medium		Exposure Index: High		Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
Funduscopic Examination	Officer	n	113		111		106		Overall		0.364[a]
		Number/%									
		Abnormal	0	0.0%	2	1.8%	1	0.9%	M vs. L	—	0.489
		Normal	113	100.0%	109	98.2%	105	99.1%	H vs. L	—	0.968
	Enlisted Flyer	n	52		53		51		Overall		0.366[a]
		Number/%									
		Abnormal	1	1.9%	0	0.0%	0	0.0%	M vs. L	—	0.990
		Normal	51	98.1%	53	100.0%	51	100.0%	H vs. L	—	0.999
	Enlisted Groundcrew	n	133		140		119		Overall		0.164
		Number/%									
		Abnormal	0	0.0%	2	1.4%	0	0.0%	M vs. L	—	0.524
		Normal	133	100.0%	138	98.6%	119	100.0%	H vs. L	—	—
Carotid Bruits	Officer	n	113		111		106		Overall		0.382[a]
		Number/%									
		Abnormal	1	0.9%	0	0.0%	0	0.0%	M vs. L	—	0.999
		Normal	112	99.1%	111	100.0%	106	100.0%	H vs. L	—	0.999
	Enlisted Flyer	n	52		53		51		Overall		0.348[a]
		Number/%									
		Abnormal	2	3.8%	0	0.0%	2	3.9%	M vs. L	—	0.486
		Normal	50	96.2%	53	100.0%	49	96.1%	H vs. L	1.02 (0.14,7.53)	0.984
	Enlisted Groundcrew	n	133		140		119		Overall		0.123[a]
		Number/%									
		Abnormal	1	0.8%	0	0.0%	3	2.5%	M vs. L	—	0.974
		Normal	132	99.2%	140	100.0%	116	97.5%	H vs. L	3.41 (0.35,33.29)	0.289

TABLE 15-9. (continued)

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index: Low		Exposure Index: Medium		Exposure Index: High		Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
Radial Pulses	Officer	n	113		110		102		Overall		0.390[a]
		Number/%									
		Abnormal	1	0.9%	0	0.0%	0	0.0%	M vs. L	—	0.999
		Normal	112	99.1%	110	100.0%	102	100.0%	H vs. L	—	0.999
	Enlisted Flyer	n	50		52		50		Overall		—
		Number/%									
		Abnormal	0	0.0%	0	0.0%	0	0.0%	M vs. L	—	—
		Normal	50	100.0%	52	100.0%	50	100.0%	H Vs. L	—	—
	Enlisted Groundcrew	n	131		140		117		Overall		0.374[a]
		Number/%									
		Abnormal	1	0.8%	0	0.0%	0	0.0%	M vs. L	—	0.967
		Normal	130	99.2%	140	100.0%	117	100.0%	H vs. L	—	0.999
Femoral Pulses	Officer	n	113		110		102		Overall		0.078[a]
		Number/%									
		Abnormal	1	0.9%	4	3.6%	0	0.0%	M vs. L	4.23 (0.46,38.42)	0.201
		Normal	112	99.1%	106	96.4%	102	100.0%	H vs. L	—	0.999
	Enlisted Flyer	n	50		52		50		Overall		0.171[a]
		Number/%									
		Abnormal	1	2.0%	2	3.8%	5	10.0%	M vs. L	1.96 (0.17,22.32)	0.589
		Normal	49	98.0%	50	96.2%	45	90.0%	H vs. L	5.44 (0.61,48.42)	0.129
	Enlisted Groundcrew	n	131		140		117		Overall		0.652[a]
		Number/%									
		Abnormal	3	2.3%	2	1.4%	1	0.8%	M vs. L	0.62 (0.10,3.76)	0.603
		Normal	128	97.7%	138	98.6%	116	99.2%	H vs. L	0.37 (0.04,3.59)	0.390

TABLE 9. (continued)

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index Low		Exposure Index Medium		Exposure Index High		Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
Popliteal Pulses	Officer	n	113		110		102		Overall		0.247[a]
		Number/%									
		Abnormal	3	2.6%	3	2.7%	0	0.0%	M vs. L	1.03 (0.20,5.22)	0.976
		Normal	110	97.4%	107	97.3%	102	100.0%	H vs. L	—	0.287
	Enlisted Flyer	n	50		52		50		Overall		0.328[a]
		Number/%									
		Abnormal	2	4.0%	2	3.8%	5	10.0%	M vs. L	0.96 (0.13,7.09)	0.968
		Normal	48	96.0%	50	96.2%	45	90.0%	H vs. L	2.67 (0.49,14.44)	0.254
	Enlisted Groundcrew	n	131		140		117		Overall		0.697[a]
		Number/%									
		Abnormal	6	4.6%	5	3.6%	3	2.6%	M vs. L	0.77 (0.23,2.59)	0.674
		Normal	125	95.4%	135	96.4%	114	97.4%	H vs. L	0.55 (0.13,2.24)	0.069
Dorsalis Pedis Pulses	Officer	n	113		110		102		Overall		0.557
		Number/%									
		Abnormal	13	11.5%	8	7.3%	10	9.8%	M vs. L	0.60 (0.24,1.52)	0.285
		Normal	100	88.5%	102	92.7%	92	90.2%	H vs. L	0.84 (0.35,2.00)	0.689
	Enlisted Flyer	n	50		52		50		Overall		0.811
		Number/%									
		Abnormal	9	18.0%	9	17.3%	11	22.0%	M vs. L	0.95 (0.34,2.64)	0.928
		Normal	41	82.0%	43	82.7%	39	78.0%	H vs. L	1.28 (0.48,3.44)	0.617
	Enlisted Groundcrew	n	130		140		117		Overall		0.689
		Number/%									
		Abnormal	18	13.8%	17	12.1%	12	10.3%	M vs. L	0.86 (0.42,1.75)	0.674
		Normal	112	86.2%	123	87.9%	105	89.7%	H vs. L	0.71 (0.33,1.55)	0.390

TABLE 15-9. (continued)

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index Low		Exposure Index Medium		Exposure Index High		Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
Posterior Tibial Pulses	Officer	n	113		110		102		Overall		0.153[a]
		Number/%									
		Abnormal	4	3.5%	4	3.6%	0	0.0%	M vs. L	1.03 (0.25,4.22)	0.976
		Normal	109	96.5%	106	96.4%	102	100.0%	H vs. L	—	0.149
	Enlisted Flyer	n	50		52		50		Overall		0.654[a]
		Number/%									
		Abnormal	3	6.0%	3	5.8%	5	10.0%	M vs. L	0.96 (0.18,4.99)	0.960
		Normal	47	94.0%	49	94.2%	45	90.0%	H vs. L	1.74 (0.39,7.71)	0.465
	Enlisted Groundcrew	n	130		140		117		Overall		0.443[a]
		Number/%									
		Abnormal	5	3.8%	2	1.4%	4	3.4%	M vs. L	0.36 (0.07,1.90)	0.230
		Normal	125	96.2%	138	98.6%	113	96.6%	H vs. L	0.88 (0.23,3.38)	0.857
Leg Pulses	Officer	n	113		110		102		Overall		0.616
		Number/%									
		Abnormal	16	14.2%	14	12.7%	10	9.8%	M vs. L	0.88 (0.41,1.91)	0.757
		Normal	97	85.8%	96	87.3%	92	90.2%	H vs. L	0.66 (0.28,1.53)	0.332
	Enlisted Flyer	n	50		52		50		Overall		0.239
		Number/%									
		Abnormal	10	20.0%	10	19.2%	16	32.0%	M vs. L	0.95 (0.36,2.53)	0.920
		Normal	40	80.0%	42	80.8%	34	68.0%	H vs. L	1.88 (0.76,4.69)	0.174
	Enlisted Groundcrew	n	130		140		117		Overall		0.756
		Number/%									
		Abnormal	21	16.2%	20	14.3%	15	12.8%	M vs. L	0.86 (0.44,1.68)	0.667
		Normal	109	83.8%	120	85.7%	102	87.2%	H vs. L	0.76 (0.37,1.56)	0.459

TABLE [illegible]. (continued)

Unadjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index Low		Exposure Index Medium		Exposure Index High		Exposure Index Contrast	Est. Relative Risk (95% C.I.)	p-Value
Peripheral Pulses	Officer	n	113		110		102		Overall		0.616
		Number/%									
		Abnormal	16	14.2%	14	12.7%	10	9.8%	M vs. L	0.88 (0.41,1.91)	0.757
		Normal	97	85.8%	96	87.3%	92	90.2%	H vs. L	0.66 (0.28,1.53)	0.332
	Enlisted Flyer	n	50		52		50		Overall		0.239
		Number/%									
		Abnormal	10	20.0%	10	19.2%	16	32.0%	M vs. L	0.95 (0.36,2.53)	0.920
		Normal	40	80.0%	42	80.8%	34	68.0%	H vs. L	1.88 (0.76,4.69)	0.174
	Enlisted Groundcrew	n	130		140		117		Overall		0.651
		Number/%									
		Abnormal	22	16.9%	20	14.3%	15	12.8%	M vs. L	0.82 (0.42,1.58)	0.549
		Normal	108	83.1%	120	85.7%	102	87.2%	H vs. L	0.72 (0.36,1.47)	0.368
All Pulses	Officer	n	112		110		102		Overall		0.603
		Number/%									
		Abnormal	16	14.3%	14	12.7%	10	9.8%	M vs. L	0.88 (0.40,1.89)	0.734
		Normal	96	85.7%	96	87.3%	92	90.2%	H vs. L	0.65 (0.28,1.51)	0.317
	Enlisted Flyer	n	50		52		50		Overall		0.239
		Number/%									
		Abnormal	10	20.0%	10	19.2%	16	32.0%	M vs. L	0.95 (0.36,2.53)	0.920
		Normal	40	80.0%	42	80.8%	34	68.0%	H vs. L	1.88 (0.76,4.69)	0.174
	Enlisted Groundcrew	n	130		140		117		Overall		0.651
		Number/%									
		Abnormal	22	16.9%	20	14.3%	15	12.8%	M vs. L	0.82 (0.42,1.58)	0.549
		Normal	108	83.1%	120	85.7%	102	87.2%	H vs. L	0.72 (0.36,1.47)	0.368

*No conditions reported that were not verified; therefore, reported and verified analyses are the same.
[a]Small cell size may affect validity of p-value.
—Estimated relative risk not applicable for continuous analysis of a variable; estimated relative risk/confidence interval/p-value not given due to cells with zero frequency.

TABLE 15-10.

Adjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index Low	Exposure Index Medium	Exposure Index High	Exposure Index Contrast	Adj. Relative Risk (95% C.I.)	p-Value
Reported/ Verified Essential Hypertension*	Officer	n	111	109	104	Overall		0.465
						M vs. L	0.88 (0.47,1.65)	0.682
						H vs. L	1.27 (0.69,2.33)	0.441
	Enlisted Flyer	n	51	52	51	Overall		0.457
						M vs. L	0.87 (0.37,2.07)	0.757
						H vs. L	1.48 (0.63,3.48)	0.373
	Enlisted Groundcrew	n	129	138	117	Overall		0.545
						M vs. L	1.34 (0.76,2.36)	0.156
						H vs. L	1.30 (0.72,2.33)	0.384
Reported Heart Disease (Excluding Hypertension)	Officer	n	113	111	106	Overall		0.040
						M vs. L	0.52 (0.30,0.90)	0.019
						H vs. L	0.57 (0.33,1.00)	0.082
	Enlisted Flyer	n	52	53	51	Overall		0.891
						M vs. L	0.90 (0.40,2.01)	0.795
						H vs. L	0.82 (0.37,1.83)	0.631
	Enlisted Groundcrew	n	133	140	119	Overall		0.575
						M vs. L	0.84 (0.50,1.42)	0.509
						H vs. L	1.11 (0.66,1.89)	0.689

TABLE 15-10. (continued)

Adjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index			Exposure Index Contrast	Adj. Relative Risk (95% C.I.)	p-Value
			Low	Medium	High			
Verified Heart Disease (Excluding Hypertension)	Officer	n	113	111	106	Overall		0.040
						M vs. L	0.52 (0.30,0.90)	0.019
						H vs. L	0.57 (0.33,1.00)	0.082
	Enlisted Flyer	n	52	53	51	Overall		0.891
						M vs. L	0.90 (0.40,2.01)	0.795
						H vs. L	0.82 (0.37,1.83)	0.631
	Enlisted Groundcrew	n	133	140	119	Overall		0.442
						M vs. L	0.77 (0.45,1.30)	0.332
						H vs. L	1.08 (0.63,1.82)	0.787
Reported/ Verified Myocardial Infarction*	Officer	n	112	111	104	Overall		0.665
						M vs. L	2.02 (0.41,9.88)	0.384
						H vs. L	1.65 (0.32,8.51)	0.549
	Enlisted Flyer	n	52	53	51	Overall		0.713
						M vs. L	1.00 (0.23,4.35)	0.992
						H vs. L	0.52 (0.09,3.07)	0.472
	Enlisted Groundcrew	n	132	138	119	Overall		0.831
						M vs. L	0.90 (0.20,4.02)	0.897
						H vs. L	1.38 (0.36,5.35)	0.638

TABLE 15-10. (continued)

Adjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index			Exposure Index Contrast	Adj. Relative Risk (95% C.I.)	p-Value
			Low	Medium	High			
Systolic Blood Pressure	Officer	n	100	107	98	Overall		0.786
		Adj. Mean	129.39	131.03	130.00	M vs. L	—	0.495
		95% C.I.	(121.17, 137.61)	(123.16, 138.90)	(121.85, 138.15)	H vs. L	—	0.803
		n	103	107	99	Overall		0.700
						M vs. L	0.92 (0.43,1.96)	0.818
						H vs. L	1.25 (0.59,2.62)	0.562
	Enlisted Flyer	n	50	53	49	Overall		0.181
		Adj. Mean	126.79	130.16	133.35	M vs. L	—	0.357
		95% C.I.	(117.67, 135.92)	(122.03, 138.29)	(124.75, 141.96)	H vs. L	—	0.065
		n	50	53	49	Overall		0.430
						M vs. L	1.27 (0.44,3.67)	0.660
						H vs. L	1.91 (0.70,5.21)	0.208
	Enlisted Groundcrew	n	128	132	111	Overall		0.288
		Adj. Mean	129.52	132.79	130.66	M vs. L	—	0.120
		95% C.I.	(125.46, 133.59)	(128.57, 137.02)	(126.35, 134.97)	H vs. L	—	0.602
		n	128	134	111	Overall		0.573
						M vs. L	1.41 (0.73,2.72)	0.308
						H vs. L	1.28 (0.65,2.52)	0.478

TABLE 15-10. (continued)

Adjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index			Exposure Index Contrast	Adj. Relative Risk (95% C.I.)	p-Value
			Low	Medium	High			
Heart Sounds	Officer	n	113	111	106	Overall		0.491
						M vs. L	0.64 (0.16,2.51)	0.522
						H vs. L	0.38 (0.07,2.03)	0.258
	Enlisted Flyer	n	—	—	—	Overall		—
						M vs. L	—	—
						H vs. L	—	—
	Enlisted Groundcrew	n	133	140	119	Overall		0.258
						M vs. L	0.32 (0.06,1.60)	0.165
						H vs. L	0.99 (0.32,3.03)	0.984
ECG-Overall	Officer	n	113	111	106	Overall		0.920
						M vs. L	0.98 (0.47,2.03)	0.952
						H vs. L	0.87 (0.41,1.83)	0.704
	Enlisted Flyer	n	52	53	51	Overall		0.494
						M vs. L	1.39 (0.53,3.69)	0.503
						H vs. L	0.77 (0.27,2.15)	0.617
	Enlisted Groundcrew	n	131	135	112	Overall		0.975
						M vs. L	1.06 (0.48,2.36)	0.873
						H vs. L	1.09 (0.50,2.39)	0.826

TABLE 15-10. (continued)

Adjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index			Exposure Index Contrast	Adj. Relative Risk (95% C.I.)	p-Value
			Low	Medium	High			
Nonspecific T-Waves	Officer	n	113	111	106	Overall		0.883
						M vs. L	1.23 (0.50,3.02)	0.653
						H vs. L	1.03 (0.41,2.60)	0.952
	Enlisted Flyer	n	52	53	51	Overall		0.091
						M vs. L	3.22 (0.94,11.00)	0.063
						H vs. L	1.26 (0.32,4.97)	0.749
	Enlisted Groundcrew	n	133	140	119	Overall		0.975
						M vs. L	1.10 (0.45,2.70)	0.834
						H vs. L	1.01 (0.42,2.46)	0.976
Bradycardia	Officer	n	112	111	104	Overall		0.108**
						M vs. L	0.34 (0.10,1.14)**	0.082**
						H vs. L	0.37 (0.11,1.23)**	0.105**
	Enlisted Flyer	n	52	53	51	Overall		0.602
						M vs. L	0.85 (0.13,5.44)	0.865
						H vs. L	0.32 (0.03,3.75)	0.363
	Enlisted Groundcrew	n	132	138	119	Overall		0.369
						M vs. L	0.44 (0.10,1.82)	0.258
						H vs. L	0.39 (0.08,1.99)	0.254

TABLE 15-10. (continued)

Adjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index			Exposure Index Contrast	Adj. Relative Risk (95% C.I.)	p-Value
			Low	Medium	High			
Arrhythmia	Officer	n	102	108	101	Overall		0.325
						M vs. L	0.36 (0.09,1.48)	0.159
						H vs. L	0.75 (0.24,2.40)	0.631
	Enlisted Flyer	n	—	—	—	Overall		—
						M vs. L	—	—
						H vs. L	—	—
	Enlisted Groundcrew	n	131	134	114	Overall		0.967
						M vs. L	0.86 (0.26,2.90)	0.810
						H vs. L	0.99 (0.32,3.06)	0.992
ECG-Other Diagnoses	Officer	n	112	111	104	Overall		0.356**
						M vs. L	1.09 (0.56,2.14)**	0.803**
						H vs. L	0.67 (0.32,1.38)**	0.276**
	Enlisted Flyer	n	52	53	51	Overall		0.178
						M vs. L	1.27 (0.51,3.20)	0.610
						H vs. L	0.49 (0.16,1.44)	0.194
	Enlisted Groundcrew	n	133	140	119	Overall		0.566
						M vs. L	1.16 (0.60,2.25)	0.653
						H vs. L	0.79 (0.39,1.62)	0.529

TABLE 15-10. (continued)

Adjusted Exposure Index for Cardiovascular Variables by Occupation

Variable	Occupation	Statistic	Exposure Index			Exposure Index Contrast	Adj. Relative Risk (95% C.I.)	p-Value
			Low	Medium	High			
Diastolic Blood Pressure	Officer	n	100	107	98	Overall		0.537
		Adj. Mean	75.49	75.30	76.64	M vs. L	—	0.886
		95% C.I.	(71.02,79.95)	(71.02,79.57)	(72.22,81.07)	H vs. L	—	0.383
		n	101	107	101	Overall		0.017
						M vs. L	1.03 (0.14,7.62)	0.976
						H vs. L	5.53 (1.12,27.36)	0.036
	Enlisted Flyer	n	50	53	49	Overall		0.464
		Adj. Mean	75.32	76.98	74.45	M vs. L	—	0.428
		95% C.I.	(70.10,80.55)	(72.33,81.64)	(69.52,79.37)	H vs. L	—	0.665
		n	50	53	49	Overall		0.434
						M vs. L	2.88 (0.53,15.76)	0.222
						H vs. L	1.97 (0.32,12.30)	0.465
	Enlisted Groundcrew	n	128	132	111	Overall		0.304**
		Adj. Mean**	77.60	78.93	77.31	M vs. L	—	0.227**
		95% C.I.**	(75.46,79.74)	(76.71,81.16)	(75.04,79.58)	H vs. L	—	0.801**
		n	129	134	113	Overall		0.222
						M vs. L	2.74 (0.69,10.88)	0.150
						H vs. L	2.89 (0.70,1.81)	0.142