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12 PSYCHOLOGICAL ASSESSMENT

12.1 INTRODUCTION

12.1.1 Background

Signs of dioxin toxicity in animals (e.g., lethargy, stupor, poor coordination, lack of feeding, and agitation) have been observed in multiple studies in many species and have been attributed to the "wasting syndrome" of multi-organ toxicity rather than to primary central nervous system (CNS) involvement (1). Pharmacokinetic studies in rats (2), mice (3), and monkeys (4) have demonstrated that the blood brain barrier is relatively impermeable to dioxin, and experimental animal studies, therefore, provide little insight into the potential neuropsychological consequences of dioxin in humans.

In rats exposed to high doses of dioxin (1,000 micrograms intraperitoneally), only slight differences were noted in spontaneous motor activity and maze performance relative to controls (5). A more recent study from the same laboratory found no neurobehavioral impairment in rats given a sublethal dose of dioxin sufficient to cause the wasting syndrome (6). Experiments in monkeys have documented subtle behavioral dysfunction and cognitive impairment consequent to dioxin exposure in utero (7–10).

Using chloracne as a marker for high-level dioxin exposure, early studies of industrial chemical workers provided the first suggestion of associated psychological effects. Studies shortly after a Nitro, West Virginia, accident in 1949 documented nervousness, fatigue, irritability, cold intolerance, and decreased libido in many of the workers with chloracne. Most of these symptoms resolved over a 4-year period (11, 12). Two follow-up studies of expanded plant cohorts in 1979 noted a strong association between the occurrence of chloracne and insomnia (13, 14).

Other industrial-based studies reported a wide range of acute and subacute symptoms associated with exposure to chlorophenols. In addition to those cited above, impotence, reduced emotional responses, sensory deficits, reading difficulties, memory loss, and emotional instability have been described (15–20). Employing the Minnesota Multiphasic Personality Inventory (MMPI), one early study of chemical production workers found an association between the development of chloracne and hypomania and a significantly increased incidence of personality disorders in those most heavily exposed (19). Another report described marked personality changes in two of three chemists involved in the synthesis of dioxin (20). Yet another study of 55 Czechoslovakian workers found a significant incidence of anxiety and depression and of dementia associated with encephalopathy (7 percent) and neurasthenia (75 percent). Over a 10-year follow-up period, all symptoms of anxiety and depression had resolved (18).

Neuropsychiatric testing was included in the medical evaluations reported in two studies of 155 trailer park residents exposed to dioxin by contaminated soil in Quail Run, Missouri (21, 22). Relative to controls, exposed subjects had variations from the normal in the tension or anxiety and anger or hostility scales of the Profile of Mood States Inventory as well as in the vocabulary subtest of the Wechsler Adult Intelligence Scale (WAIS). No significant group differences in cognitive function were noted and, given the confounding role of the situational stress associated with exposure, the abnormalities noted could not be attributed to dioxin.

As one of the few epidemiological studies in humans to incorporate serum dioxin data into psychometric analyses, the National Institute for Occupational Safety and Health's study of chemical plant workers deserves special mention (23). This cross-sectional study of 281 workers in two industrial plants

investigated the association between exposure to chemicals (including dioxin) and symptoms of depression revealed by a battery of psychological screening tests (the Beck Depression Inventory and the depression subscale of the Symptom Checklist-90-Revised [SCL-90-R]). The mean serum dioxin level in the exposed cohort was 220 parts per trillion (ppt) versus 6 ppt in referents. By both scales, the prevalence of depression was comparable in each group. Of interest and consistent with numerous other reports, the self-perception of dioxin exposure was significantly associated with depressive symptoms, although the mean serum dioxin level in those thought to have been exposed (43 ppt) was significantly lower than that in the group reporting no such exposure (116 ppt).

The association between psychological symptoms and reported herbicide exposure during military service in Vietnam has been the subject of numerous studies. In one Veterans' Administration study of 153 veterans, a subgroup of 58 subjects reporting moderate to high herbicide exposure was compared to the remaining 95 patients reporting no or minimal exposure. After covariate adjustment, the self-reported exposed group had scores on the MMPI that indicated depression, poor morale, organic symptoms, family problems, and hypomania (24). Similar conclusions were reached in a more recent study of 7,924 United States Army veterans whose reported exposure to herbicides was a powerful predictor of a broad spectrum of negative mental and physical health outcomes (25).

Another large-scale study of 6,810 Vietnam veterans who belong to the American Legion found that, although perceived exposure to herbicides could not independently predict psychosocial outcomes, it was associated with such outcomes when combined with combat, indicating that a synergistic effect may have occurred (26).

Further evidence that service in Vietnam may be associated with psychological morbidity independent of exposure to herbicides is presented in the Vietnam Experience Study, conducted by the United States Centers for Disease Control and Prevention (27). This report, which included comprehensive psychological testing but did not include serum dioxin measurements, revealed an increased incidence of psychological dysfunction related to service in Vietnam, including depression (4.5 percent of Vietnam veterans versus 3.2 percent in non-Vietnam veterans), anxiety (4.9 percent versus 3.2 percent, respectively), and alcohol abuse or dependence (13.7 percent versus 9.2 percent, respectively).

Prior reports of the Air Force Health Study (AFHS) have revealed few statistically significant differences in the psychological indices between the Ranch Hand and Comparison cohorts (28–30). In the 1987 examinations, Ranch Hands demonstrated a greater level of depression, manifested more physical complaints (somatization), and felt more health-related anxiety than Comparisons (30).

12.1.2 Summary of Previous Analyses of the Air Force Health Study

12.1.2.1 1982 Baseline Study Summary Results

An extensive battery of psychological parameters was assessed on all participants during the 1982 baseline questionnaire and as part of the physical examination process. There were no questionnaire differences for past history of emotional or psychological illnesses between the Ranch Hand and Comparison groups. For the psychological indices of fatigue, anger, erosion of skills, anxiety, and severity of depression (as determined by a modification of the Diagnostic Interview Schedule), no group differences were detected among the college-educated Ranch Hands. For the high school-educated stratum, Ranch Hands demonstrated significantly more fatigue, anger, erosion of skills, and anxiety. An unadjusted analysis of reported depression showed significantly more depression in the Ranch Hands, as did the isolation index adjusted for educational level.

At the time of the physical examination, additional data were collected with the Cornell Index (CI) and the MMPI. The CNS functional testing was conducted by a modified Halstead-Reitan Battery (HRB) and intelligence was measured by the WAIS.

The CI showed a significant increase in psychophysiological symptoms in the high school-educated Ranch Hands. MMPI results in the high school-educated participants showed Ranch Hand mean values significantly increased in the scales of denial, hypochondria, masculinity-femininity, and mania-hypomania as contrasted to the college-educated participants. The social introversion scale was significantly decreased in the college-educated Ranch Hands. The effect of education was influential ($p<0.01$) in all scales of the MMPI. None of the self-reported data, including those from the in-home questionnaire, was adjusted for possible group differences in post-traumatic stress disorder (PTSD) or combat experience and intensity.

Performance testing by the HRB showed no neuropsychiatric impairment in the Ranch Hands in contrast to the results of the self-administered MMPI and the CI. The effect of education on the HRB testing was strong ($p<0.0001$). WAIS intelligence scores revealed group similarities in the full-scale and verbal and performance scales. As expected, the intelligence quotient (IQ) of college graduates was significantly higher than the IQ of high school graduates.

12.1.2.2 1985 Follow-up Study Summary Results

Two of the psychological tests (MMPI, HRB) conducted at the 1982 baseline examination were repeated at the first follow-up examination in 1985. An updated history of mental and emotional disorders and combat experience in Vietnam also was obtained on all participants. An indicator of PTSD was derived from a new MMPI subscale and was used for covariate adjustments of non-MMPI psychological data. The Cornell Medical Index (CMI) was substituted for the CI in the 1985 psychological assessment. Questionnaire data (verified by a medical records review) for the lifetime events of psychotic illness, alcohol dependence, anxiety, or other neuroses disclosed no significant differences between groups for these conditions.

The group distributions for the 14 MMPI variables, each stratified by the three occupational categories, were examined. Two of the 42 tests approached statistical significance (psychopathic deviate for enlisted flyers and mania/hypomania for officers). Ranch Hand enlisted flyers had a lower mean than Comparison enlisted flyers, and Ranch Hand officers had a higher mean than Comparison officers. The group distributions of the total CMI score were similarly contrasted, with separate analyses performed with stratification by the five covariates of age, race, occupation, education, and current alcohol drinking status. For one stratum of each of these covariates (born in or after 1942, non-Black, enlisted groundcrew, high school education, and current alcohol drinker), a significant difference in the distribution of the Ranch Hand and Comparison scores was found. In all cases for the CMI, the Ranch Hand mean was greater than the Comparison mean.

The unadjusted analyses showed a significant difference for the MMPI scales of denial ($p<0.001$) and masculinity-femininity ($p=0.017$), the total CMI ($p<0.001$), and the Section A-H area subscore ($p=0.003$). A marginally significant difference was observed for the MMPI scales of hysteria ($p=0.067$) and social introversion ($p=0.069$). Comparisons had a greater percentage of abnormal scores for the denial and masculinity-femininity scales, whereas Ranch Hands showed adverse findings for the total CMI, the Section A-H area subscore, hysteria, and social introversion.

The adjusted analyses were generally similar to the unadjusted analyses with respect to group differences. The MMPI scales of denial and masculinity-femininity were statistically significant in both the adjusted and unadjusted analyses, where Comparisons showed an adverse effect over Ranch Hands. The A-H

subscore of the CMI (suggesting diffuse medical problems) also was significant, where Ranch Hands had higher mean scores than Comparisons, suggesting that Ranch Hands had more illness. The M-R subscore of the CMI, a broad indicator of emotional health, was not statistically different between the two groups.

The HRB impairment index, a measure of CNS functional integrity, did not differ significantly between the Ranch Hand and Comparison groups. Strong covariates in the adjusted analysis were age, race, and education.

Because of alternate statistical models and slightly different psychological testing parameters, a direct contrast between the psychological results of the baseline and 1985 follow-up examinations was not always possible. Several broad patterns were observed: the discordance between distributional tests and results from traditional statistical models of the MMPI variables was noted with data from both examinations; there was a narrowing of group differences at the 1985 follow-up examination for most variables, either by a decrease in Ranch Hand reporting or by an increase in Comparison reporting; and as at the baseline examination, functional CNS testing, as measured by the HRB impairment index, showed no group differences and did not support an organic basis for differences in self-reported symptomatology. The longitudinal analysis of two MMPI scales—depression and denial—showed a significant reversal of depression seen at the baseline examination in the high school-educated Ranch Hands. The number of depression abnormalities decreased in Ranch Hands and increased in Comparisons.

The determination of PTSD in both Air Force cohorts by a relatively new MMPI scale showed a prevalence rate of less than 1 percent. This low rate was strongly influenced by characteristics of the study population (e.g., age, education, and military occupation).

In conclusion, significant test results were present in both groups or were noted in specific subgroups of a covariate. Educational level, age, and alcohol use showed strong effects on the psychological scales and scores in this psychological assessment. Tests of the CNS by the HRB demonstrated a similar prevalence of abnormality in both groups. Ranch Hands exhibited an increased mean A-H subscore of the CMI, suggesting they had more illness than Comparisons.

12.1.2.3 1987 Follow-up Study Summary Results

The psychological assessment was based on verified psychological disorders, reported sleep disorders, and two clinical psychological tests, the SCL-90-R and the Millon Clinical Multiaxial Inventory (MCMI). The verified data on lifetime psychological disorders showed no group differences for psychoses, drug dependence, and anxiety. Marginally more Ranch Hands than Comparisons had a verified history of alcohol dependence and other neuroses based on unadjusted analyses. The Ranch Hands reported experiencing great or disabling fatigue during the day and talking in their sleep more frequently than the Comparisons. No group differences were detected in the other 13 sleep disorder variables in the unadjusted analyses. Although no significant differences between the Ranch Hands and the Comparisons were found in the unadjusted analyses of the 12 SCL-90-R variables, the Ranch Hands had marginally more abnormalities than the Comparisons for depression, somatization, and an index of the general severity of symptoms. The results of the unadjusted analyses of the MCMI scores revealed that the Ranch Hands had significantly higher mean antisocial and paranoid scores than the Comparisons. Marginally significant differences were identified on the narcissistic and psychotic delusion scores, where the mean score of the Ranch Hands exceeded that of the Comparisons. After adjustment for the covariates, a significant increase in the Ranch Hand mean remained on the narcissistic score. The Comparisons had a significantly higher mean dependent score than the Ranch Hands.

12.1.2.4 Serum Dioxin Analysis of 1987 Follow-up Study Summary Results

In general, the results of the analyses of the verified psychological disorders, reported sleep disorders, and the SCL-90-R variables did not reveal significant associations with initial dioxin or current dioxin and time since tour of duty or find significant differences among the four current dioxin categories. In contrast, several of the analyses of the MCMI variables displayed significant results. There was a lack of consistency across similar variables included in the SCL-90-R, MCMI, and reported information. In conclusion, the body burden of dioxin did not appear to be related to psychological or psychophysiological disorders.

12.1.2.5 1992 Follow-up Study Summary Results

The psychological assessment was based on verified psychological disorders and the SCL-90-R. Differences in the SCL-90-R inventory variables were found between Ranch Hand and Comparison groups. Variables revealing significant or marginally significant differences in adjusted analyses were other neuroses, SCL-90-R anxiety, SCL-90-R hostility, SCL-90-R obsessive-compulsive behavior, SCL-90-R paranoid ideation, SCL-90-R somatization, and SCL-90-R global severity index. These differences were observed when combining participants across all occupations. All significant results showed a greater percentage of Ranch Hands than Comparisons that had a history of other neuroses or high (adverse) SCL-90-R scores. Many unadjusted analyses of the psychological endpoints showed associations with dioxin, but the results became nonsignificant when the analyses were adjusted for relevant covariates.

A marginally significant association between initial dioxin and the prevalence of high SCL-90-R psychoticism scores was observed in adjusted analyses, with the percentage of high SCL-90-R psychoticism scores increasing as initial dioxin increased. The same pattern and marginally significant association was observed with initial dioxin and high SCL-90-R global severity index scores. Most of the significant results in the adjusted analysis of the association between the psychological endpoints and categorized dioxin were from the contrasts of Ranch Hands in the background dioxin category with Comparisons. These differences between Ranch Hands in the background dioxin category and Comparisons were found in the analysis of the SCL-90-R obsessive-compulsive behavior, paranoid ideation, and somatization scores. The analysis also revealed that Ranch Hands in the background category had a larger percentage of high SCL-90-R scores than did Comparisons. The adjusted analysis of categorized dioxin also showed a significant increase in the percentage of Ranch Hands in the high dioxin category with a high SCL-90-R anxiety score over Comparisons. In the analyses of current dioxin, a significant inverse association between whole weight current dioxin, adjusted for total lipids, and a history of alcohol dependence was observed.

12.1.3 Parameters for the 1997 Psychological Assessment

12.1.3.1 Dependent Variables

Data collected through the SCL-90-R were used in the psychological assessment (31). In addition, psychological disorders, as verified through a medical records review, were used to supplement the psychological evaluation for the 1997 follow-up.

12.1.3.1.1 Medical Records Data

At the health interview during the 1997 examination, each participant was asked whether he had a mental or emotional disorder since the date of his last interview. Reported disorders for which treatment was obtained were subsequently verified by a review of medical records. Information on verified psychological disorders from the 1997 examination was combined with information on verified disorders

from the baseline and 1985, 1987, and 1992 follow-up examinations, and a series of dependent variables regarding verified history of psychological disorders was created. In particular, the verified histories of psychoses (International Classification of Diseases, 9th revision, Clinical Modification [ICD-9-CM] codes 290.0–298.9), alcohol dependence (ICD-9-CM codes 303.00–303.93), drug dependence (ICD-9-CM codes 304.00–304.93), anxiety (ICD-9-CM codes 300.00–300.09), and other neuroses (ICD-9-CM codes 300.10–302.9, 305.00–305.03, 305.20–309.9, and 311) were studied.

Participants with a verified pre-Southeast Asia (SEA) history of a psychological disorder were excluded from the analyses pertaining to that disorder. In addition, participants who tested positive for the human immunodeficiency virus (HIV) were excluded from all analyses of these variables.

12.1.3.1.2 Physical Examination Data

The SCL-90-R, used by the AFHS at the 1987 and 1992 follow-up examinations, was used again in the psychological assessment. The SCL-90-R is a multidimensional self-reported symptom inventory that measures symptomatic psychological distress in terms of nine primary symptom dimensions. The nine dimensions are anxiety, depression, hostility, interpersonal sensitivity, obsessive-compulsive behavior, paranoid ideation, phobic anxiety, psychoticism, and somatization. Each participant was asked to respond to 90 questions in terms of the following 5-point scale: 0=not at all, 1=a little bit, 2=moderately, 3=quite a bit, and 4=extremely. Responses were grouped into the nine primary symptom categories, and a raw score for a participant for a category was determined by adding the scores of the answered questions in that category and dividing by the number of answered questions in that category. The raw scores were then converted to T-scores (reference scores for a given population norm) for analysis.

The SCL-90-R also measures distress using three global indices: global severity index (GSI), positive symptom total (PST), and positive symptom distress index (PSDI). The GSI is defined as the sum of the scores of all answered questions divided by the number of answered questions on the entire test. This index combines information on the number of symptoms and the intensity of distress. The PST is the number of questions to which the participant responds positively (i.e., on the 5-point scale, responses 1, 2, 3, or 4). The PSDI is determined by adding the scores of all answered questions and dividing by the PST. This index describes the intensity of the positive symptoms. Each of these indices also was converted to a T-score.

The T-scores for the nine primary symptom dimensions and the three global indices were then classified as high or normal, where high was defined as a T-score of 63 or greater. All participants were included in the analyses of the nine primary symptom dimensions and the three global indices of distress, including those participants who responded "not at all" to all 90 questions. Participants who tested positive for HIV were excluded from the analysis of the SCL-90-R variables.

12.1.3.2 Covariates

Covariates examined in the adjusted statistical analyses of the psychological assessment included age, race, military occupation, education level (high school, college), current alcohol use (drinks/day), lifetime alcohol history (drink-years), current total household income, current employment (yes, no), current marital status (married, not married), and current parental status (currently having a child under the age of 18: yes, no). Age, race, and military occupation were determined from military records. Current total household income information was collected in the questionnaire in categories with $5,000 increments, between $5,000 and $100,000. The midpoint of each category was used as the current total household income, with $102,500 used for the $100,000 or more category. Educational level, current employment, current parental status, and current marital status were all based on self-reported information from the questionnaire.

Lifetime alcohol history was based on information from the 1997 questionnaire and combined with similar information gathered at the 1987 and 1992 follow-up examinations. Each participant was asked about his drinking patterns throughout his lifetime. When a participant's drinking patterns changed, he was asked to describe how his alcohol consumption differed and the duration of time that the drinking pattern lasted. The participant's average daily alcohol consumption was determined for each of the reported drinking pattern periods throughout his lifetime, and an estimate of the corresponding total number of drink-years was derived. One drink-year was the equivalent of drinking 1.5 ounces of an 80-proof alcoholic beverage, one 12-ounce beer, or one 5-ounce glass of wine per day for 1 year. Current alcohol use was based on the average number of drinks per day during the month prior to completing the questionnaire. These alcohol covariates were not used in adjusted analyses of alcohol dependence.

The covariates current total household income, current employment, current marital status, and current parental status were used in the analysis of dependent variables based on medical records data (psychoses, alcohol dependence, drug dependence, anxiety, and other neuroses). Although these dependent variables capture a history of the condition, and the covariates described above were based on the current status of a participant's life, the covariates were used as surrogate information to describe the participant's life experience. In addition, lifetime alcohol history was used as a covariate for these dependent variables, but current alcohol use was not used. Current alcohol use reflected a participant's alcohol use only in the month prior to the physical examination. The lifetime alcohol history covariate was used to investigate the cumulative lifetime effects of alcohol use.

12.1.4 Statistical Methods

Table 12-1 summarizes the statistical analyses performed for the 1997 psychological assessment. The first part of this table lists the dependent variables analyzed, data source, data form, cutpoints, covariates, and statistical analysis methods. The second part of this table provides a description of covariates examined. A covariate was used in its continuous form whenever possible for all adjusted analyses; if the covariate is inherently discrete (e.g., military occupation), or if a categorized form was needed to develop measures of association with the dependent variables, the covariate was categorized as shown in Table 12-1. Table 12-2 provides a summary of the number of participants with missing dependent variable and covariate data. In addition, the number of participants excluded because of medical conditions is given.

Table 12-1. Statistical Analysis for the Psychological Assessment

Dependent Variables

Variable (Units)	Data Source	Data Form	Cutpoints	Covariates[a]	Exclusions[b]	Statistical Analysis and Methods
Psychoses	MR-V	D	Yes No	(1)	(a)	U:LR A:LR
Alcohol Dependence	MR-V	D	Yes No	(2)	(a)	U:LR A:LR
Drug Dependence	MR-V	D	Yes No	(1)	(a)	U:LR,CS A:LR
Anxiety	MR-V	D	Yes No	(1)	(a)	U:LR A:LR
Other Neuroses	MR-V	D	Yes No	(1)	(a)	U:LR A:LR

Table 12-1. Statistical Analysis for the Psychological Assessment (Continued)

Variable (Units)	Data Source	Data Form	Cutpoints	Covariates[a]	Exclusions[b]	Statistical Analysis and Methods
SCL-90-R Anxiety	PE	D	High: T≥63 Normal: T<63	(3)	(b)	U:LR A:LR
SCL-90-R Depression	PE	D	High: T≥63 Normal: T<63	(3)	(b)	U:LR A:LR
SCL-90-R Hostility	PE	D	High: T≥63 Normal: T<63	(3)	(b)	U:LR A:LR
SCL-90-R Interpersonal Sensitivity	PE	D	High: T≥63 Normal: T<63	(3)	(b)	U:LR A:LR
SCL-90-R Obsessive-Compulsive Behavior	PE	D	High: T≥63 Normal: T<63	(3)	(b)	U:LR A:LR
SCL-90-R Paranoid Ideation	PE	D	High: T≥63 Normal: T<63	(3)	(b)	U:LR A:LR
SCL-90-R Phobic Anxiety	PE	D	High: T≥63 Normal: T<63	(3)	(b)	U:LR A:LR
SCL-90-R Psychoticism	PE	D	High: T≥63 Normal: T<63	(3)	(b)	U:LR A:LR
SCL-90-R Somatization	PE	D	High: T≥63 Normal: T<63	(3)	(b)	U:LR A:LR
SCL-90-R Global Severity Index (GSI)	PE	D	High: T≥63 Normal: T<63	(3)	(b)	U:LR A:LR
SCL-90-R Positive Symptom Total (PST)	PE	D	High: T≥63 Normal: T<63	(3)	(b)	U:LR A:LR
SCL-90-R Positive Symptom Distress Index (PSDI)	PE	D	High: T≥63 Normal: T<63	(3)	(b)	U:LR A:LR

[a]Covariates:
(1): age, race, military occupation, education, lifetime alcohol history, current total household income, current employment, current marital status, current parental status.
(2): age, race, military occupation, education, current total household income, current employment, current marital status, current parental status.
(3): age, race, military occupation, education, current alcohol use, lifetime alcohol history, current total household income, current employment, current marital status, current parental status.

[b]Exclusions:
(a): participants with a pre-SEA history of the disorder, participants testing positive for HIV.
(b): participants testing positive for HIV.

Covariates

Variable (Units)	Data Source	Data Form	Cutpoints
Age (years)	MIL	D/C	Born ≥1942 Born <1942
Race	MIL	D	Black Non-Black
Occupation	MIL	D	Officer Enlisted Flyer Enlisted Groundcrew

Table 12-1. Statistical Analysis for the Psychological Assessment (Continued)

Variable (Units)	Data Source	Data Form	Cutpoints
Education	Q-SR	D	College High School
Current Alcohol Use (drinks/day)	Q-SR	D/C	0-1 >1–4 >4
Lifetime Alcohol History (drink-years)	Q-SR	D/C	0 >0–40 >40
Current Total Household Income (dollars)	Q-SR	D/C	≤$65,000 >$65,000
Current Employment	Q-SR	D	Yes No
Current Marital Status	Q-SR	D	Married Not Married
Current Parental Status	Q-SR	D	Child <18 years old No child <18 years old

Abbreviations

Data Source: MIL: Air Force military records
MR-V: Medical records (verified)
PE: 1997 Psychological examination
Q-SR: Health questionnaires (self-reported)

Data Form: D: Discrete analysis only
D/C: Appropriate form for analysis (either discrete or continuous)

Statistical Analysis: U: Unadjusted analysis
A: Adjusted analysis

Statistical Methods: CS: Chi-square contingency table analysis (continuity-adjusted)
LR: Logistic regression analysis

Table 12-2. Number of Participants Excluded or with Missing Data for the Psychological Assessment

Variable	Variable Use	Group		Dioxin (Ranch Hands Only)		Categorized Dioxin	
		Ranch Hand	Comparison	Initial	1987	Ranch Hand	Comparison
SCL-90-R Categories and Indices	DEP	1	0	1	1	1	0
Education	COV	1	0	0	1	1	0
Current Alcohol Use	COV	1	0	0	1	1	0
Lifetime Alcohol History	COV	6	2	3	6	6	1

Table 12-2. Number of Participants Excluded or with Missing Data for the Psychological Assessment (Continued)

Variable	Variable Use	Group		Dioxin (Ranch Hands Only)		Categorized Dioxin	
		Ranch Hand	Comparison	Initial	1987	Ranch Hand	Comparison
Current Total Household Income	COV	9	15	4	9	9	14
Current Employment	COV	1	0	0	1	1	0
Current Marital Status	COV	1	0	0	1	1	0
Current Parental Status	COV	1	0	0	1	1	0
Pre-SEA Alcohol Dependence	EXC	0	1	0	0	0	1
Pre-SEA Anxiety	EXC	4	3	2	4	4	3
Pre-SEA Other Neuroses	EXC	12	9	5	12	12	9
HIV Positive	EXC	3	2	3	3	3	2

Note: DEP = Dependent variable.
COV = Covariate.
EXC = Exclusion.
870 Ranch Hands and 1,251 Comparisons.
482 Ranch Hands for initial dioxin; 863 Ranch Hands for 1987 dioxin.
863 Ranch Hands and 1,213 Comparisons for categorized dioxin.

12.2 RESULTS

12.2.1 Dependent Variable-Covariate Associations

The psychological dependent variables were tested for significant association with each of the covariates used within the adjusted analyses. The results are presented in Appendix F, Table F-4. These associations are pairwise between the dependent variable and the covariate and are not adjusted for any other covariates. Participants with a verified pre-SEA history of a psychological disorder were excluded from the analyses pertaining to that disorder. In addition, participants who tested positive for HIV were excluded from all analyses. A brief summary of the pattern of dependent variable-covariate associations is contained in the following paragraphs. This brief description is followed by a more detailed description of significant covariate associations with each dependent variable.

The psychological dependent variables each displayed significant associations with several of the covariates. For each significant association with age, the greater percentage of high SCL-90-R scores was among the younger participants. Race was found marginally significant with only two of the dependent variables, drug dependence and SCL-90-R paranoid ideation. Each association displayed the greater percentage of high scores among the Black participants. Occupation showed a significant association with all dependent variables except drug dependence. Officers consistently displayed the lowest percentage of psychological problems. Associations with education generally were significant. Each association displayed the higher prevalence of a psychological disorder or the greater percentage of high SCL-90-R scores among participants with only a high school education.

Current alcohol use was significantly or marginally significantly associated with most of the psychology dependent variables. For each association, the largest percentage of high SCL-90-R scores was among the heaviest current drinkers (in terms of drinks per day), followed by the lightest current drinkers. The results were similar for lifetime alcohol history. Current total household income and current marital status were significantly associated with most of the psychological dependent variables. Each of these associations for both covariates displayed a greater percentage of abnormalities among participants with a

lower income or among unmarried participants. A significant association with current employment was found for alcohol dependence and SCL-90-R somatization. Unemployed participants had a greater percentage of alcohol dependence and high somatization scores than did employed participants. The current parental status covariate was significantly associated with alcohol dependence. A larger percentage of participants with no child less than 18 years old had a history of alcohol dependence than participants with a child less than 18 years old.

A significant association between a history of psychoses and occupation (p=0.032) was found. Enlisted flyers displayed the highest proportion of history of psychoses (5.0%). Psychoses was also significantly associated with current total household income (p=0.010) and current marital status (p=0.001). The prevalence of psychoses decreased as income rose and was increased among unmarried participants (7.8%).

A history of alcohol dependence was significantly associated with occupation (p=0.014). The highest percentage of participants with alcohol dependence was among enlisted flyers (8.9%), followed by enlisted groundcrew (7.9%) and officers (4.9%). Current total household income also displayed a significant association with alcohol dependence (p=0.001). Participants with lower incomes were dependent on alcohol more often than those participants with higher incomes (8.8% vs. 5.0%). In addition, alcohol dependence was significantly associated with current employment (p=0.039), current marital status (p=0.001), and current parental status (p=0.009). The higher prevalence of alcohol dependence history was among those participants not currently employed (8.5%), not currently married (14.4%), or those without a child under the age of 18 (7.5%).

Current marital status was the only covariate found significantly associated with a history of drug dependence (p=0.008). The higher percentage of drug dependence was among participants who were currently unmarried (1.1%).

A history of anxiety showed significant associations with occupation (p=0.001), education (p=0.001), current total household income (p=0.001), and current marital status (p=0.001). Enlisted groundcrew showed the highest percentage of anxiety (33.9%), followed by enlisted flyers (30.9%) and officers (17.3%). Participants with only a high school education, in the lower income category, or who were not married had the higher percentages of anxiety (31.3%, 32.8%, and 34.0%, respectively).

Tests of association between covariates and a history of other neuroses revealed several significant results. The association with occupation (p=0.001) showed that enlisted flyers had the highest proportion of other neuroses (61.4%), followed by enlisted groundcrew (60.1%) and officers (43.7%). Education also displayed a significant association with other neuroses (p=0.001). Participants with only a high school education displayed the higher percentage of other neuroses (60.9%). The significant lifetime alcohol history association (p=0.001) showed 62.8 percent of the heaviest drinkers (in terms of drink-years) with other neuroses, followed by 50.9 percent of participants who did not drink, and 50.2 percent in the moderate lifetime drinking category. The association with current total household income (p=0.001) showed that the percentage of participants with other neuroses decreased as the income level increased. The association with current marital status found 62.9 percent of unmarried participants with history of other neuroses, compared to 51.9 percent of those married (p=0.001).

The SCL-90-R anxiety scores were significantly associated with occupation (p=0.001), education, (p=0.001), lifetime alcohol history (p=0.009), current total household income (p=0.001), and current marital status (p=0.028). The enlisted groundcrew stratum displayed the largest percentage of participants with a high SCL-90-R anxiety score (14.3%), followed by enlisted flyers (13.4%) and officers (5.0%). High SCL-90-R anxiety scores were greater among high school-educated participants

(14.1%) compared to those who were college-educated (7.5%). High anxiety scores were most prevalent in the heaviest lifetime drinkers (13.7%), followed by non-drinkers (11.0%) and moderate lifetime drinkers (9.1%). Participants in the lower income category and those not married displayed the greater percentages of high SCL-90-R anxiety scores (14.5% and 13.8%, respectively).

The significant covariate associations with the SCL-90-R depression score were found with age (p=0.040), occupation (p=0.001), education (p=0.001), current alcohol use (p=0.023), lifetime alcohol use (p=0.001), current total household income (p=0.001), and current marital status (p=0.002). High depression scores were more prevalent among younger participants (16.8%) and greatest among the enlisted groundcrew (19.3%). High school-educated participants displayed more high depression scores (19.4%) than college-educated participants (11.2%). Participants currently drinking the most had the largest percentage of high depression scores (28.0%). Similarly, participants with a lifetime history of drinking the most had largest percentage of high SCL-90-R depression scores (19.4%). The percentage of high SCL-90-R depression scores decreased as income level increased. The significant association with current marital status showed more high depression scores among unmarried participants (20.3%).

SCL-90-R hostility scores were significantly associated with age (p=0.038), occupation (p=0.001), education (p=0.001), current alcohol use (p=0.024), lifetime alcohol use (p=0.004), and current total household income (p=0.001). The prevalence of high SCL-90-R hostility scores decreased as age increased and was greatest for enlisted groundcrew (11.2%). High hostility scores were more prevalent among high school-educated participants (11.3%) than among college-educated participants (5.4%). Analysis of current alcohol use showed that the heaviest drinkers had the largest prevalence of high hostility scores (18.0%). The percentage of high hostility scores increased as the number of drink-years increased within the examination of lifetime alcohol history (3.4%, 7.4%, and 10.9% for non-drinkers, moderate drinkers, and heavy drinkers, respectively). The association with current total household income showed the greater percentage of high hostility scores among participants in the lower income category (10.6%).

Association tests between the SCL-90-R interpersonal sensitivity scores and age, occupation, education, current total household income, and current marital status were each significant (p=0.020, p=0.001, p=0.001, p=0.001, and p=0.023, respectively). Of the younger participants, 17.3 percent had high interpersonal sensitivity scores, compared to 13.6 percent for the older participants. The percentage of high scores was largest for enlisted groundcrew and enlisted flyers (20.4% and 19.0%, respectively). Participants with at most a high school education had almost twice the percentage of high SCL-90-R interpersonal sensitivity scores than college-educated participants (20.4% vs. 10.8%). Examination of current total household income and current marital status showed the greater percentages of high interpersonal sensitivity scores among participants in the lower income category (20.0%) and among those who were not married (19.2%).

SCL-90-R obsessive-compulsive behavior scores were significantly associated with occupation (p=0.001), education (p=0.001), lifetime alcohol history (p=0.002), and current total household income (p=0.001). Enlisted flyers displayed the greatest prevalence of high obsessive-compulsive scores (20.5%). Participants with at most a high school education had the greater percentage of high scores (19.7%), compared to college-educated participants (11.8%). Participants who were the heaviest lifetime drinkers displayed the largest proportion of high obsessive-compulsive behavior scores (19.8%). The association with current total household income showed the larger percentage of high SCL-90-R obsessive-compulsive scores among participants with lower incomes (20.8%), compared to 9.8 percent for participants with higher incomes.

Age, occupation, education, current total household income, and current marital status were each significantly associated with the SCL-90-R paranoid ideation (p=0.001, p=0.001, p=0.001, p=0.001, and p=0.002, respectively). Younger participants had a greater prevalence of high paranoid ideation scores (9.0%) than older participants (5.2%). The proportion of high paranoid ideation scores was largest for enlisted groundcrew (10.4%). High school-educated participants exhibited the larger proportion of high paranoid ideation scores (9.7%), as did participants with lower incomes (9.7%) and unmarried participants (10.8%).

Significant covariate associations with SCL-90-R phobic anxiety and SCL-90-R psychoticism were similar and included age (p=0.005 and p=0.025, respectively), occupation (p=0.001 for each), education (p=0.001 for each), lifetime alcohol history (p=0.014 and p=0.004, respectively), and current total household income (p=0.001 for each). Current marital status was also significantly associated with psychoticism (p=0.001). The percentage of high scores for both variables was higher among younger participants (12.4% and 15.6%, respectively) and highest among enlisted groundcrew (14.4% and 18.3%, respectively). High school-educated participants displayed the greater prevalence of high scores for both variables (14.5% and 17.1%, respectively). In addition, percentages of high scores increased for each variable as lifetime drinking increased. Participants with lower incomes displayed the greater proportion of high scores for each variable (14.1% and 18.1%, respectively). The percentage of high SCL-90-R psychoticism scores was increased among unmarried participants (19.2%).

Covariate association tests with SCL-90-R somatization were significant for occupation (p=0.001), education (p=0.001), current alcohol use (p=0.037), current total household income (p=0.001), and current employment (p=0.020). The percentage of high SCL-90-R somatization scores was greatest among enlisted flyers (25.2%), followed by enlisted groundcrew (21.0%) and officers (7.3%). Participants with at most a high school education displayed the greater proportion of high somatization scores (22.3%) compared to college-educated participants (11.2%). The prevalence of high somatization scores was greatest for the heaviest current drinkers (20.0%) and smallest for moderate drinkers (11.9%). Examination of current total household income and current employment revealed a greater proportion of high somatization scores among the lower income earners (21.8%) and among unemployed participants (18.9%).

Association tests with the SCL-90-R GSI were significant for age (p=0.048), occupation (p=0.001), education (p=0.001), current alcohol use (p=0.017), lifetime alcohol use (p=0.001), current total household income (p=0.001), and current marital status (p=0.016). Younger participants displayed the greater percentage of high GSI scores (16.6%), as did enlisted groundcrew (20.1%). The percentage of high GSI scores was also larger among participants with at most a high school education (19.2%) compared to college-educated participants (11.1%). The greatest percentage of high GSI scores was among the heaviest current drinkers (28.0%), as well as among the heaviest lifetime drinkers (19.5%). High GSI scores were more prevalent among participants in the lower income bracket (19.9%) and among the unmarried participants (19.0%).

Occupation, education, lifetime alcohol use, and current total household income each displayed significant associations with the SCL-90-R PST scores (p=0.001, p=0.001, p=0.002, and p=0.001, respectively). The percentages of high PST scores for enlisted groundcrew, enlisted flyers, and officers were 20.9 percent, 20.2 percent, and 8.5 percent, respectively. High school-educated participants displayed a larger percentage of high scores (20.8%) than did college-educated participants (11.7%). The prevalence of high SCL-90-R PST scores was greatest among the heaviest lifetime drinkers (20.3%). Participants in the lower income category showed the larger percentage of high SCL-90-R PST scores (21.0%).

The SCL-90-R PSDI displayed significant covariate associations with occupation (p=0.001), education (p=0.001), current alcohol use (p=0.030), and current total household income (p=0.012). High PSDI

scores were more prevalent among enlisted groundcrew and enlisted flyers (9.5% for each) than among officers (3.7%). Participants with at most a high school education displayed the greater percentage of high SCL-90-R PSDI scores (9.5%), and the heaviest current drinkers showed the highest percentage (12.0%). The prevalence of high SCL-90-R PSDI scores was greatest for participants with lower incomes (8.7%).

12.2.2 Exposure Analysis

The following section presents results of the statistical analyses of the dependent variables shown in Table 12-1. Dependent variables were derived from a medical records review and verification of self-reported psychological conditions and the psychological examination portion of the 1997 follow-up examination.

Four models were examined for each dependent variable given in Table 12-1. The analyses of these models are presented below. Further details on dioxin and the modeling strategy are found in Chapters 2 and 7, respectively. These analyses were performed both unadjusted and adjusted for relevant covariates. Model 1 examined the relation between the dependent variable and group (i.e., Ranch Hand or Comparison). In this model, exposure was defined as "yes" for Ranch Hands and "no" for Comparisons without regard to the magnitude of the exposure. As an attempt to quantify exposure, three contrasts of Ranch Hands and Comparisons were performed along with the overall Ranch Hand versus Comparison contrast. These three contrasts compared Ranch Hands and Comparisons within each occupational category (i.e., officers, enlisted flyers, and enlisted groundcrew). As described in previous reports and Table 2-8, the average levels of exposure to dioxin were highest for enlisted groundcrew, followed by enlisted flyers, then officers.

Model 2 explored the relation between the dependent variable and an extrapolated initial dioxin measure for Ranch Hands who had a 1987 dioxin measurement greater than 10 ppt. If a participant did not have a 1987 dioxin level, the 1992 level was used to estimate the initial dioxin level. If a participant did not have a 1987 or a 1992 dioxin level, the 1997 level was used to estimate the initial dioxin level. A statistical adjustment for the percentage of body fat at the time of the participant's blood measurement of dioxin was included in this model to account for body-fat-related differences in elimination rate (32).

Model 3 divided the Ranch Hands examined in Model 2 into two categories based on their initial dioxin measures. These two categories are referred to as "low Ranch Hand" and "high Ranch Hand." Two additional categories, Ranch Hands with 1987 serum dioxin levels at or below 10 ppt and Comparisons with 1987 serum dioxin levels at or below 10 ppt, were formed and included in the model. Ranch Hands with 1987 serum dioxin levels at or below 10 ppt are referred to as the "background Ranch Hand" category. Dioxin levels in 1992 were used if the 1987 level was not available, and dioxin levels in 1997 were used if the 1987 and 1992 levels were not available. These four categories—Comparisons, background Ranch Hands, low Ranch Hands, and high Ranch Hands—were used in Model 3 analyses. The relation between the dependent variable in each of the three Ranch Hand categories and the dependent variable in the Comparison category was examined. A fourth contrast, exploring the relation of the dependent variable in the combined low and high Ranch Hand categories relative to Comparisons, also was conducted. This combination is referred to in the tables as the "low plus high Ranch Hand" category. As in Model 2, a statistical adjustment for the percentage of body fat at the time of the participant's blood measurement of dioxin was included in this model.

Model 4 examined the relation between the dependent variable and 1987 lipid-adjusted dioxin levels in all Ranch Hands with a dioxin measurement. If a participant did not have a 1987 dioxin measurement, the 1992 measurement was used to determine the dioxin level. If a participant did not have a 1987 or a 1992 dioxin measurement, the 1997 measurement was used to determine the dioxin level.

12.2.2.1 Medical Records Variables

12.2.2.1.1 Psychoses

All results from the analyses of a history of psychoses (Models 1 through 4) were nonsignificant, both unadjusted and adjusted for covariates (Table 12-3(a–h): $p \geq 0.23$ for each analysis).

Table 12-3. Analysis of Psychoses

(a) MODEL 1: RANCH HANDS VS. COMPARISONS – UNADJUSTED

Occupational Category	Group	n	Number (%) Yes	Est. Relative Risk (95% C.I.)	p-Value
All	***Ranch Hand***	***867***	***34 (3.9)***	***1.02 (0.65,1.60)***	***0.927***
	Comparison	***1,249***	***48 (3.8)***		
Officer	Ranch Hand	341	9 (2.6)	1.09 (0.45,2.61)	0.853
	Comparison	493	12 (2.4)		
Enlisted Flyer	Ranch Hand	151	10 (6.6)	1.82 (0.68,4.91)	0.235
	Comparison	187	7 (3.7)		
Enlisted Groundcrew	Ranch Hand	375	15 (4.0)	0.78 (0.41,1.47)	0.435
	Comparison	569	29 (5.1)		

(b) MODEL 1: RANCH HANDS VS. COMPARISONS – ADJUSTED

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	***1.03 (0.65,1.63)***	***0.905***
Officer	1.12 (0.47,2.71)	0.796
Enlisted Flyer	1.85 (0.68,5.04)	0.230
Enlisted Groundcrew	0.76 (0.40,1.47)	0.423

(c) MODEL 2: RANCH HANDS – INITIAL DIOXIN – UNADJUSTED

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)[a]	
Initial Dioxin	n	Number (%) Yes	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	160	10 (6.3)	0.90 (0.65,1.24)	0.501
Medium	162	7 (4.3)		
High	157	7 (4.5)		

[a] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[b] Relative risk for a twofold increase in initial dioxin.

Note: Low = 27–63 ppt; Medium = >63–152 ppt; High = >152 ppt.

(d) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED

Analysis Results for Log_2 (Initial Dioxin)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
472	0.82 (0.55,1.23)	0.338

[a] Relative risk for a twofold increase in initial dioxin.

Table 12-3. Analysis of Psychoses (Continued)

(e) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – UNADJUSTED

Dioxin Category	n	Number (%) Yes	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,211	47 (3.9)		
Background RH	381	10 (2.6)	0.71 (0.35,1.43)	0.339
Low RH	239	12 (5.0)	1.29 (0.67,2.47)	0.447
High RH	240	12 (5.0)	1.23 (0.64,2.36)	0.535
Low plus High RH	479	24 (5.0)	1.26 (0.76,2.09)	0.373

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(f) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED

Dioxin Category	n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
Comparison	1,196		
Background RH	374	0.85 (0.41,1.73)	0.648
Low RH	236	1.42 (0.73,2.77)	0.297
High RH	236	0.90 (0.45,1.80)	0.759
Low plus High RH	472	1.13 (0.67,1.91)	0.647

[a] Relative risk and confidence interval relative to Comparisons.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(g) MODEL 4: RANCH HANDS – 1987 DIOXIN – UNADJUSTED

1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)	
1987 Dioxin	n	Number (%) Yes	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	288	9 (3.1)	1.11 (0.89,1.39)	0.368
Medium	287	12 (4.2)		
High	285	13 (4.6)		

[a] Relative risk for a twofold increase in 1987 dioxin.

Note: Low = ≤7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

Table 12-3. Analysis of Psychoses (Continued)

(h) MODEL 4: RANCH HANDS – 1987 DIOXIN – ADJUSTED		
	Analysis Results for Log_2 (1987 Dioxin + 1)	
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
846	1.08 (0.84,1.40)	0.550

[a] Relative risk for a twofold increase in 1987 dioxin.

12.2.2.1.2 Alcohol Dependence

All unadjusted and adjusted results from the analysis of alcohol dependence were nonsignificant for Models 1 through 4 (Table 12-4(a–h): p>0.30 for each analysis).

Table 12-4. Analysis of Alcohol Dependence

(a) MODEL 1: RANCH HANDS VS. COMPARISONS – UNADJUSTED					
Occupational Category	Group	n	Number (%) Yes	Est. Relative Risk (95% C.I.)	p-Value
All	***Ranch Hand***	***867***	***62 (7.2)***	***1.08 (0.77,1.52)***	***0.655***
	Comparison	***1,248***	***83 (6.7)***		
Officer	Ranch Hand	341	15 (4.4)	0.83 (0.43,1.58)	0.566
	Comparison	493	26 (5.3)		
Enlisted Flyer	Ranch Hand	151	14 (9.3)	1.09 (0.52,2.32)	0.818
	Comparison	187	16 (8.6)		
Enlisted Groundcrew	Ranch Hand	375	33 (8.8)	1.24 (0.77,2.00)	0.377
	Comparison	568	41 (7.2)		

(b) MODEL 1: RANCH HANDS VS. COMPARISONS – ADJUSTED		
Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	***1.04 (0.74,1.48)***	***0.816***
Officer	0.82 (0.43,1.58)	0.557
Enlisted Flyer	0.94 (0.43,2.04)	0.871
Enlisted Groundcrew	1.25 (0.76,2.03)	0.377

(c) MODEL 2: RANCH HANDS – INITIAL DIOXIN – UNADJUSTED				
Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)[a]	
Initial Dioxin	n	Number (%) Yes	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	160	14 (8.8)	1.04 (0.81,1.34)	0.747
Medium	162	10 (6.2)		
High	157	14 (8.9)		

[a] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[b] Relative risk for a twofold increase in initial dioxin.

Note: Low = 27–63 ppt; Medium = >63–152 ppt; High = >152 ppt.

Table 12-4. Analysis of Alcohol Dependence (Continued)

(d) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED		
	Analysis Results for Log_2 (Initial Dioxin)	
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
475	1.04 (0.77,1.42)	0.790

[a] Relative risk for a twofold increase in initial dioxin.

Note: Results are not adjusted for parental status because of the sparse number of participants with alcohol dependence.

(e) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – UNADJUSTED				
Dioxin Category	n	Number (%) Yes	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,210	80 (6.6)		
Background RH	381	24 (6.3)	0.93 (0.58,1.50)	0.767
Low RH	239	18 (7.5)	1.16 (0.68,1.97)	0.594
High RH	240	20 (8.3)	1.31 (0.78,2.18)	0.307
Low plus High RH	479	38 (7.9)	1.23 (0.82,1.84)	0.316

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(f) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED			
Dioxin Category	n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
Comparison	1,196		
Background RH	376	1.04 (0.63,1.69)	0.888
Low RH	237	1.11 (0.64,1.91)	0.714
High RH	238	1.01 (0.58,1.73)	0.985
Low plus High RH	475	1.05 (0.69,1.60)	0.802

[a] Relative risk and confidence interval relative to Comparisons.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

Table 12-4. Analysis of Alcohol Dependence (Continued)

(g) MODEL 4: RANCH HANDS – 1987 DIOXIN – UNADJUSTED				
1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)	
1987 Dioxin	n	Number (%) Yes	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	288	16 (5.6)	1.07 (0.90,1.28)	0.420
Medium	287	24 (8.4)		
High	285	22 (7.7)		

[a] Relative risk for a twofold increase in 1987 dioxin.

Note: Low = ≤7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

(h) MODEL 4: RANCH HANDS – 1987 DIOXIN – ADJUSTED		
	Analysis Results for Log_2 (1987 Dioxin + 1)	
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
851	0.99 (0.82,1.20)	0.898

[a] Relative risk for a twofold increase in 1987 dioxin.

12.2.2.1.3 Drug Dependence

Only a small percentage of participants had a verified drug dependence; consequently, analysis of drug dependence was limited. All analyses performed for Models 1, 3, and 4 indicated no differences among Ranch Hands and Comparisons and no association between dioxin levels and a history of drug dependence (Table 12-5(a–b,e–h): p>0.15 for all analyses). No Ranch Hands with extrapolated initial dioxin levels (Model 2) had a drug dependence.

Table 12-5. Analysis of Drug Dependence

(a) MODEL 1: RANCH HANDS VS. COMPARISONS – UNADJUSTED					
Occupational Category	Group	n	Number (%) Yes	Est. Relative Risk (95% C.I.)	p-Value
All	***Ranch Hand***	***867***	***2 (0.2)***	***0.72 (0.13,3.94)***	***0.700***
	Comparison	***1,249***	***4 (0.3)***		
Officer	Ranch Hand	341	0 (0.0)	--	0.999[a]
	Comparison	493	1 (0.2)		
Enlisted Flyer	Ranch Hand	151	0 (0.0)	--	--
	Comparison	187	0 (0.0)		
Enlisted Groundcrew	Ranch Hand	375	2 (0.5)	1.01 (0.17,6.08)	0.990
	Comparison	569	3 (0.5)		

[a] P-value determined using a chi-square test with continuity correction because of the sparse number of participants with drug dependence.
--: Results not presented because of the sparse number of participants with drug dependence.

Table 12-5. Analysis of Drug Dependence (Continued)

(b) MODEL 1: RANCH HANDS VS. COMPARISONS – ADJUSTED

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	*0.58 (0.09,3.74)*	*0.553*
Officer	--	--
Enlisted Flyer	--	--
Enlisted Groundcrew	0.78 (0.11,5.56)	0.802

--: Results not presented because of the sparse number of participants with drug dependence.

Note: Results are not adjusted for current employment because of the sparse number of participants with drug dependence; in addition, results for all occupational categories combined not adjusted for occupation.

(c) MODEL 2: RANCH HANDS – INITIAL DIOXIN – UNADJUSTED

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)[a]	
Initial Dioxin	n	Number (%) Yes	Estimated Relative Risk (95% C.I.)	p-Value
Low	160	0 (0.0)	--	--
Medium	162	0 (0.0)		
High	157	0 (0.0)		

[a] Adjusted for percent body fat at the time of the blood measurement of dioxin.
--: Results not presented because of the sparse number of participants with drug dependence.

Note: Low = 27–63 ppt; Medium = >63–152 ppt; High = >152 ppt.

(d) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED

Analysis Results for Log_2 (Initial Dioxin)		
n	Adjusted Relative Risk (95% C.I.)	p-Value
--	--	--

--: Results not presented because of the sparse number of participants with drug dependence.

Table 12-5. Analysis of Drug Dependence (Continued)

(e) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – UNADJUSTED

Dioxin Category	n	Number (%) Yes	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,211	4 (0.3)		
Background RH	381	2 (0.5)	1.32 (0.24,7.34)	0.749
Low RH	239	0 (0.0)	--	0.830[c]
High RH	240	0 (0.0)	--	0.828[c]
Low plus High RH	479	0 (0.0)	--	0.481[c]

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] P-value determined using a chi-square test with continuity correction because of the sparse number of participants with drug dependence.
--: Results not presented because of the sparse number of participants with drug dependence.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(f) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED

Dioxin Category	n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
Comparison	1,196		
Background RH	374	1.37 (0.19,9.67)	0.755
Low RH	236	--	--
High RH	236	--	--
Low plus High RH	472	--	--

[a] Relative risk and confidence interval relative to Comparisons.
--: Results not presented because of the sparse number of participants with drug dependence.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

Results are not adjusted for current employment or occupation because of the sparse number of participants with drug dependence.

(g) MODEL 4: RANCH HANDS – 1987 DIOXIN – UNADJUSTED

1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)	
1987 Dioxin	n	Number (%) Yes	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	288	2 (0.7)	0.46 (0.16,1.34)	0.155
Medium	287	0 (0.0)		
High	285	0 (0.0)		

[a] Relative risk for a twofold increase in 1987 dioxin.

Note: Low = ≤7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

Table 12-5. Analysis of Drug Dependence (Continued)

(h) MODEL 4: RANCH HANDS – 1987 DIOXIN – ADJUSTED		
	Analysis Results for Log_2 (1987 Dioxin + 1)	
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
846	0.45 (0.10,2.11)	0.226

[a] Relative risk for a twofold increase in 1987 dioxin.

Note: Results are not adjusted for race, occupation, current employment, current marital status, and current parental status because of the sparse number of participants with drug dependence.

12.2.2.1.4 Anxiety

The unadjusted and adjusted analysis results for a history of anxiety were nonsignificant for both Models 1 and 2 (Table 12-6(a–d): p>0.30 for each analysis).

Table 12-6. Analysis of Anxiety

(a) MODEL 1: RANCH HANDS VS. COMPARISONS – UNADJUSTED					
Occupational Category	Group	n	Number (%) Yes	Est. Relative Risk (95% C.I.)	p-Value
All	***Ranch Hand***	***863***	***232 (26.9)***	***1.00 (0.83,1.22)***	***0.969***
	Comparison	***1,246***	***334 (26.8)***		
Officer	Ranch Hand	340	56 (16.5)	0.91 (0.63,1.31)	0.605
	Comparison	493	88 (17.9)		
Enlisted Flyer	Ranch Hand	150	48 (32.0)	1.10 (0.69,1.75)	0.685
	Comparison	187	56 (30.0)		
Enlisted Groundcrew	Ranch Hand	373	128 (34.3)	1.03 (0.78,1.36)	0.813
	Comparison	566	190 (33.6)		

(b) MODEL 1: RANCH HANDS VS. COMPARISONS – ADJUSTED		
Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	***1.00 (0.82,1.23)***	***0.979***
Officer	0.93 (0.64,1.35)	0.709
Enlisted Flyer	1.01 (0.63,1.63)	0.953
Enlisted Groundcrew	1.04 (0.79,1.38)	0.776

Table 12-6. Analysis of Anxiety (Continued)

(c) MODEL 2: RANCH HANDS – INITIAL DIOXIN – UNADJUSTED

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)[a]	
Initial Dioxin	n	Number (%) Yes	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	159	41 (25.8)	1.07 (0.92,1.24)	0.360
Medium	162	55 (34.0)		
High	156	47 (30.1)		

[a] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[b] Relative risk for a twofold increase in initial dioxin.

Note: Low = 27–63 ppt; Medium = >63–152 ppt; High = >152 ppt.

(d) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED

Analysis Results for Log_2 (Initial Dioxin)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
470	0.91 (0.76,1.09)	0.302

[a] Relative risk for a twofold increase in initial dioxin.

(e) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – UNADJUSTED

Dioxin Category	n	Number (%) Yes	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,208	328 (27.2)		
Background RH	379	86 (22.7)	0.78 (0.60,1.03)	0.083
Low RH	238	70 (29.4)	1.12 (0.82,1.52)	0.473
High RH	239	73 (30.5)	1.18 (0.87,1.60)	0.279
Low plus High RH	477	143 (30.0)	1.15 (0.91,1.45)	0.240

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

Table 12-6. Analysis of Anxiety (Continued)

(f) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED

Dioxin Category	n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
Comparison	1,194		
Background RH	372	0.98 (0.74,1.31)	0.902
Low RH	235	1.17 (0.85,1.60)	0.343
High RH	235	0.82 (0.59,1.13)	0.225
Low plus High RH	470	0.98 (0.77,1.25)	0.857

[a] Relative risk and confidence interval relative to Comparisons.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(g) MODEL 4: RANCH HANDS – 1987 DIOXIN – UNADJUSTED

1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)	
1987 Dioxin	n	Number (%) Yes	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	286	62 (21.7)	1.14 (1.03,1.26)	0.011
Medium	286	76 (26.6)		
High	284	91 (32.0)		

[a] Relative risk for a twofold increase in 1987 dioxin.

Note: Low = ≤7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

(h) MODEL 4: RANCH HANDS – 1987 DIOXIN – ADJUSTED

		Analysis Results for Log_2 (1987 Dioxin + 1)	
	n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
1987 Dioxin	841	0.93 (0.84,1.03)	0.368

[a] Relative risk for a twofold increase in 1987 dioxin.

The Model 3 unadjusted analysis revealed marginally significantly more Comparisons than Ranch Hands with anxiety (Table 12-6(e): p=0.083, Est. RR=0.78). After adjustment for covariates, the difference was nonsignificant (Table 12-6(f): p=0.902). All other Model 3 contrasts were nonsignificant (Table 12-6(e,f): p>0.22).

A significant positive association between 1987 dioxin levels and anxiety was found from the unadjusted Model 4 analysis (Table 12-6(g): p=0.011, Est. RR=1.14). Similar to Model 3 results, the association was nonsignificant after covariate adjustment (Table 12-6(h): p=0.368).

12.2.2.1.5 Other Neuroses

The Model 1 unadjusted analysis of a history of other neuroses showed a marginally significant difference between Ranch Hands and Comparisons within the officer stratum (Table 12-7(a): p=0.099, Est. RR=0.79). This difference became nonsignificant after adjustment for covariates (Table 12-7(b): p=0.127, Adj. RR=0.80). A significant difference within the enlisted groundcrew stratum was seen for both the unadjusted and adjusted contrasts (Table 12-7(a,b): p=0.021, Est. RR=1.38; p=0.011, Adj. RR=1.44, respectively). For Ranch Hand enlisted groundcrew, 64.7 percent had other neuroses, as compared to 57.1 percent of Comparison enlisted groundcrew. All other Model 1 contrasts were nonsignificant (Table 12-7(a,b): p>0.43).

Table 12-7. Analysis of Other Neuroses

(a) MODEL 1: RANCH HANDS VS. COMPARISONS – UNADJUSTED

Occupational Category	Group	n	Number (%) Yes	Est. Relative Risk (95% C.I.)	p-Value
All	***Ranch Hand***	***855***	***467 (54.6)***	***1.06 (0.89,1.26)***	***0.529***
	Comparison	***1,240***	***660 (53.2)***		
Officer	Ranch Hand	338	136 (40.2)	0.79 (0.60,1.05)	0.099
	Comparison	491	226 (46.0)		
Enlisted Flyer	Ranch Hand	149	93 (62.4)	1.08 (0.69,1.69)	0.726
	Comparison	185	112 (60.5)		
Enlisted Groundcrew	Ranch Hand	368	238 (64.7)	1.38 (1.05,1.80)	0.021
	Comparison	564	322 (57.1)		

(b) MODEL 1: RANCH HANDS VS. COMPARISONS – ADJUSTED

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	***1.08 (0.90,1.29)***	***0.434***
Officer	0.80 (0.60,1.07)	0.127
Enlisted Flyer	1.04 (0.66,1.65)	0.857
Enlisted Groundcrew	1.44 (1.09,1.91)	0.011

(c) MODEL 2: RANCH HANDS – INITIAL DIOXIN – UNADJUSTED

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)[a]	
Initial Dioxin	n	Number (%) Yes	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	158	90 (57.0)	1.02 (0.89,1.18)	0.743
Medium	161	104 (64.6)		
High	155	98 (63.2)		

[a] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[b] Relative risk for a twofold increase in initial dioxin.

Note: Low = 27–63 ppt; Medium = >63–152 ppt; High = >152 ppt.

Table 12-7. Analysis of Other Neuroses (Continued)

(d) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED

Analysis Results for Log_2 (Initial Dioxin)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
467	0.88 (0.74,1.05)	0.164

[a] Relative risk for a twofold increase in initial dioxin.

(e) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – UNADJUSTED

Dioxin Category	n	Number (%) Yes	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,202	637 (53.0)		
Background RH	374	170 (45.5)	0.75 (0.60,0.95)	0.018
Low RH	237	143 (60.3)	1.34 (1.01,1.79)	0.041
High RH	237	149 (62.9)	1.48 (1.11,1.97)	0.008
Low plus High RH	474	292 (61.6)	1.41 (1.13,1.75)	0.002

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(f) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED

Dioxin Category	n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
Comparison	1,187		
Background RH	367	0.89 (0.69,1.14)	0.368
Low RH	234	1.37 (1.02,1.84)	0.036
High RH	233	1.18 (0.87,1.61)	0.286
Low plus High RH	467	1.27 (1.01,1.60)	0.038

[a] Relative risk and confidence interval relative to Comparisons.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

Table 12-7. Analysis of Other Neuroses (Continued)

(g) MODEL 4: RANCH HANDS – 1987 DIOXIN – UNADJUSTED

1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)	
1987 Dioxin	n	Number (%) Yes	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	282	127 (45.0)	1.20 (1.09,1.32)	<0.001
Medium	284	152 (53.5)		
High	282	183 (64.9)		

[a] Relative risk for a twofold increase in 1987 dioxin.

Note: Low = ≤7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

(h) MODEL 4: RANCH HANDS – 1987 DIOXIN – ADJUSTED

Analysis Results for Log_2 (1987 Dioxin + 1)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
834	1.02 (0.91,1.14)	0.763

[a] Relative risk for a twofold increase in 1987 dioxin.

Model 2 analyses of other neuroses were nonsignificant, both unadjusted and adjusted for covariates (Table 12-7(c,d): p>0.16 for each analysis).

Each contrast of Ranch Hands with Comparisons in the unadjusted Model 3 analysis of other neuroses was significant (Table 12-7(e): p=0.018, Est. RR=0.75, for the Ranch Hand background dioxin category contrast; p=0.041, Est. RR=1.34, for the Ranch Hand low dioxin category contrast; p=0.008, Est. RR=1.48, for the Ranch Hand high dioxin category contrast; p=0.002, Est. RR=1.41, for the contrast of Ranch Hands in the combined low and high dioxin categories with Comparisons). Except for Ranch Hands in the background category, a higher proportion of Ranch Hands had other neuroses than did Comparisons. Results remained significant in the adjusted analysis of Ranch Hands in the low dioxin category (Table 12-7(f): p=0.036, Adj. RR=1.37) and the adjusted analysis of Ranch Hands in the combined low and high dioxin categories (Table 12-7(f): p=0.038, Adj. RR=1.27). The remaining adjusted analyses were nonsignificant (Table 12-7(f): p>0.28).

The Model 4 unadjusted analysis of other neuroses revealed a significant positive association between 1987 dioxin levels and other neuroses (Table 12-7(g): p<0.001, Est. RR=1.20). After accounting for covariates, the association was nonsignificant (Table 12-7(h): p=0.763).

12.2.2.2 Psychological Examination Variables

The 12 variables contained in this section are derived from the SCL-90-R. These 12 variables consist of nine primary symptom disease categories and three global indices of distress. A short description, which has been taken from the SCL-90-R reference manual (31), of each of the primary symptom disease categories and global indices of distress is given before the description of the results of the statistical analyses. The function of each of these global measures of the SCL-90-R, the GSI, the PSDI, and the PST, is to communicate in a single score the level or depth of the individual's psychopathology.

Seven items are a part of the SCL-90-R, which are not subsumed under any of the primary symptom dimensions; these symptoms actually "load" on several of the dimensions but are not unique to any of them. These seven items are having a poor appetite, overeating, having trouble falling asleep, awakening in the early morning, experiencing restless or disturbed sleep, thinking of death or dying, and feeling guilty. While in this sense they violate one of the statistical criteria for inclusion in the test, they are a part of the item set because they are clinically important. These items contribute to the global scores on the SCL-90-R and are intended to be used configurally. Thus, a high depression score with "early morning awakening" and "poor appetite" may mean something quite different from a similar score with these symptoms absent. By the same token, the presence of conscious "feelings of guilt" is an important clinical indicator that communicates important information to the clinician. The additional items are not scored collectively as a dimension but are summed into the global scores.

12.2.2.2.1 SCL-90-R Anxiety

The anxiety dimension is composed of a set of symptoms and signs that are associated clinically with high levels of manifest anxiety. General signs such as nervousness, tension, and trembling are included in the definition, as are panic attacks and feelings of terror. Cognitive components involving feelings of apprehension and dread, and some of the somatic correlates of anxiety, also are included as dimensional components. The symptoms comprising the anxiety dimension are experiencing nervousness or shakiness inside, trembling, being suddenly scared for no reason, feeling fearful, experiencing heart pounding or racing, feeling tense and keyed up, having spells of terror and panic, feeling so restless you couldn't sit still, feeling that something bad is going to happen, and experiencing frightening thoughts and images.

The Model 1 unadjusted analysis of SCL-90-R anxiety revealed no significant differences between Ranch Hands and Comparisons when examined across all occupations or within each occupational stratum (Table 12-8(a): p>0.10 for each contrast). When covariates were entered into the Model 1 analysis, a marginally significant difference was found for enlisted flyers (Table 12-8(b): p=0.073, Adj. RR=0.53). High SCL-90-R anxiety scores were more prevalent among Comparison enlisted flyers than Ranch Hand enlisted flyers (16.0% vs. 10.0%).

Table 12-8. Analysis of SCL-90-R Anxiety

(a) MODEL 1: RANCH HANDS VS. COMPARISONS – UNADJUSTED					
Occupational Category	Group	n	Number (%) High	Est. Relative Risk (95% C.I.)	p-Value
All	***Ranch Hand***	***866***	***82 (9.5)***	***0.83 (0.62,1.10)***	***0.197***
	Comparison	***1,249***	***140 (11.2)***		
Officer	Ranch Hand	341	14 (4.1)	0.71 (0.37,1.37)	0.309
	Comparison	493	28 (5.7)		
Enlisted Flyer	Ranch Hand	150	15 (10.0)	0.58 (0.30,1.13)	0.108
	Comparison	187	30 (16.0)		
Enlisted Groundcrew	Ranch Hand	375	53 (14.1)	0.98 (0.67,1.42)	0.905
	Comparison	569	82 (14.4)		

Table 12-8. Analysis of SCL-90-R Anxiety (Continued)

(b) MODEL 1: RANCH HANDS VS. COMPARISONS – ADJUSTED

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	***0.85 (0.63,1.14)***	***0.267***
Officer	0.75 (0.39,1.46)	0.400
Enlisted Flyer	0.53 (0.27,1.06)	0.073
Enlisted Groundcrew	1.02 (0.70,1.50)	0.904

(c) MODEL 2: RANCH HANDS – INITIAL DIOXIN – UNADJUSTED

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)[a]	
Initial Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	160	19 (11.9)	0.98 (0.79,1.21)	0.847
Medium	161	19 (11.8)		
High	157	17 (10.8)		

[a] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[b] Relative risk for a twofold increase in initial dioxin.

Note: Low = 27–63 ppt; Medium = >63–152 ppt; High = >152 ppt.

(d) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED

Analysis Results for Log_2 (Initial Dioxin)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
471	0.73 (0.57,0.95)	0.016

[a] Relative risk for a twofold increase in initial dioxin.

(e) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – UNADJUSTED

Dioxin Category	n	Number (%) High	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,211	133 (11.0)		
Background RH	381	27 (7.1)	0.65 (0.42,1.00)	0.051
Low RH	239	26 (10.9)	0.98 (0.63,1.53)	0.919
High RH	239	29 (12.1)	1.07 (0.70,1.65)	0.756
Low plus High RH	478	55 (11.5)	1.02 (0.73,1.43)	0.895

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

Table 12-8. Analysis of SCL-90-R Anxiety (Continued)

(f) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED

Dioxin Category	n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
Comparison	1,196		
Background RH	374	0.86 (0.55,1.35)	0.506
Low RH	236	1.09 (0.69,1.73)	0.717
High RH	235	0.76 (0.48,1.20)	0.237
Low plus High RH	471	0.91 (0.64,1.29)	0.595

[a] Relative risk and confidence interval relative to Comparisons.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(g) MODEL 4: RANCH HANDS – 1987 DIOXIN – UNADJUSTED

1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)	
1987 Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	288	19 (6.6)	1.15 (0.99,1.34)	0.065
Medium	287	30 (10.5)		
High	284	33 (11.6)		

[a] Relative risk for a twofold increase in 1987 dioxin.

Note: Low = ≤7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

(h) MODEL 4: RANCH HANDS – 1987 DIOXIN – ADJUSTED

	Analysis Results for Log_2 (1987 Dioxin + 1)	
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
845	0.96 (0.81,1.13)	0.618

[a] Relative risk for a twofold increase in 1987 dioxin.

Similar to Model 1, the result from the Model 2 unadjusted analysis of SCL-90-R anxiety was nonsignificant (Table 12-8(c): p=0.847). The adjusted analysis revealed a significant association between initial dioxin and the prevalence of high SCL-90-R anxiety scores (Table 12-8(d): p=0.016, Adj. RR=0.73). As initial dioxin increased, the prevalence of high SCL-90-R anxiety scores decreased.

The unadjusted Model 3 analysis revealed a marginally significant difference in the prevalence of high SCL-90-R anxiety scores among Ranch Hands in the background category (7.1%) and Comparisons (11.0%) (Table 12-8(e): p=0.051, Est. RR=0.65). Results were nonsignificant after adjustment for covariates (Table 12-8(f): p=0.506). Other Model 3 contrasts were nonsignificant (Table 12-8(e,f): p>0.23 for each contrast).

The unadjusted analysis of Model 4 revealed a marginally significant positive association between the 1987 dioxin levels and the prevalence of high SCL-90-R anxiety scores (Table 12-8(g): p=0.065, Est. RR=1.15). The results were nonsignificant after covariate adjustment (Table 12-8(h): p=0.619).

12.2.2.2.2 SCL-90-R Depression

The symptoms of the depression dimension reflect a broad range of the manifestations of clinical depression. Symptoms of dysphoric mood and affect are represented, as are signs of withdrawal of life interest, lack of motivation, and loss of vital energy. In addition, feelings of hopelessness, thoughts of suicide, and other cognitive and somatic correlates of depression are included. The symptoms comprising the depression dimension are losing sexual interest or pleasure, feeling low in energy or slowed down, thinking of ending your life, crying easily, feeling trapped or caught, blaming yourself for things, feeling lonely, feeling blue, worrying too much about things, feeling no interest in things, feeling hopeless about the future, feeling everything is an effort, and feeling worthless.

Both the unadjusted and adjusted analyses revealed a marginally significant difference in the prevalence of high SCL-90-R depression scores between Ranch Hands (13.3%) and Comparisons (16.1%) when examined across all occupations (Table 12-9(a,b): p=0.073, Est. RR=0.80; p=0.077, Adj. RR=0.79, respectively). In addition, a significant difference was found within the enlisted flyer stratum in both the unadjusted and adjusted analyses (Table 12-9(a,b): p=0.038, Est. RR=0.53; p=0.013, Adj. RR=0.45, respectively). The prevalence of high SCL-90-R depression scores was higher among Comparisons (21.4%) than Ranch Hands (12.7%) for this occupation. All remaining Model 1 contrasts, as well as the Model 2 analyses, were nonsignificant (Table 12-9(a–d): p>0.13).

Table 12-9. Analysis of SCL-90-R Depression

(a) MODEL 1: RANCH HANDS VS. COMPARISONS – UNADJUSTED

Occupational Category	Group	n	Number (%) High	Est. Relative Risk (95% C.I.)	p-Value
All	***Ranch Hand***	***866***	***115 (13.3)***	***0.80 (0.62,1.02)***	***0.073***
	Comparison	***1,249***	***201 (16.1)***		
Officer	Ranch Hand	341	28 (8.2)	0.85 (0.52,1.39)	0.512
	Comparison	493	47 (9.5)		
Enlisted Flyer	Ranch Hand	150	19 (12.7)	0.53 (0.29,0.97)	0.038
	Comparison	187	40 (21.4)		
Enlisted Groundcrew	Ranch Hand	375	68 (18.1)	0.88 (0.63,1.23)	0.469
	Comparison	569	114 (20.0)		

(b) MODEL 1: RANCH HANDS VS. COMPARISONS – ADJUSTED

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	***0.79 (0.61,1.03)***	***0.077***
Officer	0.89 (0.54,1.46)	0.642
Enlisted Flyer	0.45 (0.24,0.84)	0.013
Enlisted Groundcrew	0.90 (0.64,1.28)	0.562

Table 12-9. Analysis of SCL-90-R Depression (Continued)

(c) MODEL 2: RANCH HANDS – INITIAL DIOXIN – UNADJUSTED

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)[a]	
Initial Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	160	22 (13.8)	1.10 (0.91,1.32)	0.345
Medium	161	23 (14.3)		
High	157	26 (16.6)		

[a] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[b] Relative risk for a twofold increase in initial dioxin.

Note: Low = 27–63 ppt; Medium = >63–152 ppt; High = >152 ppt.

(d) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED

Analysis Results for Log_2 (Initial Dioxin)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
471	0.84 (0.67,1.06)	0.138

[a] Relative risk for a twofold increase in initial dioxin.

(e) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – UNADJUSTED

Dioxin Category	n	Number (%) High	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,211	194 (16.0)		
Background RH	381	43 (11.3)	0.70 (0.49,1.00)	0.052
Low RH	239	30 (12.6)	0.74 (0.49,1.12)	0.156
High RH	239	41 (17.2)	1.03 (0.71,1.50)	0.862
Low plus High RH	478	71 (14.9)	0.88 (0.65,1.18)	0.383

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

Table 12-9. Analysis of SCL-90-R Depression (Continued)

(f) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED

Dioxin Category	n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
Comparison	1,196		
Background RH	374	0.88 (0.60,1.27)	0.485
Low RH	236	0.78 (0.51,1.20)	0.256
High RH	235	0.74 (0.49,1.11)	0.142
Low plus High RH	471	0.76 (0.55,1.04)	0.087

[a] Relative risk and confidence interval relative to Comparisons.

Note: RH = Ranch Hand,
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(g) MODEL 4: RANCH HANDS – 1987 DIOXIN – UNADJUSTED

1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)	
1987 Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	288	29 (10.1)	1.15 (1.01,1.31)	0.040
Medium	287	38 (13.2)		
High	284	47 (16.6)		

[a] Relative risk for a twofold increase in 1987 dioxin.

Note: Low = ≤7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

(h) MODEL 4: RANCH HANDS – 1987 DIOXIN – ADJUSTED

Analysis Results for Log_2 (1987 Dioxin + 1)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
845	0.97 (0.84,1.13)	0.712

[a] Relative risk for a twofold increase in 1987 dioxin.

The unadjusted Model 3 analysis revealed a marginally significant difference in the prevalence of high SCL-90-R depression scores among Ranch Hands in the background category (11.3%) and Comparisons (16.0%) (Table 12-9(e): p=0.052, Est. RR=0.70). All other unadjusted contrasts were nonsignificant (Table 12-9(e): p>0.15). The Model 3 adjusted analysis revealed a marginally significant difference among Ranch Hands in the combined low and high dioxin categories and Comparisons (Table 12-9(g): p=0.087, Adj. RR=0.76). The remaining adjusted contrasts were nonsignificant (Table 12-9(f): p>0.14).

A significant positive association between the 1987 dioxin levels and the prevalence of a high SCL-90-R depression score was found from the unadjusted analysis of Model 4 (Table 12-9(g): p=0.040, Est. RR=1.15). The association was nonsignificant after adjustments for covariates (Table 12-9(h): p=0.712).

12.2.2.2.3 SCL-90-R Hostility

The hostility dimension reflects thoughts, feelings, or actions that are characteristic of the negative affect state of anger. The selection of items includes all three modes of manifestation and reflects qualities such as aggression, irritability, rage, and resentment. The symptoms comprising the hostility dimension are feeling easily annoyed or irritated; having uncontrollable temper outbursts; having urges to beat, injure, or harm someone; having urges to break or smash things; getting into frequent arguments; and shouting or throwing things.

The analysis of SCL-90-R hostility showed no significant results for Models 1 and 2 (Table 12-10(a–d): p>0.12 for each analysis).

Table 12-10. Analysis of SCL-90-R Hostility

(a) MODEL 1: RANCH HANDS VS. COMPARISONS – UNADJUSTED

Occupational Category	Group	n	Number (%) High	Est. Relative Risk (95% C.I.)	p-Value
All	***Ranch Hand***	***866***	***61 (7.0)***	***0.78 (0.56,1.08)***	***0.124***
	Comparison	***1,249***	***111 (8.9)***		
Officer	Ranch Hand	341	11 (3.2)	0.68 (0.33,1.42)	0.304
	Comparison	493	23 (4.7)		
Enlisted Flyer	Ranch Hand	150	11 (7.3)	0.63 (0.29,1.34)	0.228
	Comparison	187	21 (11.2)		
Enlisted Groundcrew	Ranch Hand	375	39 (10.4)	0.87 (0.57,1.32)	0.513
	Comparison	569	67 (11.8)		

(b) MODEL 1: RANCH HANDS VS. COMPARISONS – ADJUSTED

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	0.81 (0.55,1.19)	0.287
Officer	0.71 (0.34,1.49)	0.367
Enlisted Flyer	0.66 (0.30,1.45)	0.301
Enlisted Groundcrew	0.90 (0.59,1.39)	0.642

(c) MODEL 2: RANCH HANDS – INITIAL DIOXIN – UNADJUSTED

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)[a]	
Initial Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	160	12 (7.5)	1.12 (0.88,1.42)	0.377
Medium	161	12 (7.5)		
High	157	15 (9.6)		

[a] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[b] Relative risk for a twofold increase in initial dioxin.

Note: Low = 27–63 ppt; Medium = >63–152 ppt; High = >152 ppt.

Table 12-10. Analysis of SCL-90-R Hostility (Continued)

(d) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED

Analysis Results for Log_2 (Initial Dioxin)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
471	0.94 (0.71,1.25)	0.692

[a] Relative risk for a twofold increase in initial dioxin.

(e) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – UNADJUSTED

Dioxin Category	n	Number (%) High	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,211	107 (8.8)		
Background RH	381	22 (5.8)	0.66 (0.41,1.07)	0.090
Low RH	239	16 (6.7)	0.73 (0.42,1.26)	0.261
High RH	239	23 (9.6)	1.05 (0.65,1.70)	0.828
Low plus High RH	478	39 (8.2)	0.88 (0.60,1.30)	0.512

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(f) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED

Dioxin Category	n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
Comparison	1,196		
Background RH	374	0.86 (0.52,1.40)	0.536
Low RH	236	0.80 (0.46,1.40)	0.440
High RH	235	0.84 (0.51,1.38)	0.488
Low plus High RH	471	0.82 (0.55,1.22)	0.333

[a] Relative risk and confidence interval relative to Comparisons.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

Table 12-10. Analysis of SCL-90-R Hostility (Continued)

(g) MODEL 4: RANCH HANDS – 1987 DIOXIN – UNADJUSTED

1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)	
1987 Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	288	16 (5.6)	1.19 (1.01,1.41)	0.045
Medium	287	19 (6.6)		
High	284	26 (9.2)		

[a] Relative risk for a twofold increase in 1987 dioxin.

Note: Low = ≤7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

(h) MODEL 4: RANCH HANDS – 1987 DIOXIN – ADJUSTED

Analysis Results for Log_2 (1987 Dioxin + 1)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
845	1.01 (0.84,1.23)	0.889

[a] Relative risk for a twofold increase in 1987 dioxin.

A marginally significant difference in the prevalence of high SCL-90-R hostility scores was found among Ranch Hands in the background dioxin category (5.8%) and Comparisons (8.8%) from the Model 3 unadjusted analysis (Table 12-10(e): p=0.090, Est. RR=0.66). After adjustment for covariates, the difference was nonsignificant (Table 12-10(f): p=0.536), as well as all other Model 3 contrasts (Table 12-10(e,f): p>0.26 for all remaining contrasts).

The Model 4 unadjusted analysis showed a significant positive association between the 1987 dioxin levels and the prevalence of high SCL-90-R hostility scores (Table 12-10(g): p=0.045, Est. RR=1.19). After covariates were included in the model, the association was nonsignificant (Table 12-10(h): p=0.889).

12.2.2.2.4 SCL-90-R Interpersonal Sensitivity

The interpersonal sensitivity dimension focuses on feelings of personal inadequacy and inferiority, particularly in comparison with others. Self-deprecation, feelings of uneasiness, and marked discomfort during interpersonal interactions are characteristic manifestations of this syndrome. In addition, individuals with high scores on interpersonal sensitivity report acute self-consciousness and negative expectations concerning the communications and interpersonal behaviors with others. The symptoms comprising the interpersonal sensitivity dimension are feeling critical of others, feeling shy or uneasy with the opposite sex, having feelings easily hurt, feeling others do not understand or are unsympathetic to, feeling that people are unfriendly or dislike you, feeling inferior to others, feeling uneasy when people are watching or talking about you, feeling very self-conscious with others, and feeling uncomfortable about eating or drinking in public.

The Model 1 unadjusted analysis of SCL-90-R interpersonal sensitivity revealed marginally significant differences between Ranch Hands and Comparisons examined across all occupational strata and within the enlisted flyer stratum (Table 12-11(a): p=0.066, Est. RR=0.80; p=0.072, Est. RR=0.59, respectively). The results remained marginally significant for the contrast of Ranch Hands and Comparisons across all occupations in the adjusted analysis and became significant for the enlisted flyer contrast (Table 12-11(b):

p=0.070, Adj. RR=0.79; p=0.029, Adj. RR=0.52, respectively). Both contrasts showed that Comparisons had an increased prevalence of high SCL-90-R interpersonal sensitivity scores over Ranch Hands (16.4% vs. 13.5% for all occupations combined and 22.5% vs. 14.7% for enlisted flyers). All other Model 1 contrasts were nonsignificant (Table 12-11(a,b): p>0.27 for all remaining contrasts).

Table 12-11. Analysis of SCL-90-R Interpersonal Sensitivity

(a) MODEL 1: RANCH HANDS VS. COMPARISONS – UNADJUSTED

Occupational Category	Group	n	Number (%) High	Est. Relative Risk (95% C.I.)	p-Value
All	***Ranch Hand***	***866***	***117 (13.5)***	***0.80 (0.62,1.02)***	***0.066***
	Comparison	***1,249***	***205 (16.4)***		
Officer	Ranch Hand	341	25 (7.3)	0.90 (0.53,1.51)	0.679
	Comparison	493	40 (8.1)		
Enlisted Flyer	Ranch Hand	150	22 (14.7)	0.59 (0.34,1.05)	0.072
	Comparison	187	42 (22.5)		
Enlisted Groundcrew	Ranch Hand	375	70 (18.7)	0.83 (0.60,1.15)	0.272
	Comparison	569	123 (21.6)		

(b) MODEL 1: RANCH HANDS VS. COMPARISONS – ADJUSTED

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	***0.79 (0.61,1.02)***	***0.070***
Officer	0.93 (0.55,1.56)	0.772
Enlisted Flyer	0.52 (0.28,0.93)	0.029
Enlisted Groundcrew	0.86 (0.61,1.20)	0.366

(c) MODEL 2: RANCH HANDS – INITIAL DIOXIN – UNADJUSTED

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)[a]	
Initial Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	160	27 (16.9)	0.98 (0.81,1.18)	0.798
Medium	161	26 (16.2)		
High	157	26 (16.6)		

[a] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[b] Relative risk for a twofold increase in initial dioxin.

Note: Low = 27–63 ppt; Medium = >63–152 ppt; High = >152 ppt.

(d) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED

Analysis Results for Log_2 (Initial Dioxin)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
471	0.78 (0.62,0.97)	0.026

[a] Relative risk for a twofold increase in initial dioxin.

Table 12-11. Analysis of SCL-90-R Interpersonal Sensitivity (Continued)

(e) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – UNADJUSTED

Dioxin Category	n	Number (%) High	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,211	198 (16.4)		
Background RH	381	37 (9.7)	0.57 (0.39,0.83)	0.003
Low RH	239	36 (15.1)	0.90 (0.61,1.32)	0.586
High RH	239	43 (18.0)	1.08 (0.75,1.56)	0.672
Low plus High RH	478	79 (16.5)	0.99 (0.74,1.31)	0.923

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(f) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED

Dioxin Category	n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
Comparison	1,196		
Background RH	374	0.73 (0.49,1.07)	0.110
Low RH	236	0.92 (0.62,1.38)	0.698
High RH	235	0.77 (0.53,1.14)	0.190
Low plus High RH	471	0.84 (0.63,1.14)	0.270

[a] Relative risk and confidence interval relative to Comparisons.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(g) MODEL 4: RANCH HANDS – 1987 DIOXIN – UNADJUSTED

1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)	
1987 Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	288	28 (9.7)	1.12 (0.98,1.28)	0.090
Medium	287	39 (13.6)		
High	284	49 (17.3)		

[a] Relative risk for a twofold increase in 1987 dioxin.

Note: Low = ≤7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

Table 12-11. Analysis of SCL-90-R Interpersonal Sensitivity (Continued)

(h) MODEL 4: RANCH HANDS – 1987 DIOXIN – ADJUSTED		
	Analysis Results for Log_2 (1987 Dioxin + 1)	
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
845	0.95 (0.82,1.10)	0.511

[a] Relative risk for a twofold increase in 1987 dioxin.

The Model 2 unadjusted analysis of the association between initial dioxin and SCL-90-R interpersonal sensitivity scores was nonsignificant (Table 12-11(c): p=0.798). After adjustment for covariates, the association became significant (Table 12-11(d): p=0.026, Adj. RR=0.78). The prevalence of high SCL-90-R interpersonal sensitivity scores decreased as initial dioxin increased.

A significant difference between Ranch Hands in the background dioxin category and Comparisons was found from the unadjusted Model 3 analysis of SCL-90-R interpersonal sensitivity (Table 12-11(e): p=0.003, Est. RR=0.57). The prevalence of high SCL-90-R scores was greater among Comparisons (16.4%) than among Ranch Hands in the background dioxin category (9.7%). All other Model 3 unadjusted contrasts, as well as all adjusted contrasts, were nonsignificant (Table 12-11(e,f): p≥0.11 for all remaining contrasts).

The result from the Model 4 unadjusted analysis of SCL-90-R interpersonal sensitivity was marginally significant, indicating a positive association with the 1987 dioxin levels (Table 12-11(g): p=0.090, Est. RR=1.12). After adjustment for covariates, the result became nonsignificant (Table 12-11(h): p=0.511).

12.2.2.2.5 SCL-90-R Obsessive-Compulsive Behavior

The obsessive-compulsive dimension reflects symptoms that are highly identified with the standard clinical syndrome of the same name. This measure focuses on thoughts, impulses, and actions that are experienced as unremitting and irresistible by the individual but are of an ego-alien or unwanted nature. Behaviors and experiences of a more general cognitive performance attenuation also are included in this measure. The symptoms comprising the obsessive-compulsive dimension are experiencing repeated unpleasant thoughts that won't leave the mind, having trouble remembering things, worrying about sloppiness or carelessness, feeling blocked in getting things done, having to do things very slowly to ensure correctness, having to check and double-check what is done, having difficulty making decisions, having mind go blank, having trouble concentrating, and having to repeat the same actions (e.g., touching, counting, washing).

All Model 1 and 2 analyses of SCL-90-R obsessive-compulsive behavior were nonsignificant, both unadjusted and adjusted for covariates (Table 12-12(a–d): p>0.12 for each analysis).

Table 12-12. Analysis of SCL-90-R Obsessive-Compulsive Behavior

(a) MODEL 1: RANCH HANDS VS. COMPARISONS – UNADJUSTED

Occupational Category	Group	n	Number (%) High	Est. Relative Risk (95% C.I.)	p-Value
All	***Ranch Hand***	***866***	***121 (14.0)***	***0.83 (0.65,1.06)***	***0.125***
	Comparison	***1,249***	***205 (16.4)***		
Officer	Ranch Hand	341	30 (8.8)	0.92 (0.57,1.48)	0.718
	Comparison	493	47 (9.5)		
Enlisted Flyer	Ranch Hand	150	28 (18.7)	0.82 (0.48,1.40)	0.462
	Comparison	187	41 (21.9)		
Enlisted Groundcrew	Ranch Hand	375	63 (16.8)	0.78 (0.56,1.09)	0.150
	Comparison	569	117 (20.6)		

(b) MODEL 1: RANCH HANDS VS. COMPARISONS – ADJUSTED

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	***0.83 (0.65,1.07)***	***0.157***
Officer	0.95 (0.58,1.54)	0.824
Enlisted Flyer	0.77 (0.44,1.35)	0.365
Enlisted Groundcrew	0.81 (0.57,1.14)	0.225

(c) MODEL 2: RANCH HANDS – INITIAL DIOXIN – UNADJUSTED

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)[a]	
Initial Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	160	26 (16.3)	1.02 (0.85,1.23)	0.854
Medium	161	27 (16.8)		
High	157	24 (15.3)		

[a] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[b] Relative risk for a twofold increase in initial dioxin.

Note: Low = 27–63 ppt; Medium = >63–152 ppt; High = >152 ppt.

(d) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED

	Analysis Results for Log_2 (Initial Dioxin)	
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
471	0.89 (0.71,1.11)	0.294

[a] Relative risk for a twofold increase in initial dioxin.

Table 12-12. Analysis of SCL-90-R Obsessive-Compulsive Behavior (Continued)

(e) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – UNADJUSTED

Dioxin Category	n	Number (%) High	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,211	198 (16.4)		
Background RH	381	43 (11.3)	0.68 (0.48,0.97)	0.032
Low RH	239	38 (15.9)	0.96 (0.65,1.40)	0.821
High RH	239	39 (16.3)	0.96 (0.66,1.40)	0.831
Low plus High RH	478	77 (16.1)	0.96 (0.72,1.28)	0.773

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(f) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED

Dioxin Category	n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
Comparison	1,196		
Background RH	374	0.84 (0.58,1.21)	0.340
Low RH	236	1.01 (0.68,1.50)	0.948
High RH	235	0.72 (0.48,1.07)	0.103
Low plus High RH	471	0.85 (0.63,1.15)	0.298

[a] Relative risk and confidence interval relative to Comparisons.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(g) MODEL 4: RANCH HANDS – 1987 DIOXIN – UNADJUSTED

1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)	
1987 Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	288	30 (10.4)	1.13 (1.00,1.29)	0.058
Medium	287	42 (14.6)		
High	284	48 (16.9)		

[a] Relative risk for a twofold increase in 1987 dioxin.

Note: Low = ≤7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

Table 12-12. Analysis of SCL-90-R Obsessive-Compulsive Behavior (Continued)

(h) MODEL 4: RANCH HANDS – 1987 DIOXIN – ADJUSTED		
	Analysis Results for Log_2 (1987 Dioxin + 1)	
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
845	1.00 (0.87,1.16)	0.964

[a] Relative risk for a twofold increase in 1987 dioxin.

The Model 3 unadjusted analysis of SCL-90-R obsessive-compulsive behavior revealed a significant difference in the prevalence of high SCL-90-R scores between Ranch Hands in the background category (11.3%) and Comparisons (16.4%) (Table 12-12(e): p=0.032, Est. RR=0.68). The result was nonsignificant after adjustment for covariates (Table 12-12(f): p=0.340). All other Model 3 contrasts were also nonsignificant (Table 12-12(e,f): p>0.10 for all other contrasts).

A marginally significant positive association was found between the 1987 dioxin levels and the prevalence of high SCL-90-R obsessive-compulsive behavior scores from the unadjusted Model 4 analysis (Table 12-12(g): p=0.058, Est. RR=1.13). After adjustment for covariates, the association was nonsignificant (Table 12-12(h): p=0.964).

12.2.2.2.6 SCL-90-R Paranoid Ideation

The present dimension represents paranoid behavior fundamentally as a disordered mode of thinking. The cardinal characteristics of projective thought, hostility, suspiciousness, grandiosity, centrality, fear of loss of autonomy, and delusions are viewed as primary reflections of this disorder; item selection was oriented toward representing this conceptualization. The symptoms comprising the paranoid ideation dimension are feeling others are to blame for most of your troubles, feeling that most people cannot be trusted, feeling that you are watched or talked about by others, having ideas and beliefs that others do not share, not receiving proper credit from others for your achievements, and feeling that people will take advantage of you if you let them.

All results from the Model 1 and 2 analyses of SCL-90-R paranoid ideation were nonsignificant (Table 12-13(a–d): p>0.19 for each examination).

Table 12-13. Analysis of SCL-90-R Paranoid Ideation

(a) MODEL 1: RANCH HANDS VS. COMPARISONS – UNADJUSTED					
Occupational Category	Group	n	Number (%) High	Est. Relative Risk (95% C.I.)	p-Value
All	***Ranch Hand***	***866***	***57 (6.6)***	***0.92 (0.65,1.30)***	***0.627***
	Comparison	***1,249***	***89 (7.1)***		
Officer	Ranch Hand	341	8 (2.4)	0.77 (0.32,1.83)	0.547
	Comparison	493	15 (3.0)		
Enlisted Flyer	Ranch Hand	150	8 (5.3)	0.56 (0.24,1.34)	0.196
	Comparison	187	17 (9.1)		
Enlisted Groundcrew	Ranch Hand	375	41 (10.9)	1.10 (0.72,1.69)	0.652
	Comparison	569	57 (10.0)		

Table 12-13. Analysis of SCL-90-R Paranoid Ideation (Continued)

(b) MODEL 1: RANCH HANDS VS. COMPARISONS – ADJUSTED

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	***0.98 (0.68,1.40)***	***0.898***
Officer	0.84 (0.35,2.03)	0.698
Enlisted Flyer	0.56 (0.23,1.37)	0.206
Enlisted Groundcrew	1.17 (0.76,1.81)	0.479

(c) MODEL 2: RANCH HANDS – INITIAL DIOXIN – UNADJUSTED

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)[a]	
Initial Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	160	8 (5.0)	1.16 (0.91,1.47)	0.227
Medium	161	15 (9.3)		
High	157	16 (10.2)		

[a] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[b] Relative risk for a twofold increase in initial dioxin.

Note: Low = 27–63 ppt; Medium = >63–152 ppt; High = >152 ppt.

(d) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED

Analysis Results for Log_2 (Initial Dioxin)		
Adjusted Relative Risk (95% C.I.)[a]		p-Value
471	0.85 (0.66,1.17)	0.374

[a] Relative risk for a twofold increase in initial dioxin.

(e) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – UNADJUSTED

Dioxin Category	n	Number (%) High	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,211	85 (7.0)		
Background RH	381	17 (4.5)	0.65 (0.38,1.10)	0.110
Low RH	239	13 (5.4)	0.75 (0.41,1.38)	0.357
High RH	239	26 (10.9)	1.56 (0.98,2.48)	0.062
Low plus High RH	478	39 (8.2)	1.08 (0.72,1.64)	0.703

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

Table 12-13. Analysis of SCL-90-R Paranoid Ideation (Continued)

(f) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED

Dioxin Category	n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
Comparison	1,196		
Background RH	374	0.90 (0.51,1.57)	0.702
Low RH	236	0.87 (0.47,1.61)	0.657
High RH	235	1.16 (0.71,1.89)	0.559
Low plus High RH	471	1.00 (0.65,1.54)	0.990

[a] Relative risk and confidence interval relative to Comparisons.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(g) MODEL 4: RANCH HANDS – 1987 DIOXIN – UNADJUSTED

1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)	
1987 Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	288	14 (4.9)	1.21 (1.02,1.45)	0.032
Medium	287	13 (4.5)		
High	284	29 (10.2)		

[a] Relative risk for a twofold increase in 1987 dioxin.

Note: Low = ≤7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

(h) MODEL 4: RANCH HANDS – 1987 DIOXIN – ADJUSTED

Analysis Results for Log_2 (1987 Dioxin + 1)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
845	1.00 (0.82,1.20)	0.960

[a] Relative risk for a twofold increase in 1987 dioxin.

The Model 3 unadjusted analysis of SCL-90-R paranoid ideation revealed a marginally significant difference in the prevalence of high SCL-90-R scores among Ranch Hands in the high dioxin category (10.9%) and Comparisons (7.0%) (Table 12-13(e): p=0.062, Est. RR=1.56). All other unadjusted contrasts were nonsignificant (Table 12-13(e): p≥0.11). After covariate adjustment, all results were nonsignificant (Table 12-13(f): p>0.55 for each adjusted contrast).

A significant positive association between the prevalence of high SCL-90-R paranoid ideation scores and the 1987 dioxin levels was found in the Model 4 unadjusted analysis (Table 12-13(g): p=0.032, Est. RR=1.21). The result was nonsignificant after adjustment for covariates (Table 12-13(h): p=0.960).

12.2.2.2.7 SCL-90-R Phobic Anxiety

Phobic anxiety is defined as a persistent fear response to a specific person, place, object, or situation that is characterized as being irrational and disproportionate to the stimulus and which leads to avoidance or escape behavior. The items of the present dimension focus on the more pathognomonic and disruptive manifestations of phobic behavior. The symptoms comprising the phobic anxiety dimension are feeling afraid in open spaces or on the street; feeling afraid to go out of the house alone; feeling afraid to travel on buses, subways, or trains; having to avoid certain things, places, or activities because they are frightening; feeling uneasy in crowds, such as while shopping or at a movie; feeling nervous when left alone; and feeling afraid of fainting in public.

The Model 1 unadjusted and adjusted analyses of the officer stratum revealed that Comparisons had a marginally significant higher prevalence of high SCL-90-R phobic anxiety scores than Ranch Hands (5.7% vs. 2.9%) (Table 12-14(a,b): p=0.066, Est. RR=0.50; p=0.090, Adj. RR=0.53, respectively). All other Model 1 contrasts were nonsignificant (Table 12-14(a,b): p>0.13 for all remaining contrasts).

Table 12-14. Analysis of SCL-90-R Phobic Anxiety

(a) MODEL 1: RANCH HANDS VS. COMPARISONS – UNADJUSTED

Occupational Category	Group	n	Number (%) High	Est. Relative Risk (95% C.I.)	p-Value
All	***Ranch Hand***	***866***	***85 (9.8)***	***0.93 (0.70,1.24)***	***0.615***
	Comparison	***1,249***	***131 (10.5)***		
Officer	Ranch Hand	341	10 (2.9)	0.50 (0.24,1.05)	0.066
	Comparison	493	28 (5.7)		
Enlisted Flyer	Ranch Hand	150	15 (10.0)	0.66 (0.34,1.29)	0.223
	Comparison	187	27 (14.4)		
Enlisted Groundcrew	Ranch Hand	375	60 (16.0)	1.24 (0.86,1.78)	0.258
	Comparison	569	76 (13.4)		

(b) MODEL 1: RANCH HANDS VS. COMPARISONS – ADJUSTED

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	***0.92 (0.68,1.24)***	***0.570***
Officer	0.53 (0.25,1.11)	0.090
Enlisted Flyer	0.59 (0.29,1.18)	0.136
Enlisted Groundcrew	1.24 (0.85,1.81)	0.270

Table 12-14. Analysis of SCL-90-R Phobic Anxiety (Continued)

(c) MODEL 2: RANCH HANDS – INITIAL DIOXIN – UNADJUSTED

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)[a]	
Initial Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	160	17 (10.6)	1.18 (0.97,1.44)	0.100
Medium	161	19 (11.8)		
High	157	26 (16.6)		

[a] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[b] Relative risk for a twofold increase in initial dioxin.

Note: Low = 27–63 ppt; Medium = >63–152 ppt; High = >152 ppt.

(d) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED

Analysis Results for Log_2 (Initial Dioxin)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
471	0.89 (0.70,1.12)	0.315

[a] Relative risk for a twofold increase in initial dioxin.

(e) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – UNADJUSTED

Dioxin Category	n	Number (%) High	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,211	126 (10.4)		
Background RH	381	22 (5.8)	0.53 (0.33,0.85)	0.009
Low RH	239	25 (10.5)	1.00 (0.64,1.58)	0.986
High RH	239	37 (15.5)	1.57 (1.05,2.33)	0.027
Low plus High RH	478	62 (13.0)	1.25 (0.90,1.74)	0.177

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

Table 12-14. Analysis of SCL-90-R Phobic Anxiety (Continued)

(f) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED

Dioxin Category	n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
Comparison	1,196		
Background RH	374	0.65 (0.40,1.06)	0.086
Low RH	236	1.04 (0.65,1.67)	0.872
High RH	235	1.11 (0.72,1.70)	0.647
Low plus High RH	471	1.07 (0.76,1.52)	0.694

[a] Relative risk and confidence interval relative to Comparisons.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

(g) MODEL 4: RANCH HANDS – 1987 DIOXIN – UNADJUSTED

1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)	
1987 Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	288	15 (5.2)	1.28 (1.11,1.48)	0.001
Medium	287	27 (9.4)		
High	284	42 (14.8)		

[a] Relative risk for a twofold increase in 1987 dioxin.

Note: Low = ≤7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

(h) MODEL 4: RANCH HANDS – 1987 DIOXIN – ADJUSTED

Analysis Results for Log_2 (1987 Dioxin + 1)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
445	1.03 (0.82,1.31)	0.797

[a] Relative risk for a twofold increase in 1987 dioxin.

The unadjusted Model 2 analysis revealed a marginally significant positive association between initial dioxin and the prevalence of high SCL-90-R phobic anxiety scores (Table 12-14(c): p=0.100, Est. RR=1.18). After adjustment for covariates, the association was nonsignificant (Table 12-14(d): p=0.315, Adj. RR=0.89).

Significant differences among Comparisons and Ranch Hands in both the background and high dioxin categories were found from the unadjusted Model 3 analysis of SCL-90-R phobic anxiety (Table 12-14(e): p=0.009, Est. RR=0.53; p=0.027, Est. RR=1.57, respectively). Higher SCL-90-R phobic anxiety scores were more prevalent among Comparisons than Ranch Hands in the background dioxin category (10.4% vs. 5.8%). Higher phobic anxiety scores were more prevalent among Ranch Hands in the high dioxin category than Comparisons (15.5% vs. 10.4%). Results were marginally significant for

the adjusted Ranch Hand background dioxin category contrast with Comparisons and nonsignificant for the adjusted contrast of Ranch Hands in the high dioxin category with Comparisons (Table 12-14(f): p=0.086, Adj. RR=0.65; p=0.647, respectively). All other Model 3 contrasts were nonsignificant (Table 12-14(e,f): p>0.17 for all remaining contrasts).

The results from the Model 4 unadjusted analysis revealed a significant positive association between the 1987 dioxin levels and the SCL-90-R phobic anxiety scores (Table 12-14(g): p=0.001, Est. RR=1.28). The association was nonsignificant after adjustment for covariates (Table 12-14(h): p=0.727).

12.2.2.2.8 SCL-90-R Psychoticism

The psychoticism scale was developed in a fashion to represent the construct as a continuous dimension of human experience. Items indicative of a withdrawn, isolated, schizoid lifestyle were included, as were first-rank symptoms of schizophrenia, such as hallucinations and thought-broadcasting. The symptoms comprising the psychoticism dimension are having the idea that someone else can control your thoughts, hearing voices that other people do not hear, believing that other people are aware of your private thoughts, having thoughts that are not your own, feeling lonely even when you are with people, having thoughts about sex that bother you a lot, believing that you should be punished for your sins, thinking that something serious is wrong with your body, never feeling close to another person, and thinking that something is wrong with your mind.

The contrast combining all occupations from the Model 1 unadjusted analysis of SCL-90-R psychoticism revealed a marginally significant difference in the prevalence of higher scores (Table 12-15(a): p=0.084, Est. RR=0.80). The prevalence of high psychoticism scores was greater for Comparisons than for Ranch Hands (14.7% vs. 12.1%). The results were nonsignificant in the adjusted analysis, as well as for all other Model 1 contrasts (Table 12-15(a,b): p>0.11 for all remaining contrasts).

Table 12-15. Analysis of SCL-90-R Psychoticism

(a) MODEL 1: RANCH HANDS VS. COMPARISONS – UNADJUSTED

Occupational Category	Group	n	Number (%) High	Est. Relative Risk (95% C.I.)	p-Value
All	*Ranch Hand*	*856*	*105 (12.1)*	*0.80 (0.62,1.03)*	*0.084*
	Comparison	***1,249***	***184 (14.7)***		
Officer	Ranch Hand	341	21 (6.2)	0.65 (0.38,1.12)	0.121
	Comparison	493	45 (9.1)		
Enlisted Flyer	Ranch Hand	150	19 (12.7)	0.73 (0.39,1.35)	0.317
	Comparison	187	31 (16.6)		
Enlisted Groundcrew	Ranch Hand	375	65 (17.3)	0.90 (0.64,1.26)	0.522
	Comparison	569	108 (19.0)		

(b) MODEL 1: RANCH HANDS VS. COMPARISONS – ADJUSTED

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	***0.81 (0.62,1.06)***	***0.116***
Officer	0.68 (0.39,1.17)	0.162
Enlisted Flyer	0.67 (0.36,1.27)	0.223
Enlisted Groundcrew	0.92 (0.65,1.31)	0.651

Table 12-15. Analysis of SCL-90-R Psychoticism (Continued)

(c) MODEL 2: RANCH HANDS – INITIAL DIOXIN – UNADJUSTED

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)[a]	
Initial Dioxin	n	Number (%) High	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	160	20 (12.5)	1.19 (0.99,1.44)	0.065
Medium	161	26 (16.2)		
High	157	25 (15.9)		

[a] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[b] Relative risk for a twofold increase in initial dioxin.

Note: Low = 27–63 ppt; Medium = >63–152 ppt; High = >152 ppt.

(d) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED

Analysis Results for Log_2 (Initial Dioxin)		
n	Adjusted Relative Risk (95% C.I.)[a]	p-Value
471	0.98 (0.78,1.22)	0.838

[a] Relative risk for a twofold increase in initial dioxin.

(e) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – UNADJUSTED

Dioxin Category	n	Number (%) High	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,211	176 (14.5)		
Background RH	381	33 (8.7)	0.58 (0.39,0.86)	0.006
Low RH	239	28 (11.7)	0.77 (0.51,1.18)	0.237
High RH	239	43 (18.0)	1.25 (0.86,1.81)	0.235
Low plus High RH	478	71 (14.9)	0.98 (0.73,1.33)	0.914

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin ≤ 10 ppt.
Background (Ranch Hand): 1987 Dioxin ≤ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.