Table 9-12. Longitudinal Analysis of Relative Age Appearance (Continued)

Dioxin Category	n in 1997	Number (%) Older in 1997	Adj. Relative Risk (95% CI) [a]	p-Value [b]
Comparison	927	75 (8.1)		
Background RH	341	32 (9.4)	1.14 (0.74,1.77)	0.545
Low RH	228	22 (9.7)	1.19 (0.72,1.97)	0.487
High RH	229	22 (9.6)	1.28 (0.77,2.12)	0.339
Low plus High RH	457	44 (9.6)	1.24 (0.84,1.83)	0.289

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

[b] Adjusted for percent body fat at the time of the blood measurement of dioxin and age in 1997.

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.

Summary statistics for 1985 are provided for reference purposes for participants who attended the 1982, 1985, and 1997 examinations. Summary statistics for 1987 are provided for reference purposes for participants who attended the 1982, 1987, and 1997 examinations. Summary statistics for 1992 are provided for reference purposes for participants who attended the 1982, 1992, and 1997 examinations. Statistical analyses are based only on participants who appeared as old as or younger than their age in 1982 (see Chapter 7, Statistical Methods).

9.2.3.2.3 Body Fat (Continuous)

Longitudinal analyses that examined the mean difference between body fat in 1982 and 1997 were performed to explore associations with group and dioxin. The results of the longitudinal analyses are seen in Table 9-13.

No significant associations were observed between group status (Ranch Hand, Comparison) and the change in body fat over the 15 years of the study, either across or within occupational strata (Table 9-13(a): p>0.40 for all analyses). In addition, no significant associations were observed between change in body fat and categorized dioxin (Table 9-13(c): p>0.19 for all analyses).

A significant negative association was observed between the change in body fat and initial dioxin (Table 9-13(b): p=0.049). The mean body fat percentages increased between 1982 and 1997 for all initial dioxin categories. The increase was greater for those participants with lesser amounts of initial dioxin exposure.

Table 9-13. Longitudinal Analysis of Body Fat (Percent) (Continuous)

(a) MODEL 1: RANCH HANDS VS. COMPARISONS

Occupational Category	Group	Mean[a]/(n) Examination					Exam. Mean Change[b]	Difference of Exam. Mean Change	p-Value[c]
		1982	1985	1987	1992	1997			
All	*Ranch Hand*	*19.82*	*20.70*	*21.07*	*21.88*	*22.11*	*2.29*	*–0.01*	*0.938*
		(817)	*(799)*	*(791)*	*(795)*	*(817)*			
	Comparison	*19.94*	*21.00*	*21.24*	*22.11*	*22.24*	*2.30*		
		(976)	*(958)*	*(951)*	*(956)*	*(976)*			
Officer	Ranch Hand	20.09	20.93	21.22	21.85	22.06	1.98	0.07	0.715
		(311)	(307)	(304)	(306)	(311)			
	Comparison	19.86	20.88	20.99	21.70	21.77	1.91		
		(380)	(374)	(368)	(375)	(380)			
Enlisted Flyer	Ranch Hand	19.48	20.47	20.67	21.43	21.65	2.17	–0.34	0.403
		(147)	(144)	(142)	(144)	(147)			
	Comparison	19.56	20.35	20.69	21.56	22.07	2.51		
		(145)	(144)	(143)	(143)	(145)			
Enlisted Groundcrew	Ranch Hand	19.74	20.59	21.10	22.10	22.35	2.61	0.05	0.997
		(359)	(348)	(345)	(345)	(359)			
	Comparison	20.14	21.32	21.64	22.65	22.70	2.56		
		(451)	(440)	(440)	(438)	(451)			

[a] Transformed from natural logarithm scale.

[b] Difference between 1997 and 1982 examination means after transformation to original scale.

[c] P-value is based on analysis of natural logarithm of body fat; results adjusted for natural logarithm of body fat in 1982 and age in 1997.

Note: Summary statistics for 1985 are provided for reference purposes for participants who attended the 1982, 1985, and 1997 examinations. Summary statistics for 1987 are provided for reference purposes for participants who attended the 1982, 1987, and 1997 examinations. Summary statistics for 1992 are provided for reference purposes for participants who attended the 1982, 1992, and 1997 examinations.

(b) MODEL 2: RANCH HANDS – INITIAL DIOXIN							
Initial Dioxin Category Summary Statistics						**Analysis Results for Log₂ (Initial Dioxin)[b]**	
	Mean[a]/(n) Examination					Adjusted Slope (Std. Error)	p-Value
Initial Dioxin	1982	1985	1987	1992	1997		
Low	20.23 (154)	21.27 (151)	21.56 (153)	22.60 (149)	22.66 (154)	–0.012 (0.006)	0.049
Medium	20.89 (157)	21.97 (154)	22.26 (154)	22.97 (154)	23.48 (157)		
High	21.70 (153)	22.56 (150)	22.97 (148)	23.65 (150)	23.80 (153)		

[a] Transformed from natural logarithm scale.

[b] Results based on difference between natural logarithm of 1997 body fat and natural logarithm of 1982 body fat versus log₂ (initial dioxin); results adjusted for natural logarithm of 1982 body fat and age in 1997.

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

Summary statistics for 1985 are provided for reference purposes for participants who attended the 1982, 1985, and 1997 examinations. Summary statistics for 1987 are provided for reference purposes for participants who attended the 1982, 1987, and 1997 examinations. Summary statistics for 1992 are provided for reference purposes for participants who attended the 1982, 1992, and 1997 examinations.

Table 9-13. Longitudinal Analysis of Body Fat (Percent) (Continuous) (Continued)

(c) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY

Dioxin Category	Mean[a]/(n) Examination					Exam. Mean Change[b]	Difference of Exam. Mean Change	p-Value[c]
	1982	1985	1987	1992	1997			
Comparison	19.90 (948)	20.96 (933)	21.20 (925)	22.07 (929)	22.21 (948)	2.31		
Background RH	18.39 (347)	19.13 (339)	19.52 (331)	20.35 (337)	20.58 (347)	2.19	–0.12	0.708
Low RH	20.43 (230)	21.46 (224)	21.72 (227)	22.70 (223)	22.96 (230)	2.53	0.22	0.193
High RH	21.43 (234)	22.38 (231)	22.79 (228)	23.44 (230)	23.66 (234)	2.22	–0.09	0.322
Low plus High RH	20.93 (464)	21.92 (455)	22.25 (455)	23.07 (453)	23.31 (464)	2.38	0.07	0.853

[a] Transformed from natural logarithm scale.

[b] Difference between 1997 and 1982 examination means after transformation to original scale.

[c] P-value is based on analysis of natural logarithm of body fat; results adjusted for body fat in 1982 and age in 1997.

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.

Summary statistics for 1985 are provided for reference purposes for participants who attended the 1982, 1985, and 1997 examinations. Summary statistics for 1987 are provided for reference purposes for participants who attended the 1982, 1987, and 1997 examinations. Summary statistics for 1992 are provided for reference purposes for participants who attended the 1982, 1992, and 1997 examinations.

9.2.3.2.4   Body Fat (Discrete)

Body fat in its discrete form was analyzed across time for participants in 1997 who were considered lean or normal in 1982. The differences in percentages of obese participants for Ranch Hands and Comparisons were nonsignificant (Table 9-14(a): p>0.25 for each contrast). A marginally significant association between initial dioxin and body fat was revealed (Table 9-14(b): p=0.069). The contrast examining differences in obesity between Ranch Hands in the Background dioxin category and Comparisons also revealed a significant result (Table 9-14(c): Adj. RR=0.64, p=0.014), with less Ranch Hands being obese in 1997. All other contrasts of Ranch Hands and Comparisons in the analyses of dioxin categories were nonsignificant (p>0.15 for each remaining contrast).

Table 9-14. Longitudinal Analysis of Body Fat (Discrete)

(a) MODEL 1: RANCH HANDS VS. COMPARISONS

Occupational Category	Group	Number (%) Obese/(n) Examination				
		1982	1985	1987	1992	1997
All	Ranch Hand	108 (13.2) (817)	148 (18.5) (799)	158 (20.0) (791)	202 (25.4) (795)	229 (28.0) (817)
	Comparison	138 (14.1) (976)	191 (19.9) (958)	208 (21.9) (951)	256 (26.8) (956)	293 (30.0) (976)
Officer	Ranch Hand	36 (11.6) (311)	57 (18.6) (307)	56 (18.4) (304)	72 (23.5) (306)	81 (26.1) (311)
	Comparison	38 (10.0) (380)	56 (15.0) (374)	62 (16.9) (368)	88 (23.5) (375)	89 (23.4) (380)
Enlisted Flyer	Ranch Hand	15 (10.2) (147)	21 (14.6) (144)	25 (17.6) (142)	30 (20.8) (144)	36 (24.5) (147)
	Comparison	19 (13.1) (145)	25 (17.4) (144)	25 (17.5) (143)	31 (21.7) (143)	43 (29.7) (145)
Enlisted Groundcrew	Ranch Hand	57 (15.9) (359)	70 (20.1) (348)	77 (22.3) (345)	100 (29.0) (345)	112 (31.2) (359)
	Comparison	81 (18.0) (451)	110 (25.0) (440)	121 (27.5) (440)	137 (31.3) (438)	161 (35.7) (451)

Occupational Category	Group	Lean or Normal in 1982			
		n in 1997	Number (%) Obese in 1997	Adj. Relative Risk (95% C.I.)[a]	p-value[a]
All	Ranch Hand	709	136 (19.2)	0.93 (0.72,1.20)	0.567
	Comparison	838	170 (20.3)		
Officer	Ranch Hand	275	52 (18.9)	1.19 (0.79,1.81)	0.403
	Comparison	342	56 (16.4)		
Enlisted Flyer	Ranch Hand	132	22 (16.7)	0.81 (0.43,1.52)	0.512
	Comparison	126	25 (19.8)		
Enlisted Groundcrew	Ranch Hand	302	62 (20.5)	0.81 (0.56,1.17)	0.253
	Comparison	370	89 (24.1)		

[a] Relative risk, confidence interval, and p-values are in reference to a contrast of 1982 and 1997 results; results adjusted for age in 1997.

Note: Summary statistics for 1985 are provided for reference purposes for participants who attended the 1982, 1985, and 1997 examinations. Summary statistics for 1987 are provided for reference purposes for participants who attended the 1982, 1987, and 1997 examinations. Summary statistics for 1992 are provided for reference purposes for participants who attended the 1982, 1992, and 1997 examinations. Statistical analyses are based only on participants who were lean or had normal body fat in 1982 (see Chapter 7, Statistical Methods).

Table 9-14. Longitudinal Analysis of Body Fat (Discrete) (Continued)

(b) MODEL 2: RANCH HANDS — INITIAL DIOXIN

	Number (%) Obese/(n) Examination				
Initial Dioxin	1982	1985	1987	1992	1997
Low	21 (13.6) (154)	31 (20.5) (151)	33 (21.6) (153)	40 (26.9) (149)	51 (33.1) (154)
Medium	27 (17.2) (157)	41 (26.6) (154)	43 (27.9) (154)	55 (35.7) (154)	57 (36.3) (157)
High	31 (20.3) (153)	40 (26.7) (150)	41 (27.7) (148)	52 (34.7) (150)	52 (34.0) (153)

Initial Dioxin Category Summary Statistics			Analysis Results for Log$_2$ (Initial Dioxin)[a]	
	Lean or Normal in 1982			
Initial Dioxin	n in 1997	Number (%) Obese in 1997	Adj. Relative Risk (95% C.I.)[b]	p-Value
Low	133	32 (24.1)	0.83 (0.67, 1.02)	0.069
Medium	130	34 (26.2)		
High	122	23 (18.9)		

[a] Adjusted for age in 1997.
[b] Relative risk for a twofold increase in initial dioxin.

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

Summary statistics for 1985 are provided for reference purposes for participants who attended the 1982, 1985, and 1997 examinations. Summary statistics for 1987 are provided for reference purposes for participants who attended the 1982, 1987, and 1997 examinations. Summary statistics for 1992 are provided for reference purposes for participants who attended the 1982, 1992, and 1997 examinations. Statistical analyses are based only on participants who were lean or had normal body fat in 1982 (see Chapter 7, Statistical Methods).

(c) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY

	Number (%) Obese/(n) Examination				
Dioxin Category	1982	1985	1987	1992	1997
Comparison	130 (13.7) (948)	181 (19.4) (933)	198 (21.4) (925)	247 (26.6) (929)	282 (29.8) (948)
Background RH	28 (8.1) (347)	35 (10.3) (339)	39 (11.8) (331)	53 (15.7) (337)	66 (19.0) (347)
Low RH	35 (15.2) (230)	49 (21.9) (224)	53 (23.4) (227)	66 (29.6) (223)	79 (34.4) (230)
High RH	44 (18.8) (234)	63 (27.3) (231)	64 (28.1) (228)	81 (35.2) (230)	81 (34.6) (234)
Low plus High RH	79 (17.0) (464)	112 (24.6) (455)	117 (25.7) (455)	147 (32.5) (453)	160 (34.5) (464)

Table 9-14. Longitudinal Analysis of Body Fat (Discrete) (Continued)

| Dioxin Category | Lean or Normal in 1982 | | Adj. Relative Risk (95% C.I.)[a][b] | p-Value[b] |
	n in 1997	Number (%) Obese in 1997		
Comparison	818	166 (20.3)		
Background RH	319	44 (13.8)	0.64 (0.44,0.91)	0.014
Low RH	195	48 (24.6)	1.30 (0.90,1.89)	0.158
High RH	190	41 (21.6)	1.03 (0.70,1.52)	0.876
Low plus High RH	385	89 (23.1)	1.16 (0.87,1.56)	0.316

[a] Relative risk and confidence interval relative to Comparisons.
[b] Adjusted for age in 1997.

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.

      Summary statistics for 1985 are provided for reference purposes for participants who attended the 1982, 1985, and 1997 examinations. Summary statistics for 1987 are provided for reference purposes for participants who attended the 1982, 1987, and 1997 examinations. Summary statistics for 1992 are provided for reference purposes for participants who attended the 1982, 1992, and 1997 examinations. Statistical analyses are based only on participants who were lean or had normal body fat in 1982 (see Chapter 7, Statistical Methods).

9.2.3.3   Laboratory Variable

9.2.3.3.1   Erythrocyte Sedimentation Rate (Continuous)

The change in erythrocyte sedimentation rate between 1982 and 1997 was examined for associations with group status and dioxin. The change in erythrocyte sedimentation rate between 1982 and 1997 for Ranch Hands in the high dioxin category was significantly greater than for Comparisons during this same time period (Table 9-15(c): p=0.050). All other contrasts involving categorized dioxin (Model 3) and group and initial dioxin (Models 1 and 2, respectively) were nonsignificant (Table 9-15: p>0.13 for all analyses).