Table 16-14. Analysis of Fasting Glucose (mg/dl) (Continuous) (Continued)

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

Dioxin Category	n	Adj. Mean[a]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[b]	p-Value[c]
Comparison	1,200	103.8		
Background RH	377	102.8	−1.0 --	0.418
Low RH	235	102.9	−0.9 --	0.551
High RH	240	106.3	2.5 --	0.106
Low plus High RH	475	104.6	0.8 --	0.482

[a] Transformed from natural logarithm scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[c] P-value is based on difference of means on natural logarithm scale.

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	Mean[a]	R^2	Slope (Std. Error)[b]	p-Value
Low	288	97.8	0.019	0.020 (0.005)	<0.001
Medium	286	101.6			
High	287	104.6			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of fasting glucose versus $\log_2$ (1987 dioxin + 1).

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

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

1987 Dioxin Category Summary Statistics			Analysis Results for $\log_2$ (1987 Dioxin + 1)		
1987 Dioxin	n	Adj. Mean[a]	R^2	Adjusted Slope (Std. Error)[b]	p-Value
Low	284	101.0	0.082	0.018 (0.006)	0.002
Medium	285	102.7			
High	283	107.2			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of fasting glucose versus $\log_2$ (1987 dioxin + 1).

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

Both the unadjusted and adjusted Model 4 analyses showed significant positive associations between fasting glucose in its continuous form and 1987 dioxin (Table 16-14(g,h): slope=0.020, p<0.001, for the

unadjusted analysis; adjusted slope=0.018, p=0.002, for the adjusted analysis). The adjusted mean fasting glucose values in the low, medium, and high 1987 dioxin categories were 101.0 mg/dl, 102.7 mg/dl, and 107.2 mg/dl, respectively.

16.2.2.3.7 Fasting Glucose (Discrete)

The percentage of participants with high fasting glucose levels did not significantly differ between Ranch Hands and Comparisons across all occupations or within each occupational stratum in the Model 1 analysis (Table 16-15(a,b): p>0.52 for each analysis).

Table 16-15. Analysis of Fasting Glucose (Discrete)

(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*	*868*	*152 (17.5)*	*1.04 (0.83,1.31)*	*0.741*
	Comparison	*1,250*	*212 (17.0)*		
Officer	Ranch Hand	339	56 (16.5)	1.11 (0.76,1.61)	0.603
	Comparison	494	75 (15.2)		
Enlisted Flyer	Ranch Hand	151	29 (19.2)	1.00 (0.58,1.72)	0.991
	Comparison	187	36 (19.3)		
Enlisted Groundcrew	Ranch Hand	378	67 (17.7)	1.00 (0.71,1.40)	0.992
	Comparison	569	101 (17.8)		

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

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	*1.07 (0.84,1.37)*	*0.562*
Officer	1.11 (0.75,1.64)	0.611
Enlisted Flyer	0.90 (0.50,1.60)	0.712
Enlisted Groundcrew	1.12 (0.78,1.61)	0.526

(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	159	29 (18.2)	1.13 (0.95,1.34)	0.172
Medium	161	35 (21.7)		
High	160	38 (23.8)		

[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.

Table 16-15. Analysis of Fasting Glucose (Discrete) (Continued)

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

n	Analysis Results for Log_2 (Initial Dioxin) Adjusted Relative Risk (95% C.I.)[a]	p-Value
475	1.31 (1.06,1.62)	0.013

[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	1,212	203 (16.7)		
Background RH	381	48 (12.6)	0.89 (0.63,1.26)	0.517
Low RH	238	44 (18.5)	1.07 (0.73,1.56)	0.721
High RH	242	58 (24.0)	1.35 (0.95,1.91)	0.097
Low plus High RH	480	102 (21.3)	1.20 (0.91,1.59)	0.200

[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	1,200		
Background RH	377	0.91 (0.63,1.31)	0.609
Low RH	235	1.03 (0.70,1.53)	0.877
High RH	240	1.44 (0.99,2.11)	0.056
Low plus High RH	475	1.22 (0.91,1.64)	0.178

[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 16-15. Analysis of Fasting Glucose (Discrete) (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	34 (11.8)	1.25 (1.11,1.41)	<0.001
Medium	286	51 (17.8)		
High	287	65 (22.6)		

[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
852	1.25 (1.08,1.46)	0.003

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

The unadjusted Model 2 analysis did not show a significant relation between initial dioxin and the percentage of participants with high fasting glucose levels (Table 16-15(c): p=0.172). After adjusting for covariates, the results became significant (Table 16-15(b): Adj. RR=1.31, p=0.013). The percentages of participants with high fasting glucose values in the low, medium, and high initial dioxin categories were 18.2, 21.7, and 23.8, respectively.

Both the unadjusted and adjusted Model 3 analyses revealed a marginally significant difference in the percentage of high fasting glucose levels between Ranch Hands in the high dioxin category and Comparisons (Table 16-15(e,f): Est. RR=1.35, p=0.097; Adj. RR=1.44, p=0.056, respectively). The percentage of abnormal fasting glucose values for Ranch Hands in the high dioxin category was 24.0 versus 16.7 percent for Comparisons.

The unadjusted and adjusted Model 4 analyses each revealed significant positive associations between high fasting glucose levels and 1987 dioxin (Table 16-15(g,h): Est. RR=1.25, p<0.001; Adj. RR=1.25, p=0.003, respectively). The percentages of participants with high fasting glucose values in the low, medium, and high 1987 dioxin categories were 11.8, 17.8, and 22.6, respectively.

16.2.2.3.8 2-Hour Postprandial Glucose (Continuous)

The unadjusted and adjusted Model 1 analyses of 2-hour postprandial glucose in its continuous form did not show a significant difference between all Ranch Hands and Comparisons (Table 16-16(a,b): p>0.70 for each analysis). Stratifying by occupation revealed significant differences between Ranch Hand and Comparison officers in both the unadjusted and adjusted analyses (Table 16-16(a,b): difference of means=4.3 mg/dl, p=0.053, for the unadjusted analysis; difference of adjusted means=3.5 mg/dl, p=0.086, for the adjusted analysis). The adjusted mean 2-hour postprandial glucose level for Ranch Hand officers was 103.0 mg/dl versus 99.5 mg/dl for Comparison officers.

Table 16-16. Analysis of 2-Hour Postprandial Glucose (mg/dl) (Continuous)

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

Occupational Category	Group	n	Mean[a]	Difference of Means (95% C.I.)[b]	p-Value[c]
All	*Ranch Hand*	*714*	*105.2*	*0.3 --*	*0.818*
	Comparison	*1,023*	*104.9*		
Officer	Ranch Hand	285	106.1	4.3 --	0.053
	Comparison	419	101.8		
Enlisted Flyer	Ranch Hand	121	107.8	−3.5 --	0.342
	Comparison	146	111.3		
Enlisted Groundcrew	Ranch Hand	308	103.4	−2.3 --	0.274
	Comparison	458	105.8		

[a] Transformed from natural logarithm scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[c] P-value is based on difference of means on natural logarithm scale.

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

Occupational Category	Group	n	Adjusted Mean[a]	Difference of Adj. Means (95% C.I.)[b]	p-Value[c]
All	*Ranch Hand*	*705*	*105.5*	*0.5 --*	*0.702*
	Comparison	*1,014*	*105.0*		
Officer	Ranch Hand	283	103.0	3.5 --	0.086
	Comparison	418	99.5		
Enlisted Flyer	Ranch Hand	118	106.4	−2.9 --	0.405
	Comparison	142	109.3		
Enlisted Groundcrew	Ranch Hand	304	106.0	−1.2 --	0.563
	Comparison	454	107.2		

[a] Transformed from natural logarithm scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[c] P-value is based on difference of means on natural logarithm scale.

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

Initial Dioxin Category Summary Statistics				Analysis Results for $\log_2$ (Initial Dioxin)[b]		
Initial Dioxin	n	Mean[a]	Adj. Mean[ab]	R^2	Slope (Std. Error)[c]	p-Value
Low	125	107.4	108.3	0.076	−0.010 (0.011)	0.363
Medium	123	105.9	106.2			
High	121	107.4	106.2			

[a] Transformed from natural logarithm scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Slope and standard error based on natural logarithm of 2-hour postprandial glucose versus $\log_2$ (initial dioxin).

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

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

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)		
Initial Dioxin	n	Adj. Mean[a]	R^2	Adj. Slope (Std. Error)[b]	p-Value
Low	124	108.1	0.139	0.003 (0.013)	0.832
Medium	119	106.7			
High	121	110.3			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of 2-hour postprandial glucose versus log_2 (initial dioxin).

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

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

Dioxin Category	n	Mean[a]	Adj. Mean[ab]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[c]	p-Value[d]
Comparison	996	104.9	104.7		
Background RH	342	103.6	105.3	0.6 --	0.718
Low RH	186	107.3	107.1	2.4 --	0.296
High RH	183	106.5	104.5	–0.2 --	0.942
Low plus High RH	369	106.9	105.8	1.1 --	0.521

[a] Transformed from natural logarithm scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[d] P-value is based on difference of means on natural logarithm scale.

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	Adj. Mean[a]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[b]	p-Value[c]
Comparison	987	105.1		
Background RH	338	106.1	1.0 --	0.585
Low RH	183	106.1	1.0 --	0.655
High RH	181	104.6	-0.5 --	0.804
Low plus High RH	364	105.4	0.3 --	0.900

[a] Transformed from natural logarithm scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[c] P-value is based on difference of means on natural logarithm scale.

Note: RH = Ranch Hand.
Comparison: 1987 Dioxin $\leq$ 10 ppt.
Background (Ranch Hand): 1987 Dioxin $\leq$ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin $\leq$ 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	Mean[a]	R^2	Slope (Std. Error)[b]	p-Value
Low	264	103.7	0.003	0.011 (0.007)	0.115
Medium	230	106.0			
High	217	106.5			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of 2-hour postprandial glucose versus $\log_2$ (1987 dioxin + 1).

Note: Low = $\leq$7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

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

1987 Dioxin Category Summary Statistics			Analysis Results for $\log_2$ (1987 Dioxin + 1)		
1987 Dioxin	n	Adj. Mean[a]	R^2	Adjusted Slope (Std. Error)[b]	p-Value
Low	260	105.1	0.137	0.002 (0.008)	0.850
Medium	229	103.7			
High	213	105.3			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of 2-hour postprandial glucose versus $\log_2$ (1987 dioxin + 1).

Note: Low = $\leq$7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

The unadjusted and adjusted analyses of 2-hour postprandial glucose in Models 2 through 4 were nonsignificant (Table 16-16(c–h): p>0.11 for each analysis).

16.2.2.3.9 2-Hour Postprandial Glucose (Discrete)

The percentage of participants with impaired 2-hour postprandial glucose levels did not significantly differ between Ranch Hands and Comparisons across all occupations (Table 16-17(a,b): p>0.91 for both unadjusted and adjusted analyses). Stratifying the unadjusted analysis by occupation revealed a marginally significant difference between Ranch Hand and Comparison officers (Table 16-17(a): Est. RR=1.51, p=0.052). The percentage of 2-hour postprandial glucose values classified as impaired for Ranch Hand officers was 18.2 versus 12.9 percent for Comparison officers. No significant contrasts were revealed after stratifying the adjusted analysis by occupation (Table 16-17(b): p≥0.11 for each contrast).

Table 16-17. Analysis of 2-Hour Postprandial Glucose (Discrete)

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

Occupational Category	Group	n	Number (%) Impaired	Est. Relative Risk (95% C.I.)	p-Value
All	*Ranch Hand*	*714*	*113 (15.8)*	*1.01 (0.77,1.31)*	*0.960*
	Comparison	*1,023*	*161 (15.7)*		
Officer	Ranch Hand	285	52 (18.2)	1.51 (1.00,2.28)	0.052
	Comparison	419	54 (12.9)		
Enlisted Flyer	Ranch Hand	121	22 (18.2)	0.82 (0.45,1.52)	0.534
	Comparison	146	31 (21.2)		
Enlisted Groundcrew	Ranch Hand	308	39 (12.7)	0.73 (0.48,1.11)	0.136
	Comparison	458	76 (16.6)		

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

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	*0.98 (0.75,1.30)*	*0.912*
Officer	1.42 (0.92,2.20)	0.110
Enlisted Flyer	0.81 (0.43,1.54)	0.526
Enlisted Groundcrew	0.75 (0.48,1.16)	0.191

(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 (%) Impaired	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	125	23 (18.4)	0.88 (0.71,1.10)	0.267
Medium	123	23 (18.7)		
High	121	20 (16.5)		

[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.

Table 16-17. Analysis of 2-Hour Postprandial Glucose (Discrete) (Continued)

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

n	Analysis Results for Log_2 (Initial Dioxin) Adjusted Relative Risk (95% C.I.)[a]	p-Value
364	0.99 (0.76,1.29)	0.940

[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 (%) Impaired	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	996	155 (15.6)		
Background RH	342	47 (13.7)	0.98 (0.68,1.40)	0.906
Low RH	186	35 (18.8)	1.27 (0.84,1.92)	0.260
High RH	183	31 (16.9)	1.00 (0.65,1.54)	0.999
Low plus High RH	369	66 (17.9)	1.13 (0.82,1.56)	0.468

[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	987		
Background RH	338	0.94 (0.64,1.37)	0.729
Low RH	183	1.12 (0.73,1.72)	0.616
High RH	181	1.01 (0.64,1.60)	0.960
Low plus High RH	364	1.06 (0.76,1.49)	0.722

[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 16-17. Analysis of 2-Hour Postprandial Glucose (Discrete) (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 (%) Impaired	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	264	38 (14.4)	1.06 (0.92,1.22)	0.394
Medium	230	40 (17.4)		
High	217	35 (16.1)		

[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
702	1.10 (0.91,1.33)	0.332

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

All unadjusted and adjusted Models 2 through 4 analyses were nonsignificant (Table 16-17(c–h): p>0.26 for each analysis).

16.2.2.3.10 Fasting Urinary Glucose

The unadjusted and adjusted Models 1 through 3 analyses of fasting urinary glucose were nonsignificant (Table 16-18(a–f): p>0.12 for each analysis).

Table 16-18. Analysis of Fasting Urinary Glucose

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

Occupational Category	Group	n	Number (%) Present	Est. Relative Risk (95% C.I.)	p-Value
All	*Ranch Hand*	*868*	*35 (4.0)*	*0.93 (0.60,1.44)*	*0.745*
	Comparison	*1,250*	*54 (4.3)*		
Officer	Ranch Hand	339	11 (3.2)	1.35 (0.59,3.09)	0.482
	Comparison	494	12 (2.4)		
Enlisted Flyer	Ranch Hand	151	8 (5.3)	1.11 (0.42,2.94)	0.839
	Comparison	187	9 (4.8)		
Enlisted Groundcrew	Ranch Hand	378	16 (4.2)	0.72 (0.39,1.32)	0.288
	Comparison	569	33 (5.8)		

Table 16-18. Analysis of Fasting Urinary Glucose (Continued)

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

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	*0.98 (0.63,1.52)*	*0.924*
Officer	1.40 (0.61,3.22)	0.432
Enlisted Flyer	1.13 (0.41,3.11)	0.816
Enlisted Groundcrew	0.77 (0.42,1.43)	0.412

(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 (%) Present	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	159	5 (3.1)	1.19 (0.90,1.57)	0.220
Medium	161	13 (8.1)		
High	160	9 (5.6)		

[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
475	1.27 (0.90,1.79)	0.173

[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 (%) Present	Est. Relative Risk (95% C.I.)[a,b]	p-Value
Comparison	1,212	51 (4.2)		
Background RH	381	7 (1.8)	0.53 (0.24,1.19)	0.124
Low RH	238	9 (3.8)	0.81 (0.38,1.70)	0.571
High RH	242	18 (7.4)	1.51 (0.85,2.69)	0.160
Low plus High RH	480	27 (5.6)	1.11 (0.66,1.85)	0.696

[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 16-18. Analysis of Fasting Urinary Glucose (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	1,200		
Background RH	377	0.63 (0.27,1.43)	0.265
Low RH	235	0.92 (0.43,1.97)	0.827
High RH	240	1.33 (0.71,2.49)	0.369
Low plus High RH	475	1.11 (0.65,1.89)	0.704

[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 (%) Present	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	288	3 (1.0)	1.38 (1.12,1.71)	0.004
Medium	286	11 (3.8)		
High	287	20 (7.0)		

[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
852	1.47 (1.11,1.94)	0.006

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

Both the unadjusted and adjusted Model 4 analyses revealed significant positive relations between fasting urinary glucose and 1987 dioxin (Table 16-18(g,h): Est. RR=1.38, p=0.004; Adj. RR=1.47, p=0.006, respectively). The percentages of participants with fasting urinary glucose in the low, medium, and high 1987 dioxin categories were 1.0, 3.8, and 7.0, respectively.

16.2.2.3.11   2-Hour Postprandial Urinary Glucose

The unadjusted Model 1 analysis of 2-hour postprandial urinary glucose did not reveal a significant overall group difference between Ranch Hands and Comparisons (Table 16-19(a): p=0.122). Stratifying the unadjusted analysis by occupation revealed a significant difference between Ranch Hand and Comparison officers (Table 16-19(a): Est. RR=1.49, p=0.034). The prevalence of 2-hour postprandial

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urinary glucose was greater for Ranch Hand officers (24.0%) than for Comparison officers (17.5%). The adjusted Model 1 analysis revealed a significant difference between Ranch Hands and Comparisons across all occupations and within the officer stratum (Table 16-19(b): Adj. RR=1.22, p=0.094; Adj. RR=1.47, p=0.044, respectively). The presence of 2-hour postprandial urinary glucose for Ranch Hands was 25.1 percent versus 21.9 percent for Comparisons. For the officers, 24.0 percent of the Ranch Hands had 2-hour postprandial urinary glucose present versus 17.5 percent of the Comparisons.

Table 16-19. Analysis of 2-Hour Postprandial Urinary Glucose

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

Occupational Category	Group	n	Number (%) Present	Est. Relative Risk (95% C.I.)	p-Value
All	*Ranch Hand*	*712*	*179 (25.1)*	*1.19 (0.95,1.50)*	*0.122*
	Comparison	*1,021*	*224 (21.9)*		
Officer	Ranch Hand	283	68 (24.0)	1.49 (1.03,2.17)	0.034
	Comparison	418	73 (17.5)		
Enlisted Flyer	Ranch Hand	121	28 (23.1)	0.71 (0.41,1.24)	0.233
	Comparison	145	43 (29.7)		
Enlisted Groundcrew	Ranch Hand	308	83 (26.9)	1.20 (0.86,1.67)	0.291
	Comparison	458	108 (23.6)		

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

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	*1.22 (0.97,1.53)*	*0.094*
Officer	1.47 (1.01,2.14)	0.044
Enlisted Flyer	0.73 (0.42,1.28)	0.276
Enlisted Groundcrew	1.26 (0.90,1.76)	0.180

(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 (%) Present	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	124	34 (27.4)	0.94 (0.78,1.14)	0.535
Medium	123	30 (24.4)		
High	121	30 (24.8)		

[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.

Table 16-19. Analysis of 2-Hour Postprandial Urinary Glucose (Continued)

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

n	Analysis Results for Log$_2$ (Initial Dioxin) Adjusted Relative Risk (95% C.I.)[a]	p-Value
363	0.94 (0.75,1.17)	0.585

[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 (%) Present	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	994	214 (21.5)		
Background RH	341	85 (24.9)	1.20 (0.90,1.60)	0.222
Low RH	185	52 (28.1)	1.43 (1.00,2.03)	0.050
High RH	183	42 (23.0)	1.10 (0.75,1.60)	0.636
Low plus High RH	368	94 (25.5)	1.25 (0.95,1.65)	0.118

[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	985		
Background RH	337	1.32 (0.98,1.78)	0.072
Low RH	182	1.41 (0.98,2.02)	0.064
High RH	181	0.97 (0.66,1.44)	0.885
Low plus High RH	363	1.17 (0.88,1.56)	0.283

[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 16-19. Analysis of 2-Hour Postprandial Urinary Glucose (Continued)

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

1987 Dioxin Category Summary Statistics			Analysis Results for Log₂ (1987 Dioxin + 1)	
1987 Dioxin	n	Number (%) Present	Estimated Relative Risk (95% C.I.)ª	p-Value
Low	264	70 (26.5)	0.97 (0.86,1.10)	0.664
Medium	228	54 (23.7)		
High	217	55 (25.3)		

ª Relative risk for a twofold increase in 1987 dioxin.

Note: Low = $\leq$7.9 ppt; Medium = >7.9–19.6 ppt; High = >19.6 ppt.

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

	Analysis Results for Log₂ (1987 Dioxin + 1)	
n	Adjusted Relative Risk (95% C.I.)ª	p-Value
700	0.90 (0.78,1.03)	0.129

ª Relative risk for a twofold increase in 1987 dioxin.

Both the unadjusted and adjusted Model 2 analyses were nonsignificant (Table 16-19(c,d): p>0.53 for each analysis).

A significant difference between Ranch Hands in the low dioxin category and Comparisons was seen in the unadjusted Model 3 analysis of 2-hour postprandial urinary glucose (Table 16-19(e): Est. RR=1.43, p=0.050). After adjusting for covariates, two marginally significant contrasts were seen: Ranch Hands in the background dioxin category versus Comparisons (Table 16-19(f): Adj. RR=1.32, p=0.072) and Ranch Hands in the low dioxin category versus Comparisons (Table 16-19(f): Adj. RR=1.41, p=0.064). The presence of 2-hour postprandial urinary glucose for Ranch Hands in the background dioxin category, Ranch Hands in the low dioxin category, and Comparisons was 24.9 percent, 28.1 percent, and 21.5 percent, respectively.

The unadjusted and adjusted Model 4 analyses did not reveal a significant association between 2-hour postprandial urinary glucose and 1987 dioxin (Table 16-19(g,h): p>0.12 for each analysis).

16.2.2.3.12 Serum Insulin (Continuous)

The unadjusted and adjusted Models 1 and 2 analyses of serum insulin in its continuous form were nonsignificant (Table 16-20(a–d): p$\geq$0.17 for each analysis).

The unadjusted Model 3 analysis revealed a significant difference in mean serum insulin levels between Ranch Hands in the low plus high dioxin category and Comparisons (Table 16-20(e): difference of means=5.00 μIU/ml, p=0.046). The mean serum insulin level for Ranch Hands in the low plus high dioxin category was 52.35 μIU/ml versus 47.35 μIU/ml for Comparisons. After adjusting for covariates, the results became nonsignificant (Table 16-20(f): p>0.19 for each contrast).

Table 16-20. Analysis of Serum Insulin (µU/ml) (Continuous)

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

Occupational Category	Group	n	Mean[a]	Difference of Means (95% C.I.)[b]	p-Value[c]
All	*Ranch Hand*	*714*	*47.95*	*0.03 --*	*0.990*
	Comparison	*1,023*	*47.92*		
Officer	Ranch Hand	285	45.60	3.20 --	0.283
	Comparison	419	42.40		
Enlisted Flyer	Ranch Hand	121	49.81	−5.11 --	0.369
	Comparison	146	54.92		
Enlisted Groundcrew	Ranch Hand	308	49.49	−1.84 --	0.574
	Comparison	458	51.33		

[a] Transformed from natural logarithm scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[c] P-value is based on difference of means on natural logarithm scale.

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

Occupational Category	Group	n	Adjusted Mean[a]	Difference of Adj. Means (95% C.I.)[b]	p-Value[c]
All	*Ranch Hand*	*705*	*49.07*	*1.09 --*	*0.562*
	Comparison	*1,014*	*47.99*		
Officer	Ranch Hand	283	43.72	2.40 --	0.353
	Comparison	418	41.32		
Enlisted Flyer	Ranch Hand	118	49.21	−2.99 --	0.548
	Comparison	142	52.20		
Enlisted Groundcrew	Ranch Hand	304	53.35	1.05 --	0.735
	Comparison	454	52.31		

[a] Transformed from natural logarithm scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[c] P-value is based on difference of means on natural logarithm scale.

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

Initial Dioxin Category Summary Statistics				Analysis Results for Log_2 (Initial Dioxin)[b]		
Initial Dioxin	n	Mean[a]	Adj. Mean[ab]	R^2	Slope (Std. Error)[c]	p-Value
Low	125	52.55	54.14	0.092	0.020 (0.036)	0.571
Medium	123	52.18	52.70			
High	121	59.81	57.42			

[a] Transformed from natural logarithm scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Slope and standard error based on natural logarithm of serum insulin versus log_2 (initial dioxin).

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

Table 16-20. Analysis of Serum Insulin (µIU/ml) (Continuous) (Continued)

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

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)		
Initial Dioxin	n	Adj. Mean[a]	R^2	Adj. Slope (Std. Error)[b]	p-Value
Low	124	57.88	0.195	0.054 (0.040)	0.170
Medium	119	56.68			
High	121	67.03			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of serum insulin versus $\log_2$ (initial dioxin).

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

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

Dioxin Category	n	Mean[a]	Adj. Mean[ab]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[c]	p-Value[d]
Comparison	996	47.73	47.35		
Background RH	342	42.18	45.29	–2.06 --	0.393
Low RH	186	52.51	51.97	4.62 --	0.157
High RH	183	57.01	52.74	5.39 --	0.105
Low plus High RH	369	54.70	52.35	5.00 --	0.046

[a] Transformed from natural logarithm scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[d] P-value is based on difference of means on natural logarithm scale.

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 16-20. Analysis of Serum Insulin (μIU/ml) (Continuous) (Continued)

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

Dioxin Category	n	Adj. Mean[a]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[b]	p-Value[c]
Comparison	987	47.57		
Background RH	338	47.31	−0.26 --	0.914
Low RH	183	49.87	2.30 --	0.455
High RH	181	51.51	3.94 --	0.226
Low plus High RH	364	50.68	3.11 --	0.195

[a] Transformed from natural logarithm scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[c] P-value is based on difference of means on natural logarithm scale.

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	Mean[a]	R^2	Slope (Std. Error)[b]	p-Value
Low	264	41.18	0.025	0.100 (0.023)	<0.001
Medium	230	49.71			
High	217	56.76			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of serum insulin versus $\log_2$ (1987 dioxin + 1).

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

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

1987 Dioxin Category Summary Statistics			Analysis Results for $\log_2$ (1987 Dioxin + 1)		
1987 Dioxin	n	Adj. Mean[a]	R^2	Adjusted Slope (Std. Error)[b]	p-Value
Low	260	46.56	0.235	0.026 (0.025)	0.305
Medium	229	47.08			
High	213	53.05			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of serum insulin versus $\log_2$ (1987 dioxin + 1).

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

The unadjusted Model 4 analysis revealed a significant relation between serum insulin in its continuous form and 1987 dioxin (Table 16-20(g): slope=0.100, p<0.001). The mean serum insulin levels in the low, medium, and high 1987 dioxin categories were 41.18 µIU/ml, 49.71 µIU/ml, and 56.76 µIU/ml, respectively. After adjustment for covariates, the association was nonsignificant (Table 16-20(h): p=0.305).

16.2.2.3.13 Serum Insulin (Discrete)

Unadjusted and adjusted analyses in Models 1 and 2 did not show significant associations between dioxin and serum insulin in its discrete form (Table 16-21(a–d): p>0.14 for each analysis).

The unadjusted Model 3 analysis revealed a marginally significant difference between the percentage of Ranch Hands in the high dioxin category and Comparisons with abnormally low serum insulin levels (Table 16-21(e): Est. RR=0.58, p=0.082). The adjusted Model 3 analysis of abnormally low serum insulin levels revealed two marginally significant contrasts: Ranch Hands in the high dioxin category versus Comparisons (Table 16-21(f): Adj. RR=0.55, p=0.081) and Ranch Hands in the low plus high dioxin category versus Comparisons (Table 16-21(f): Adj. RR=0.68, p=0.093). The percentages of abnormally low serum insulin values for Ranch Hands in the high dioxin category, Ranch Hands in the low plus high dioxin category, and Comparisons were 7.1, 8.9, and 13.2, respectively.

The unadjusted Model 4 analysis revealed a significant association between 1987 dioxin and both abnormally low serum insulin levels (Table 16-21(g): Est. RR=0.83, p=0.050) and abnormally high serum insulin levels (Table 16-21(g): Est. RR=1.16, p=0.008). The percentage of participants with abnormally low serum insulin levels decreased with 1987 dioxin while the percentage of participants with abnormally high serum insulin levels increased with 1987 dioxin. The percentages of participants with abnormally low serum insulin levels in the low, medium, and high 1987 dioxin categories were 15.2, 11.7, and 7.8, respectively. The percentages of participants with abnormally high serum insulin levels in the low, medium, and high 1987 dioxin categories were 34.1, 41.7, and 49.8, respectively. Model 4 adjusted analyses showed no significant association between abnormal serum insulin levels and 1987 dioxin (p>0.58 for both contrasts).

Table 16-21. Analysis of Serum Insulin (Discrete)

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

| Occupational Category | Group | n | Number (%) | | | Abnormal Low vs. Normal | | Abnormal High vs. Normal | |
			Abnormal Low	Normal	Abnormal High	Est. Relative Risk (95% C.I.)	p-Value	Est. Relative Risk (95% C.I.)	p-Value
All	*Ranch Hand*	*714*	*86 (12.0)*	*334 (46.8)*	*294 (41.2)*	*0.85 (0.62,1.15)*	*0.278*	*0.92 (0.75,1.13)*	*0.443*
	Comparison	*1,023*	*138 (13.5)*	*453 (44.3)*	*432 (42.2)*				
Officer	Ranch Hand	285	36 (12.6)	137 (48.1)	112 (39.3)	0.76 (0.48,1.20)	0.235	1.08 (0.78,1.49)	0.655
	Comparison	419	69 (16.5)	199 (47.5)	151 (36.0)				
Enlisted Flyer	Ranch Hand	121	15 (12.4)	56 (46.3)	50 (41.3)	1.11 (0.49,2.51)	0.803	0.70 (0.42,1.17)	0.173
	Comparison	146	14 (9.6)	58 (39.7)	74 (50.7)				
Enlisted Groundcrew	Ranch Hand	308	35 (11.4)	141 (45.8)	132 (42.9)	0.88 (0.55,1.42)	0.613	0.89 (0.65,1.21)	0.442
	Comparison	458	55 (12.0)	196 (42.8)	207 (45.2)				

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

| Occupational Category | Abnormal Low vs. Normal | | Abnormal High vs. Normal | |
	Adj. Relative Risk (95% C.I.)	p-Value	Adj. Relative Risk (95% C.I.)	p-Value
All	*0.79 (0.58,1.08)*	*0.143*	*0.96 (0.77,1.21)*	*0.749*
Officer	0.76 (0.48,1.22)	0.256	1.08 (0.75,1.53)	0.688
Enlisted Flyer	0.83 (0.35,1.95)	0.671	0.72 (0.41,1.27)	0.257
Enlisted Groundcrew	0.81 (0.50,1.33)	0.412	0.97 (0.69,1.36)	0.870

Table 16-21. Analysis of Serum Insulin (Discrete) (Continued)

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

| | | Initial Dioxin Category Summary Statistics Number (%) | | | Analysis Results for Log$_2$ (Initial Dioxin)[a] | | | |
| | | | | | Abnormal Low vs. Normal | | Abnormal High vs. Normal | |
Initial Dioxin Category	n	Abnormal Low	Normal	Abnormal High	Est. Relative Risk (95% C.I.)[b]	p-Value	Est. Relative Risk (95% C.I.)[b]	p-Value
Low	125	12 (9.6)	61 (48.8)	52 (41.6)	0.96 (0.70,1.32)	0.815	1.07 (0.90,1.28)	0.447
Medium	123	13 (10.6)	51 (41.5)	59 (48.0)				
High	121	8 (6.6)	52 (43.0)	61 (50.4)				

[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) | | | |
| | Abnormal Low vs. Normal | | Abnormal High vs. Normal | |
n	Adj. Relative Risk (95% C.I.)[a]	p-Value	Adj. Relative Risk (95% C.I.)[a]	p-Value
364	0.97 (0.65,1.47)	0.901	1.15 (0.93,1.43)	0.182

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

Note: Results are not adjusted for race because of the sparse number of Ranch Hands with an abnormally low serum insulin level.

Table 16-21. Analysis of Serum Insulin (Discrete) (Continued)

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

Dioxin Category	n	Number (%) Abnormal Low	Number (%) Normal	Number (%) Abnormal High	Abnormal Low vs. Normal Est. Relative Risk (95% C.I.)[a][b]	Abnormal Low vs. Normal p-Value	Abnormal High vs. Normal Est. Relative Risk (95% C.I.)[a][b]	Abnormal High vs. Normal p-Value
Comparison	996	131 (13.2)	447 (44.9)	418 (42.0)				
Background RH	342	51 (14.9)	169 (49.4)	122 (35.7)	0.96 (0.66,1.39)	0.820	0.91 (0.69,1.20)	0.507
Low RH	186	20 (10.8)	81 (43.5)	85 (45.7)	0.84 (0.50,1.43)	0.527	1.14 (0.81,1.61)	0.460
High RH	183	13 (7.1)	83 (45.4)	87 (47.5)	0.58 (0.31,1.07)	0.082	0.99 (0.70,1.40)	0.968
Low plus High RH	369	33 (8.9)	164 (44.4)	172 (46.6)	0.70 (0.45,1.07)	0.102	1.06 (0.82,1.39)	0.643

[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 $\leq$ 10 ppt.
Background (Ranch Hand): 1987 Dioxin $\leq$ 10 ppt.
Low (Ranch Hand): 1987 Dioxin > 10 ppt, 10 ppt < Initial Dioxin $\leq$ 94 ppt.
High (Ranch Hand): 1987 Dioxin > 10 ppt, Initial Dioxin > 94 ppt.

Table 16-21. Analysis of Serum Insulin (Discrete) (Continued)

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

Dioxin Category	n	Abnormal Low vs. Normal Adj. Relative Risk (95% C.I.)[a]	p-Value	Abnormal High vs. Normal Adj. Relative Risk (95% C.I.)[a]	p-Value
Comparison	987				
Background RH	338	0.90 (0.61,1.31)	0.573	0.99 (0.74,1.34)	0.971
Low RH	183	0.82 (0.47,1.44)	0.496	1.00 (0.70,1.44)	0.994
High RH	181	0.55 (0.29,1.08)	0.081	0.94 (0.65,1.37)	0.759
Low plus High RH	364	0.68 (0.43,1.07)	0.093	0.97 (0.74,1.28)	0.843

[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	n	1987 Dioxin Category Summary Statistics Number (%) Abnormal Low	Normal	Abnormal High	Analysis Results for Log_2 (1987 Dioxin + 1) Abnormal Low vs. Normal Est. Relative Risk (95% C.I.)[a]	p-Value	Abnormal High vs. Normal Est. Relative Risk (95% C.I.)[a]	p-Value
Low	264	40 (15.2)	134 (50.8)	90 (34.1)	0.83 (0.69,1.00)	0.050	1.16 (1.04,1.30)	0.008
Medium	230	27 (11.7)	107 (46.5)	96 (41.7)				
High	217	17 (7.8)	92 (42.4)	108 (49.8)				

[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.

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Table 16-21. Analysis of Serum Insulin (Discrete) (Continued)

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

	Analysis Results for Log$_2$ (1987 Dioxin + 1)				
	Abnormal Low vs. Normal			Abnormal High vs. Normal	
n	Adj. Relative Risk (95% C.I.)[a]	p-Value		Adj. Relative Risk (95% C.I.)[a]	p-Value
702	0.94 (0.76,1.17)	0.589		1.03 (0.89,1.19)	0.685

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

16.2.2.3.14 α-1-C Hemoglobin (Continuous)

The unadjusted and adjusted Model 1 analyses did not reveal a significant difference in mean α-1-C hemoglobin levels between all Ranch Hands and Comparisons or after stratifying by occupation (Table 16-22(a,b): p≥0.28 for each analysis).

Table 16-22. Analysis of α-1-C Hemoglobin (percent) (Continuous)

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

Occupational Category	Group	n	Mean[a]	Difference of Means (95% C.I.)[b]	p-Value[c]
All	*Ranch Hand*	*868*	*6.48*	*–0.01 --*	*0.919*
	Comparison	*1,250*	*6.49*		
Officer	Ranch Hand	339	6.37	0.07 --	0.387
	Comparison	494	6.31		
Enlisted Flyer	Ranch Hand	151	6.53	–0.14 --	0.280
	Comparison	187	6.67		
Enlisted Groundcrew	Ranch Hand	378	6.57	–0.03 --	0.714
	Comparison	569	6.59		

[a] Transformed from natural logarithm scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[c] P-value is based on difference of means on natural logarithm scale.

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

Occupational Category	Group	n	Adjusted Mean[a]	Difference of Adj. Means (95% C.I.)[b]	p-Value[c]
All	*Ranch Hand*	*859*	*6.77*	*0.01 --*	*0.882*
	Comparison	*1,238*	*6.76*		
Officer	Ranch Hand	337	6.61	0.06 --	0.427
	Comparison	492	6.55		
Enlisted Flyer	Ranch Hand	148	6.74	–0.14 --	0.284
	Comparison	181	6.88		
Enlisted Groundcrew	Ranch Hand	374	6.91	0.01 --	0.905
	Comparison	565	6.90		

[a] Transformed from natural logarithm scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[c] P-value is based on difference of means on natural logarithm scale.

Table 16-22. Analysis of α-1-C Hemoglobin (percent) (Continuous) (Continued)

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

Initial Dioxin Category Summary Statistics				Analysis Results for Log$_2$ (Initial Dioxin)[b]		
Initial Dioxin	n	Mean[a]	Adj. Mean[ab]	R^2	Slope (Std. Error)[c]	p-Value
Low	159	6.43	6.47	0.107	0.017 (0.006)	0.009
Medium	161	6.70	6.71			
High	160	6.77	6.72			

[a] Transformed from natural logarithm scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Slope and standard error based on natural logarithm of α-1-C hemoglobin versus log$_2$ (initial dioxin).

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

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

Initial Dioxin Category Summary Statistics			Analysis Results for Log$_2$ (Initial Dioxin)		
Initial Dioxin	n	Adj. Mean[a]	R^2	Adj. Slope (Std. Error)[b]	p-Value
Low	158	6.68	0.163	0.024 (0.007)	0.001
Medium	157	7.01			
High	160	7.05			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of α-1-C hemoglobin versus log$_2$ (initial dioxin).

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

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

Dioxin Category	n	Mean[a]	Adj. Mean[ab]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[c]	p-Value[d]
Comparison	1,212	6.49	6.48		
Background RH	381	6.29	6.38	−0.10 --	0.116
Low RH	238	6.47	6.44	−0.04 --	0.588
High RH	242	6.79	6.70	0.22 --	0.005
Low plus High RH	480	6.63	6.57	0.09 --	0.138

[a] Transformed from natural logarithm scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[d] P-value is based on difference of means on natural logarithm scale.

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 16-22. Analysis of α-1-C Hemoglobin (percent) (Continuous) (Continued)

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

Dioxin Category	n	Adj. Mean[a]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[b]	p-Value[c]
Comparison	1,200	6.78		
Background RH	377	6.72	–0.06 --	0.412
Low RH	235	6.70	–0.08 --	0.330
High RH	240	6.97	0.19 --	0.022
Low plus High RH	475	6.83	0.05 --	0.363

[a] Transformed from natural logarithm scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[c] P-value is based on difference of means on natural logarithm scale.

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	Mean[a]	R^2	Slope (Std. Error)[b]	p-Value
Low	288	6.24	0.033	0.021 (0.004)	<0.001
Medium	286	6.46			
High	287	6.74			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of α-1-C hemoglobin versus $\log_2$ (1987 dioxin + 1).

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

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

1987 Dioxin Category Summary Statistics			Analysis Results for $\log_2$ (1987 Dioxin + 1)		
1987 Dioxin	n	Adj. Mean[a]	R^2	Adjusted Slope (Std. Error)[b]	p-Value[c]
Low	284	6.63	0.119	0.016 (0.005)	<0.001
Medium	285	6.68			
High	283	7.02			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of α-1-C hemoglobin versus $\log_2$ (1987 dioxin + 1).

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

Both the unadjusted and adjusted Model 2 analyses revealed significant relations between α-1-C hemoglobin and initial dioxin (Table 16-22(c,d): slope=0.017, p=0.009, for the unadjusted analysis;

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adjusted slope=0.024, p=0.001, for the adjusted analysis). The adjusted mean α-1-C hemoglobin levels in the low, medium, and high initial dioxin categories were 6.68, 7.01, and 7.05 percent, respectively.

The unadjusted and adjusted Model 3 analyses each revealed a significant difference between Ranch Hands in the high dioxin category and Comparisons (Table 16-22(e,f): difference of means=0.22 percent, p=0.005, for the unadjusted analysis; difference of adjusted means=0.19 percent, p=0.022, for the adjusted analysis). The adjusted mean α-1-C hemoglobin level for Ranch Hands in the high dioxin category was 6.97 percent versus 6.78 percent for the Comparisons.

A significant relation was seen between α-1-C hemoglobin in its continuous form and 1987 dioxin in each of the unadjusted and adjusted Model 4 analyses (Table 16-22(g,h): slope=0.021, p<0.001; adjusted slope=0.016, p<0.001, respectively). The adjusted mean α-1-C hemoglobin levels in the low, medium, and high initial dioxin categories were 6.63 percent, 6.68 percent, and 7.02 percent, respectively.

16.2.2.3.15   α-1-C Hemoglobin (Discrete)

The unadjusted Model 1 analysis of α-1-C hemoglobin in its discrete from did not reveal any significant differences between Ranch Hands and Comparisons across all occupations or within each occupational stratum (Table 16-23(a): p≥0.25 for each contrast). The adjusted analysis did not reveal a significant overall group difference between Ranch Hands and Comparisons (Table 16-23(b): p=0.373). After stratifying by occupation, a marginally significant difference was seen between Ranch Hand and Comparison enlisted groundcrew (Table 16-23(b): Adj. RR=1.43, p=0.087). The percentage of Ranch Hand enlisted groundcrew with high α-1-C hemoglobin values was 13.8 percent versus 11.2 percent for Comparison enlisted groundcrew.

Table 16-23. Analysis of α-1-C Hemoglobin (Discrete)

(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*	*868*	*97 (11.2)*	*1.08 (0.82,1.43)*	*0.571*
	Comparison	*1,250*	*130 (10.4)*		
Officer	Ranch Hand	339	28 (8.3)	1.11 (0.67,1.85)	0.684
	Comparison	494	37 (7.5)		
Enlisted Flyer	Ranch Hand	151	17 (11.3)	0.69 (0.36,1.31)	0.259
	Comparison	187	29 (15.5)		
Enlisted Groundcrew	Ranch Hand	378	52 (13.8)	1.26 (0.85,1.86)	0.250
	Comparison	569	64 (11.2)		

Table 16-23. Analysis of α-1-C Hemoglobin (Discrete) (Continued)

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

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	*1.14 (0.85, 1.53)*	*0.373*
Officer	1.13 (0.67, 1.90)	0.652
Enlisted Flyer	0.65 (0.33, 1.28)	0.210
Enlisted Groundcrew	1.43 (0.95, 2.16)	0.087

(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	159	16 (10.1)	1.28 (1.05, 1.56)	0.013
Medium	161	23 (14.3)		
High	160	31 (19.4)		

[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
475	1.53 (1.19, 1.96)	0.001

[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	1,212	125 (10.3)		
Background RH	381	25 (6.6)	0.75 (0.47, 1.18)	0.210
Low RH	238	25 (10.5)	0.95 (0.60, 1.53)	0.841
High RH	242	45 (18.6)	1.73 (1.17, 2.55)	0.006
Low plus High RH	480	70 (14.6)	1.29 (0.92, 1.80)	0.138

[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 16-23.   Analysis of α-1-C Hemoglobin (Discrete) (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	1,200		
Background RH	377	0.84 (0.53,1.35)	0.474
Low RH	235	0.94 (0.58,1.52)	0.799
High RH	240	1.76 (1.16,2.67)	0.008
Low plus High RH	475	1.29 (0.91,1.82)	0.148

[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	16 (5.6)	1.39 (1.21,1.60)	<0.001
Medium	286	28 (9.8)		
High	287	51 (17.8)		

[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
852	1.37 (1.15,1.64)	<0.001

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

The unadjusted and adjusted Model 2 analyses each revealed significant associations between initial dioxin and α-1-C hemoglobin in its dichotomous form (Table 16-23(c,d): Est. RR=1.28, p=0.013; Adj. RR=1.53, p=0.001, respectively). The percentages of Ranch Hands with high α-1-C hemoglobin values in the low, medium, and high initial dioxin categories were 10.1, 14.3, and 19.4, respectively.

The Model 3 unadjusted and adjusted analyses each revealed a significant difference in the percentage of high α-1-C hemoglobin values between Ranch Hands in the high dioxin category and Comparisons (Table 16-23(e,f): Est. RR=1.73, p=0.006; Adj. RR=1.76, p=0.008, respectively). The percentage of high α-1-C hemoglobin values for Ranch Hands in the high dioxin category was 18.6 versus 10.3 percent for Comparisons.

A significant relation was seen between α-1-C hemoglobin and 1987 dioxin in each of the Model 4 unadjusted and adjusted analyses (Table 16-23(g,h): Est. RR=1.39, p<0.001; Adj. RR=1.37, p<0.001, respectively). The percentages of participants with high α-1-C hemoglobin values in the low, medium, and high 1987 dioxin categories were 5.6, 9.8, and 17.8, respectively.

16.2.2.3.16 Total Testosterone (Continuous)

The unadjusted and adjusted Model 1 analyses did not reveal any significant differences in mean total testosterone levels between Ranch Hands and Comparisons across all occupations or within each occupational stratum (Table 16-24(a,b): p>0.57 for each contrast).

Table 16-24. Analysis of Total Testosterone (ng/dl) (Continuous)

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

Occupational Category	Group	n	Mean[a]	Difference of Means (95% C.I.)[b]	p-Value[c]
All	Ranch Hand	850	423.1	0.5 --	0.945
	Comparison	1,227	422.6		
Officer	Ranch Hand	330	406.9	−6.4 --	0.606
	Comparison	485	413.4		
Enlisted Flyer	Ranch Hand	146	439.6	11.2 --	0.577
	Comparison	182	428.4		
Enlisted Groundcrew	Ranch Hand	374	431.2	2.5 --	0.835
	Comparison	560	428.7		

[a] Transformed from square root scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on square root scale.
[c] P-value is based on difference of means on square root scale.

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

Occupational Category	Group	n	Adjusted Mean[a]	Difference of Adj. Means (95% C.I.)[b]	p-Value[c]
All	Ranch Hand	847	422.3	−1.1 --	0.883
	Comparison	1,227	423.4		
Officer	Ranch Hand	329	412.5	−2.2 --	0.848
	Comparison	485	414.7		
Enlisted Flyer	Ranch Hand	145	439.6	9.2 --	0.618
	Comparison	182	430.4		
Enlisted Groundcrew	Ranch Hand	373	418.5	−3.7 --	0.733
	Comparison	560	422.2		

[a] Transformed from square root scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on square root scale.
[c] P-value is based on difference of means on square root scale.

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

Initial Dioxin Category Summary Statistics				Analysis Results for $\log_2$ (Initial Dioxin)[b]		
Initial Dioxin	n	Mean[a]	Adj. Mean[ab]	R^2	Slope (Std. Error)[c]	p-Value
Low	156	404.1	397.7	0.118	0.287 (0.144)	0.047
Medium	160	392.3	392.0			
High	156	421.1	428.0			

[a] Transformed from square root scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Slope and standard error based on square root of total testosterone versus $\log_2$ (initial dioxin).

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

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

Initial Dioxin Category Summary Statistics			Analysis Results for $\log_2$ (Initial Dioxin)		
Initial Dioxin	n	Adj. Mean[a]	R^2	Adj. Slope (Std. Error)[b]	p-Value
Low	156	415.1	0.206	–0.015 (0.161)	0.927
Medium	159	395.2			
High	156	404.7			

[a] Transformed from square root scale.
[b] Slope and standard error based on square root of total testosterone versus $\log_2$ (initial dioxin).

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

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

Dioxin Category	n	Mean[a]	Adj. Mean[ab]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[c]	p-Value[d]
Comparison	1,189	422.0	423.0		
Background RH	372	448.1	429.8	6.8 --	0.499
Low RH	234	399.1	404.6	–18.4 --	0.118
High RH	238	412.1	429.4	6.4 --	0.592
Low plus High RH	472	405.6	417.0	–6.0 --	0.508

[a] Transformed from square root scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on square root scale.
[d] P-value is based on difference of means on square root scale.

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 16-24. Analysis of Total Testosterone (ng/dl) (Continuous) (Continued)

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

Dioxin Category	n	Adj. Mean[a]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[b]	p-Value[c]
Comparison	1,189	422.9		
Background RH	370	434.4	11.5 --	0.248
Low RH	234	414.5	−8.4 --	0.470
High RH	237	416.8	−6.1 --	0.613
Low plus High RH	471	415.7	−7.2 --	0.420

[a] Transformed from square root scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on square root scale.
[c] P-value is based on difference of means on square root scale.

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	Mean[a]	R^2	Slope (Std. Error)[b]	p-Value
Low	281	455.3	0.010	−0.296 (0.101)	0.003
Medium	281	408.2			
High	282	409.7			

[a] Transformed from square root scale.
[b] Slope and standard error based on square root of total testosterone versus log_2 (1987 dioxin + 1).

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

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

1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)		
1987 Dioxin	n	Adj. Mean[a]	R^2	Adjusted Slope (Std. Error)[b]	p-Value
Low	279	439.1	0.193	−0.149 (0.109)	0.172
Medium	281	418.6			
High	281	409.3			

[a] Transformed from square root scale.
[b] Slope and standard error based on square root of total testosterone versus log_2 (1987 dioxin + 1).

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

The unadjusted Model 2 analysis revealed a significant relation between initial dioxin and total testosterone in its continuous form (Table 16-24(c): slope=0.287, p=0.047). After adjusting for covariates, the results became nonsignificant (Table 16-24(d): p=0.927).

The unadjusted and adjusted Model 3 analyses of total testosterone showed no significant mean differences between any of the Ranch Hand dioxin categories and the Comparison group (Table 16-24(e,f): p>0.11 for each contrast).

A significant relation between 1987 dioxin and total testosterone was revealed in the unadjusted Model 4 analysis (Table 16-24(g): slope=−0.296, p=0.003). After covariate adjustment, the results became nonsignificant (Table 16-24(h): p=0.172).

16.2.2.3.17 Total Testosterone (Discrete)

The unadjusted and adjusted Models 1 and 2 analyses of total testosterone in its dichotomous form were not significant (Table 16-25(a–d): p>0.30 for each analysis).

Table 16-25. Analysis of Total Testosterone (Discrete)

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

Occupational Category	Group	n	Number (%) Low	Est. Relative Risk (95% C.I.)	p-Value
All	*Ranch Hand*	*850*	*72 (8.5)*	*1.17 (0.85,1.61)*	*0.344*
	Comparison	*1,227*	*90 (7.3)*		
Officer	Ranch Hand	330	29 (8.8)	1.28 (0.76,2.14)	0.352
	Comparison	485	34 (7.0)		
Enlisted Flyer	Ranch Hand	146	12 (8.2)	1.39 (0.60,3.25)	0.445
	Comparison	182	11 (6.0)		
Enlisted Groundcrew	Ranch Hand	374	31 (8.3)	1.03 (0.64,1.67)	0.890
	Comparison	560	45 (8.0)		

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

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	*1.16 (0.83,1.63)*	*0.378*
Officer	1.22 (0.71,2.07)	0.475
Enlisted Flyer	1.21 (0.50,2.96)	0.673
Enlisted Groundcrew	1.11 (0.67,1.83)	0.688

(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 (%) Low	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	156	13 (8.3)	1.00 (0.80,1.26)	0.973
Medium	160	19 (11.9)		
High	156	16 (10.3)		

[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.

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Table 16-25. Analysis of Total Testosterone (Discrete) (Continued)

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

| | Analysis Results for Log₂ (Initial Dioxin) | |
| | Adjusted Relative Risk | |
n	(95% C.I.)[a]	p-Value
471	1.16 (0.87,1.55)	0.307

[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 (%) Low	Est. Relative Risk (95% C.I.)[ab]	p-Value
Comparison	1,189	88 (7.4)		
Background RH	372	23 (6.2)	1.04 (0.64,1.69)	0.878
Low RH	234	20 (8.6)	1.08 (0.64,1.84)	0.767
High RH	238	28 (11.8)	1.40 (0.88,2.25)	0.156
Low plus High RH	472	48 (10.2)	1.23 (0.84,1.82)	0.285

[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	1,189		
Background RH	370	0.98 (0.59,1.62)	0.934
Low RH	234	0.95 (0.55,1.62)	0.841
High RH	237	1.55 (0.94,2.55)	0.085
Low plus High RH	471	1.21 (0.82,1.80)	0.340

[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 16-25. Analysis of Total Testosterone (Discrete) (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 (%) Low	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	281	17 (6.0)	1.22 (1.05,1.43)	0.013
Medium	281	21 (7.5)		
High	282	33 (11.7)		

[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
841	1.20 (0.96,1.49)	0.106

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

The unadjusted Model 3 analysis did not reveal any significant differences between any of the Ranch Hand dioxin categories and the Comparison group (Table 16-25(e): p>0.15 for each contrast). Adjusting for covariates revealed a marginally significant difference in the percentage of low total testosterone values between Ranch Hands in the high dioxin category and Comparisons (Table 16-25(f): Adj. RR=1.55, p=0.085). The percentage of low total testosterone values for Ranch Hands in the high dioxin category was 11.8 versus 7.4 percent for Comparisons.

The unadjusted Model 4 analysis revealed a significant relation between 1987 dioxin and total testosterone in its discrete form (Table 16-25(g): Est. RR=1.22, p=0.013). After adjusting for covariates, the results became nonsignificant (Table 16-25(h): p=0.106).

16.2.2.3.18   Free Testosterone (Continuous)

The unadjusted and adjusted Model 1 analyses did not reveal a significant difference in mean free testosterone levels between all Ranch Hands and Comparisons or after stratifying by occupation (Table 16-26(a,b): p>0.20 for each analysis).

Table 16-26. Analysis of Free Testosterone (pg/ml) (Continuous)

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

Occupational Category	Group	n	Mean[a]	Difference of Means (95% C.I.)[b]	p-Value[c]
All	*Ranch Hand*	*850*	*13.96*	*0.04 --*	*0.852*
	Comparison	*1,227*	*13.92*		
Officer	Ranch Hand	330	12.91	−0.36 --	0.269
	Comparison	485	13.26		
Enlisted Flyer	Ranch Hand	146	14.03	0.08 --	0.878
	Comparison	182	13.95		
Enlisted Groundcrew	Ranch Hand	374	14.89	0.40 --	0.209
	Comparison	560	14.49		

[a] Transformed from square root scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on square root scale.
[c] P-value is based on difference of means on square root scale.

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

Occupational Category	Group	n	Adjusted Mean[a]	Difference of Adj. Means (95% C.I.)[b]	p-Value[c]
All	*Ranch Hand*	*847*	*13.80*	*0.01 --*	*0.941*
	Comparison	*1,227*	*13.79*		
Officer	Ranch Hand	329	13.39	−0.21 --	0.464
	Comparison	485	13.61		
Enlisted Flyer	Ranch Hand	145	14.23	0.13 --	0.783
	Comparison	182	14.10		
Enlisted Groundcrew	Ranch Hand	373	13.81	0.17 --	0.528
	Comparison	560	13.64		

[a] Transformed from square root scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on square root scale.
[c] P-value is based on difference of means on square root scale.

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

Initial Dioxin Category Summary Statistics				Analysis Results for Log_2 (Initial Dioxin)[b]		
Initial Dioxin	n	Mean[a]	Adj. Mean[a,b]	R^2	Slope (Std. Error)[c]	p-Value
Low	156	13.08	12.94	0.084	0.066 (0.022)	0.003
Medium	160	13.69	13.68			
High	156	14.59	14.75			

[a] Transformed from square root scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Slope and standard error based on square root of free testosterone versus log_2 (initial dioxin).

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

Table 16-26. Analysis of Free Testosterone (pg/ml) (Continuous) (Continued)

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

Initial Dioxin Category Summary Statistics			Analysis Results for Log$_2$ (Initial Dioxin)		
Initial Dioxin	n	Adj. Mean[a]	R^2	Adj. Slope (Std. Error)[b]	p-Value
Low	156	13.42	0.240	−0.008 (0.024)	0.742
Medium	159	13.61			
High	156	13.61			

[a] Transformed from square root scale.
[b] Slope and standard error based on square root of free testosterone versus log$_2$ (initial dioxin).

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

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

Dioxin Category	n	Mean[a]	Adj. Mean[ab]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[c]	p-Value[d]
Comparison	1,189	13.93	13.95		
Background RH	372	14.24	13.85	−0.10 --	0.703
Low RH	234	13.11	13.23	−0.72 --	0.022
High RH	238	14.46	14.85	0.90 --	0.006
Low plus High RH	472	13.78	14.03	0.08 --	0.745

[a] Transformed from square root scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on square root scale.
[d] P-value is based on difference of means on square root scale.

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	Adj. Mean[a]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[b]	p-Value[c]
Comparison	1,189	13.80		
Background RH	370	13.98	0.18 --	0.459
Low RH	234	13.50	−0.30 --	0.315
High RH	237	13.94	0.14 --	0.643
Low plus High RH	471	13.72	−0.08 --	0.735

[a] Transformed from square root scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on square root scale.
[c] P-value is based on difference of means on square root scale.

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 16-26. Analysis of Free Testosterone (pg/ml) (Continuous) (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	Mean[a]	R^2	Slope (Std. Error)[b]	p-Value
Low	281	14.56	0.001	−0.010 (0.015)	0.489
Medium	281	13.17			
High	282	14.23			

[a] Transformed from square root scale.
[b] Slope and standard error based on square root of free testosterone versus log_2 (1987 dioxin + 1).

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

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

1987 Dioxin Category Summary Statistics			Analysis Results for Log_2 (1987 Dioxin + 1)		
1987 Dioxin	n	Adj. Mean[a]	R^2	Adjusted Slope (Std. Error)[b]	p-Value
Low	279	14.49	0.234	−0.029 (0.016)	0.066
Medium	281	13.65			
High	281	13.66			

[a] Transformed from square root scale.
[b] Slope and standard error based on square root of free testosterone versus log_2 (1987 dioxin + 1).

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

A significant association was seen between free testosterone and initial dioxin in the unadjusted Model 2 analysis (Table 16-26(c): slope=0.066, p=0.003). The adjusted analysis results were nonsignificant (Table 16-26(d): p=0.742).

The unadjusted Model 3 analysis of free testosterone in its continuous form revealed two significant contrasts: Ranch Hands in the low dioxin category versus Comparisons and Ranch Hands in the high dioxin category versus Comparisons (Table 16-26(e): difference of means=−0.72 pg/ml, p=0.022; difference of means=0.90 pg/ml, p=0.006, respectively). The adjusted analysis did not reveal any significant contrasts (Table 16-26(f): p>0.31 for each contrast).

The unadjusted Model 4 analysis did not reveal any significant relation between 1987 dioxin and free testosterone in its continuous form (Table 16-26(g): p=0.489). After covariate adjustment, a marginally significant inverse relation between 1987 dioxin and mean free testosterone level was seen (Table 16-26(h): adjusted slope=−0.029, p=0.066). The adjusted mean free testosterone levels in the low, medium, and high 1987 dioxin categories were 14.49 pg/ml, 13.65 pg/ml, and 13.66 pg/ml, respectively.

16.2.2.3.19   Free Testosterone (Discrete)

The unadjusted and adjusted Model 1 analyses did not reveal a significant overall group difference between Ranch Hands and Comparisons (Table 16-27(a,b): p>0.81 for both analyses). In each of the unadjusted and adjusted analyses, stratifying by occupation revealed a marginally significant difference between Ranch Hands and Comparisons in the enlisted flyer stratum (Table 16-27(a,b): Est. RR=7.76,

p=0.059; Adj. RR=6.41, p=0.091, respectively). The percentage of low free testosterone values for the Ranch Hand enlisted flyers was 4.1 versus 0.5 percent for Comparison enlisted flyers.

Table 16-27. Analysis of Free Testosterone (Discrete)

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

Occupational Category	Group	n	Number (%) Low	Est. Relative Risk (95% C.I.)	p-Value
All	*Ranch Hand*	*850*	*15 (1.8)*	*1.08 (0.55,2.13)*	*0.815*
	Comparison	*1,227*	*20 (1.6)*		
Officer	Ranch Hand	330	7 (2.1)	1.03 (0.39,2.73)	0.954
	Comparison	485	10 (2.1)		
Enlisted Flyer	Ranch Hand	146	6 (4.1)	7.76 (0.92,65.18)	0.059
	Comparison	182	1 (0.5)		
Enlisted Groundcrew	Ranch Hand	374	2 (0.5)	0.33 (0.07,1.53)	0.157
	Comparison	560	9 (1.6)		

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

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	*1.09 (0.54,2.19)*	*0.812*
Officer	1.06 (0.39,2.90)	0.911
Enlisted Flyer	6.41 (0.74,55.13)	0.091
Enlisted Groundcrew	0.37 (0.08,1.76)	0.210

(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 (%) Low	Estimated Relative Risk (95% C.I.)[b]	p-Value
Low	156	5 (3.2)	0.46 (0.21,0.98)	0.019
Medium	160	4 (2.5)		
High	156	0 (0.0)		

[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	0.41 (0.14,1.18)	0.051

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

Note: Results are not adjusted for occupation because of the sparse number of participants with a low free testosterone level.

Table 16-27. Analysis of Free Testosterone (Discrete) (Continued)

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

Dioxin Category	n	Number (%) Low	Est. Relative Risk (95% C.L.)[a][b]	p-Value
Comparison	1,189	20 (1.7)		
Background RH	372	5 (1.3)	0.94 (0.35,2.55)	0.906
Low RH	234	8 (3.4)	1.95 (0.84,4.52)	0.120
High RH	238	1 (0.4)	0.21 (0.03,1.57)	0.128
Low plus High RH	472	9 (1.9)	0.63 (0.20,1.99)	0.431

[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	1,189		
Background RH	370	0.88 (0.32,2.46)	0.811
Low RH	234	1.38 (0.57,3.35)	0.470
High RH	237	0.28 (0.04,2.21)	0.227
Low plus High RH	471	0.62 (0.19,2.01)	0.424

[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 (%) Low	Estimated Relative Risk (95% C.I.)[a]	p-Value
Low	281	2 (0.7)	0.94 (0.65,1.36)	0.744
Medium	281	9 (3.2)		
High	282	3 (1.1)		

[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 16-27. Analysis of Free Testosterone (Discrete) (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
841	0.94 (0.52, 1.70)	0.835

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

Both the unadjusted and adjusted Model 2 analyses revealed significant relations between initial dioxin and free testosterone (Table 16-27(c,d): Est. RR=0.46, p=0.019; Adj. RR=0.41, p=0.051, respectively). The percentages of low free testosterone values within the low, medium, and high initial dioxin categories were 3.2, 2.5, and 0.0, respectively.

The unadjusted and adjusted Models 3 and 4 analyses were nonsignificant (Table 16-27(e–h): p≥0.12 for each analysis).

16.2.2.3.20 Estradiol (Continuous)

Unadjusted and adjusted Model 1 analyses of estradiol in its continuous form did not reveal significant overall group differences between Ranch Hands and Comparisons (Table 16-28(a,b): p>0.38 for each analysis). After stratifying by occupation, a significant difference was seen between Ranch Hand officers and Comparison officers in both the unadjusted and adjusted analyses (Table 16-28(a,b): difference of means=−3.43 pg/ml, p=0.003, for unadjusted; difference of adjusted means=−3.55 pg/ml, p=0.003, for adjusted). The adjusted mean estradiol value for Ranch Hand officers was 40.35 pg/ml versus a mean value of 43.90 pg/ml for Comparison officers.

Table 16-28. Analysis of Estradiol (pg/ml) (Continuous)

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

Occupational Category	Group	n	Mean[a]	Difference of Means (95% C.I.)[b]	p-Value[c]
All	*Ranch Hand*	*870*	*40.06*	*−0.57 --*	*0.434*
	Comparison	*1,251*	*40.63*		
Officer	Ranch Hand	341	38.38	−3.43 --	0.003
	Comparison	494	41.81		
Enlisted Flyer	Ranch Hand	151	42.87	2.17 --	0.238
	Comparison	187	40.70		
Enlisted Groundcrew	Ranch Hand	378	40.49	0.89 --	0.418
	Comparison	570	39.60		

[a] Transformed from square root scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on square root scale.
[c] P-value is based on difference of means on square root scale.

Table 16-28. Analysis of Estradiol (pg/ml) (Continuous) (Continued)

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

Occupational Category	Group	n	Adjusted Mean[a]	Difference of Adj. Means (95% C.I.)[b]	p-Value[c]
All	*Ranch Hand*	*870*	*42.18*	*–0.65 --*	*0.384*
	Comparison	*1,251*	*42.83*		
Officer	Ranch Hand	341	40.35	–3.55 --	0.003
	Comparison	494	43.90		
Enlisted Flyer	Ranch Hand	151	44.77	2.21 --	0.241
	Comparison	187	42.56		
Enlisted Groundcrew	Ranch Hand	378	42.26	0.89 --	0.427
	Comparison	570	41.37		

[a] Transformed from square root scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on square root scale.
[c] P-value is based on difference of means on square root scale.

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

Initial Dioxin Category Summary Statistics				Analysis Results for Log_2 (Initial Dioxin)[b]		
Initial Dioxin	n	Mean[a]	Adj. Mean[ab]	R^2	Slope (Std. Error)[c]	p-Value
Low	160	38.37	38.41	0.007	0.084 (0.049)	0.087
Medium	162	42.23	42.24			
High	160	41.37	41.32			

[a] Transformed from square root scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Slope and standard error based on square root of estradiol versus $\log_2$ (initial dioxin).

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

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

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)		
Initial Dioxin	n	Adj. Mean[a]	R^2	Adj. Slope (Std. Error)[b]	p-Value
Low	160	40.16	0.019	0.046 (0.057)	0.423
Medium	162	42.95			
High	160	41.36			

[a] Transformed from square root scale.
[b] Slope and standard error based on square root of estradiol versus $\log_2$ (initial dioxin).

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

Table 16-28. Analysis of Estradiol (pg/ml) (Continuous) (Continued)

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

Dioxin Category	n	Mean[a]	Adj. Mean[ab]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[c]	p-Value[d]
Comparison	1,213	40.69	40.68		
Background RH	381	39.50	39.71	−0.97 --	0.323
Low RH	239	39.65	39.58	−1.10 --	0.350
High RH	243	41.64	41.43	0.75 --	0.523
Low plus High RH	482	40.65	40.51	−0.17 --	0.852

[a] Transformed from square root scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on square root scale.
[d] P-value is based on difference of means on square root scale.

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	Adj. Mean[a]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[b]	p-Value[c]
Comparison	1,213	42.96		
Background RH	381	41.76	−1.20 --	0.241
Low RH	239	41.51	−1.45 --	0.231
High RH	243	44.13	1.17 --	0.347
Low plus High RH	482	42.82	−0.14 --	0.888

[a] Transformed from square root scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on square root scale.
[c] P-value is based on difference of means on square root scale.

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 16-28. Analysis of Estradiol (pg/ml) (Continuous) (Continued)

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

1987 Dioxin Category Summary Statistics			Analysis Results for Log₂ (1987 Dioxin +1)		
1987 Dioxin	n	Mean[a]	R^2	Adjusted Slope (Std. Error)[b]	p-Value
Low	288	39.14	0.002	0.039 (0.031)	0.212
Medium	287	39.72			
High	288	41.57			

[a] Transformed from square root scale.
[b] Slope and standard error based on square root of estradiol versus $\log_2$ (1987 dioxin + 1).

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

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

1987 Dioxin Category Summary Statistics			Analysis Results for Log₂ (1987 Dioxin + 1)		
1987 Dioxin	n	Adj. Mean[a]	R^2	Adjusted Slope (Std. Error)[b]	p-Value
Low	288	42.60	0.017	0.019 (0.036)	0.599
Medium	287	42.42			
High	288	44.00			

[a] Transformed from square root scale.
[b] Slope and standard error based on square root of estradiol versus $\log_2$ (1987 dioxin + 1).

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

The unadjusted Model 2 analysis revealed a marginally significant positive association between estradiol in its continuous form and initial dioxin (Table 16-28(c): slope=0.084, p=0.087). After adjusting for covariates, the results became nonsignificant (Table 16-28(d): p=0.423).

Unadjusted and adjusted analyses for Models 3 and 4 were nonsignificant (Table 16-28(e–h): p>0.21 for each analysis).

16.2.2.3.21 Estradiol (Discrete)

The unadjusted and adjusted Model 1 analyses of estradiol in its discrete form did not reveal a significant difference between Ranch Hands and Comparisons (Table 16-29(a,b): p≥0.12 for each contrast).

Table 16-29. Analysis of Estradiol (Discrete)

(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*	*870*	*236 (27.1)*	*0.96 (0.79,1.16)*	*0.666*
	Comparison	*1,251*	*350 (28.0)*		
Officer	Ranch Hand	341	80 (23.5)	0.78 (0.57,1.08)	0.131
	Comparison	494	139 (28.1)		
Enlisted Flyer	Ranch Hand	151	44 (29.1)	0.89 (0.56,1.42)	0.632
	Comparison	187	59 (31.6)		
Enlisted Groundcrew	Ranch Hand	378	112 (29.6)	1.16 (0.87,1.55)	0.319
	Comparison	570	152 (26.7)		

Table 16-29. Analysis of Estradiol (Discrete) (Continued)

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

Occupational Category	Adjusted Relative Risk (95% C.I.)	p-Value
All	*0.95 (0.78,1.16)*	*0.619*
Officer	0.78 (0.56,1.07)	0.120
Enlisted Flyer	0.89 (0.56,1.42)	0.616
Enlisted Groundcrew	1.16 (0.87,1.55)	0.312

(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	33 (20.6)	1.17 (1.00,1.36)	0.045
Medium	162	52 (32.1)		
High	160	47 (29.4)		

[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
482	1.12 (0.94,1.33)	0.213

[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	1,213	343 (28.3)		
Background RH	381	102 (26.8)	0.96 (0.74,1.25)	0.774
Low RH	239	59 (24.7)	0.82 (0.60,1.13)	0.234
High RH	243	73 (30.0)	1.05 (0.78,1.43)	0.731
Low plus High RH	482	132 (27.4)	0.93 (0.74,1.18)	0.566

[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 16-29. Analysis of Estradiol (Discrete) (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	1,213		
Background RH	381	0.97 (0.75,1.27)	0.842
Low RH	239	0.79 (0.57,1.09)	0.155
High RH	243	1.05 (0.77,1.44)	0.757
Low plus High RH	482	0.91 (0.72,1.16)	0.460

[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	79 (27.4)	1.04 (0.94,1.15)	0.430
Medium	287	69 (24.0)		
High	288	86 (29.9)		

[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
863	0.99 (0.89,1.12)	0.926

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

A significant relation was seen between estradiol and initial dioxin in the unadjusted Model 2 analysis (Table 16-29(c): Est. RR=1.17, p=0.045). After adjusting for covariates, the results became nonsignificant (Table 16-29(d): p=0.213).

Unadjusted and adjusted analyses for Models 3 and 4 were nonsignificant (Table 13-29(e–h): p>0.15 for each analysis).

16.2.2.3.22 LH (Continuous)

The unadjusted and adjusted analysis of LH did not show a significant relation with dioxin in Models 1 through 3 (Table 16-30(a–f): p>0.13 for each analysis).

Table 16-30. Analysis of LH (mIU/ml) (Continuous)

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

Occupational Category	Group	n	Mean[a]	Difference of Means (95% C.I.)[b]	p-Value[c]
All	*Ranch Hand*	*870*	*3.86*	*0.00 --*	*0.979*
	Comparison	*1,251*	*3.86*		
Officer	Ranch Hand	341	4.09	0.27 --	0.131
	Comparison	494	3.82		
Enlisted Flyer	Ranch Hand	151	3.67	−0.34 --	0.194
	Comparison	187	4.02		
Enlisted Groundcrew	Ranch Hand	378	3.74	−0.11 --	0.491
	Comparison	570	3.85		

[a] Transformed from natural logarithm scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[c] P-value is based on difference of means on natural logarithm scale.

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

Occupational Category	Group	n	Adjusted Mean[a]	Difference of Adj. Means (95% C.I.)[b]	p-Value[c]
All	*Ranch Hand*	*870*	*3.84*	*−0.01 --*	*0.955*
	Comparison	*1,251*	*3.85*		
Officer	Ranch Hand	341	3.85	0.22 --	0.185
	Comparison	494	3.63		
Enlisted Flyer	Ranch Hand	151	3.55	−0.37 --	0.147
	Comparison	187	3.92		
Enlisted Groundcrew	Ranch Hand	378	4.03	−0.08 --	0.650
	Comparison	570	4.10		

[a] Transformed from natural logarithm scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[c] P-value is based on difference of means on natural logarithm scale.

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

Initial Dioxin Category Summary Statistics				Analysis Results for Log_2 (Initial Dioxin)[b]		
Initial Dioxin	n	Mean[a]	Adj. Mean[ab]	R^2	Slope (Std. Error)[c]	p-Value
Low	160	3.84	3.84	0.001	−0.016 (0.023)	0.496
Medium	162	3.82	3.82			
High	160	3.66	3.65			

[a] Transformed from natural logarithm scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Slope and standard error based on natural logarithm of LH versus log_2 (initial dioxin).

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

Table 16-30. Analysis of LH (mIU/ml) (Continuous) (Continued)

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

Initial Dioxin Category Summary Statistics			Analysis Results for Log_2 (Initial Dioxin)		
Initial Dioxin	n	Adj. Mean[a]	R^2	Adj. Slope (Std. Error)[b]	p-Value
Low	160	3.65	0.014	–0.008 (0.027)	0.755
Medium	162	3.67			
High	160	3.56			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of LH versus log_2 (initial dioxin).

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

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

Dioxin Category	n	Mean[a]	Adj. Mean[ab]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[c]	p-Value[d]
Comparison	1,213	3.85	3.85		
Background RH	381	4.04	4.01	0.16 --	0.264
Low RH	239	3.82	3.83	–0.02 --	0.900
High RH	243	3.72	3.74	–0.11 --	0.504
Low plus High RH	482	3.77	3.78	–0.07 --	0.601

[a] Transformed from natural logarithm scale.
[b] Adjusted for percent body fat at the time of the blood measurement of dioxin.
[c] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[d] P-value is based on difference of means on natural logarithm scale.

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 16-30. Analysis of LH (mIU/ml) (Continuous) (Continued)

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

Dioxin Category	n	Adj. Mean[a]	Difference of Adj. Mean vs. Comparisons (95% C.I.)[b]	p-Value[c]
Comparison	1,213	3.84		
Background RH	381	4.00	0.16 --	0.281
Low RH	239	3.73	−0.11 --	0.479
High RH	243	3.81	−0.03 --	0.839
Low plus High RH	482	3.77	−0.07 --	0.553

[a] Transformed from natural logarithm scale.
[b] Difference of means after transformation to original scale; confidence interval on difference of means not presented because analysis was performed on natural logarithm scale.
[c] P-value is based on difference of means on natural logarithm scale.

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	Mean[a]	R^2	Adjusted Slope (Std. Error)[b]	p-Value
Low	288	4.15	0.005	−0.030 (0.015)	0.042
Medium	287	3.75			
High	288	3.77			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of LH versus $\log_2$ (1987 dioxin + 1).

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

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

1987 Dioxin Category Summary Statistics			Analysis Results for $\log_2$ (1987 Dioxin + 1)		
1987 Dioxin	n	Adj. Mean[a]	R^2	Adjusted Slope (Std. Error)[b]	p-Value
Low	288	4.13	0.034	−0.024 (0.017)	0.149
Medium	287	3.67			
High	288	3.87			

[a] Transformed from natural logarithm scale.
[b] Slope and standard error based on natural logarithm of LH versus $\log_2$ (1987 dioxin + 1).

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