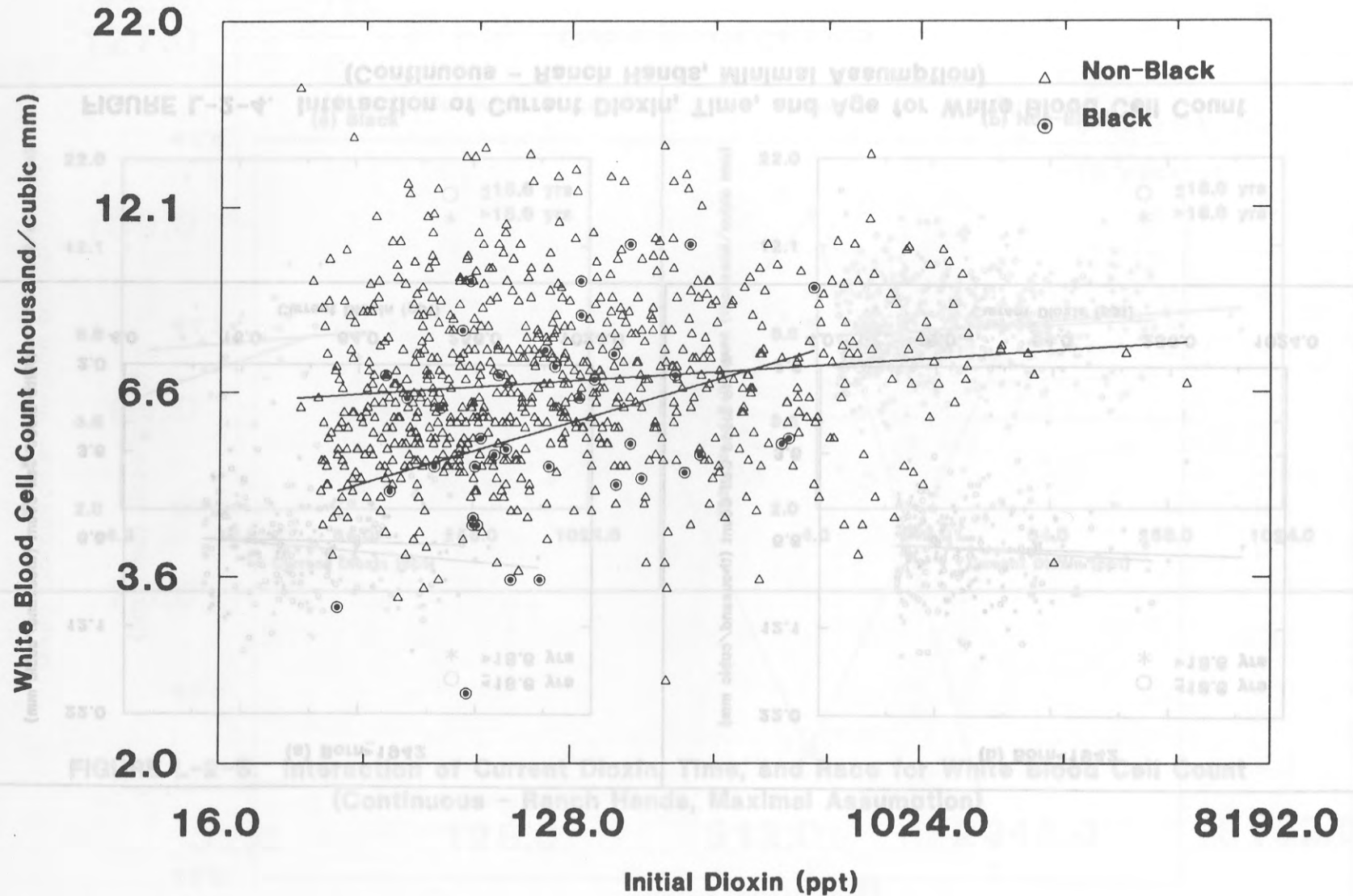




**FIGURE L-2-3. Interaction of Initial Dioxin and Race for White Blood Cell Count
(Continuous - Ranch Hands, Maximal Assumption)**

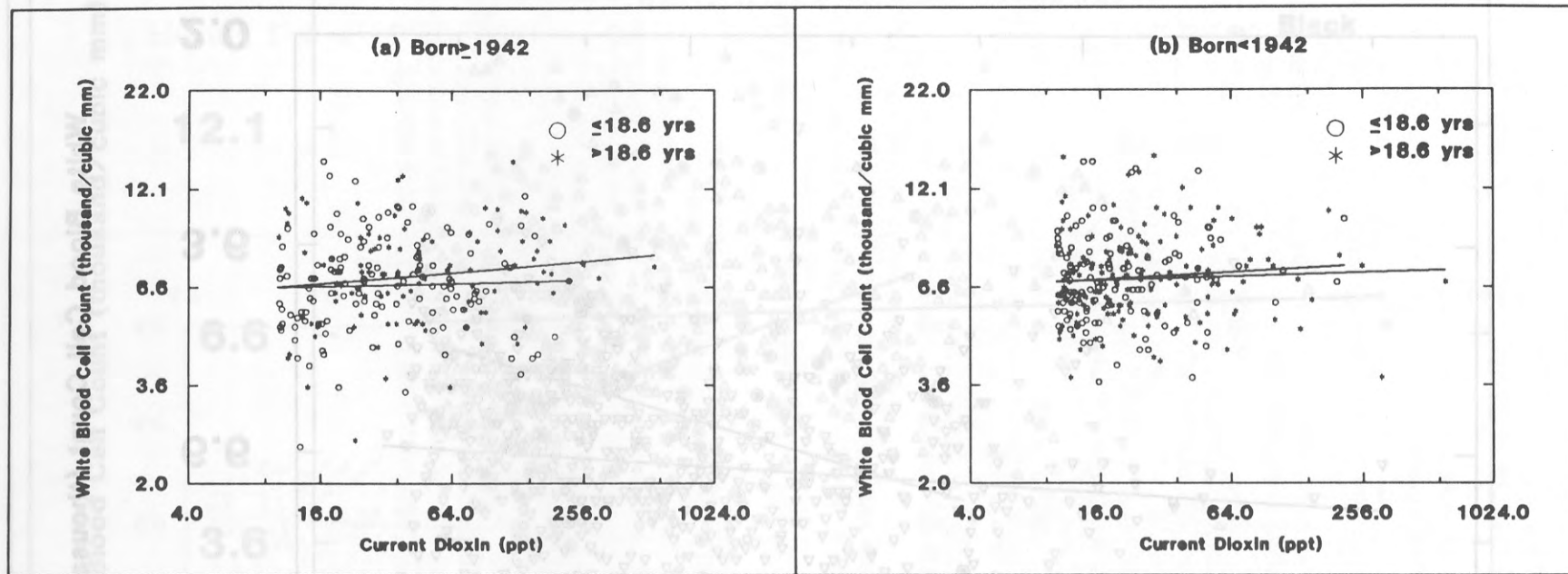


FIGURE L-2-4. Interaction of Current Dioxin, Time, and Age for White Blood Cell Count (Continuous - Ranch Hands, Minimal Assumption)

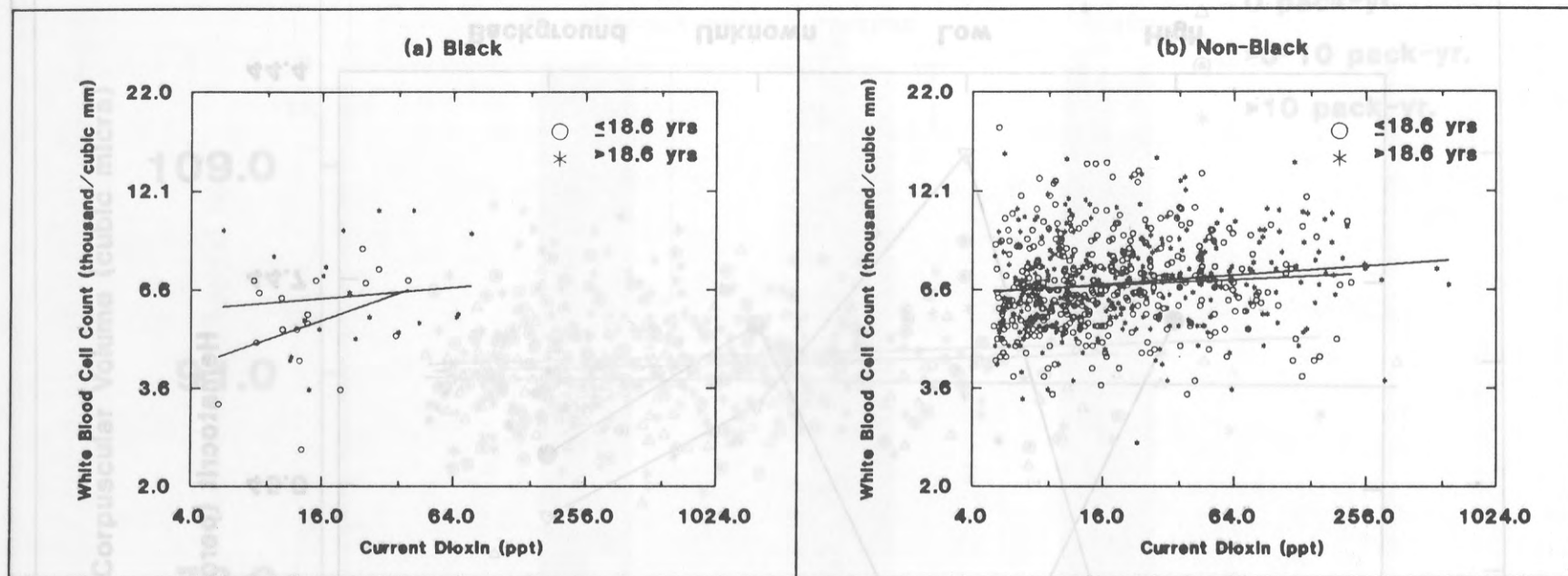


FIGURE L-2-5. Interaction of Current Dioxin, Time, and Race for White Blood Cell Count (Continuous - Ranch Hands, Maximal Assumption)

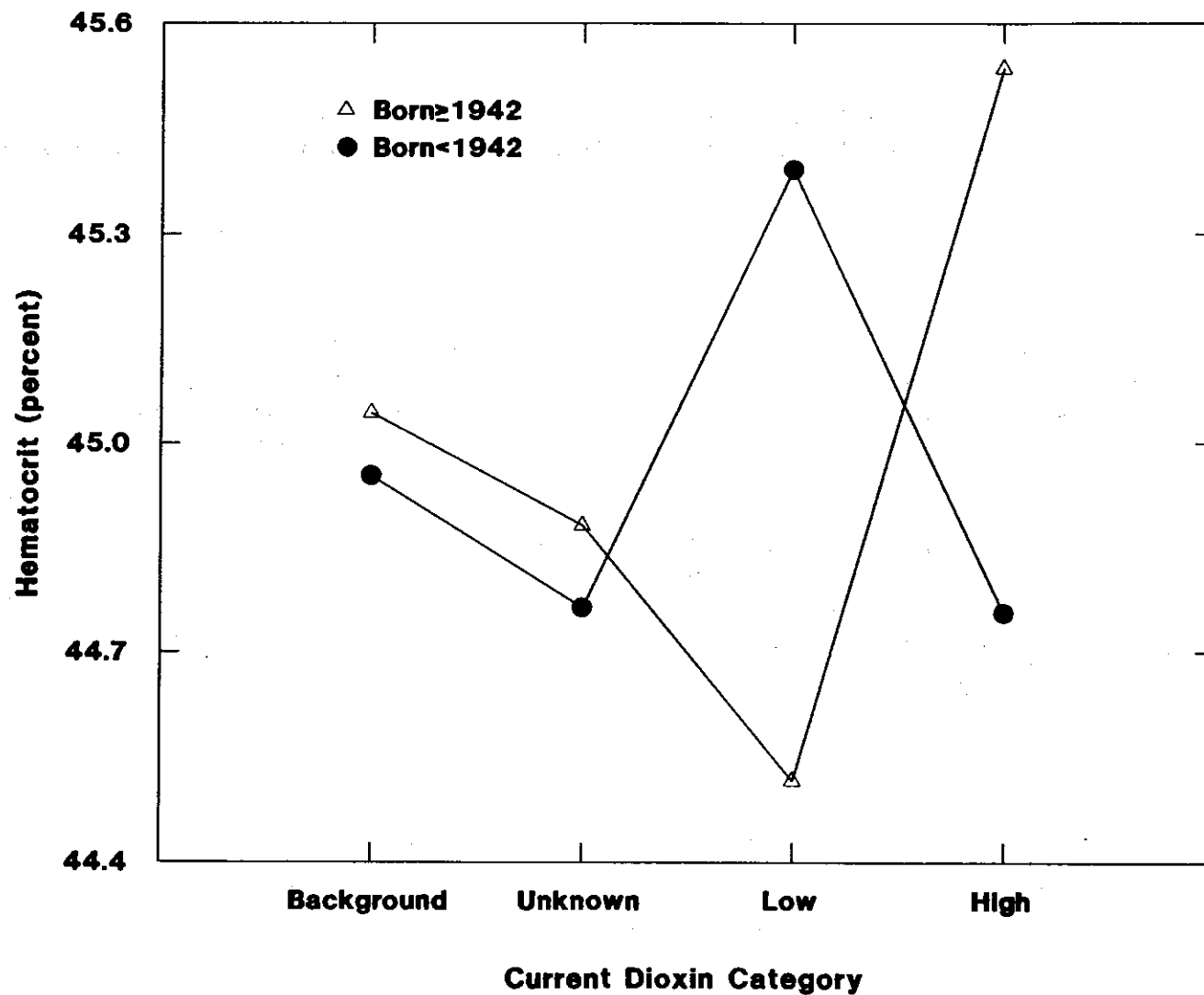


FIGURE L-2-6. Interaction of Categorized Current Dioxin and Age for Hematocrit (Continuous)

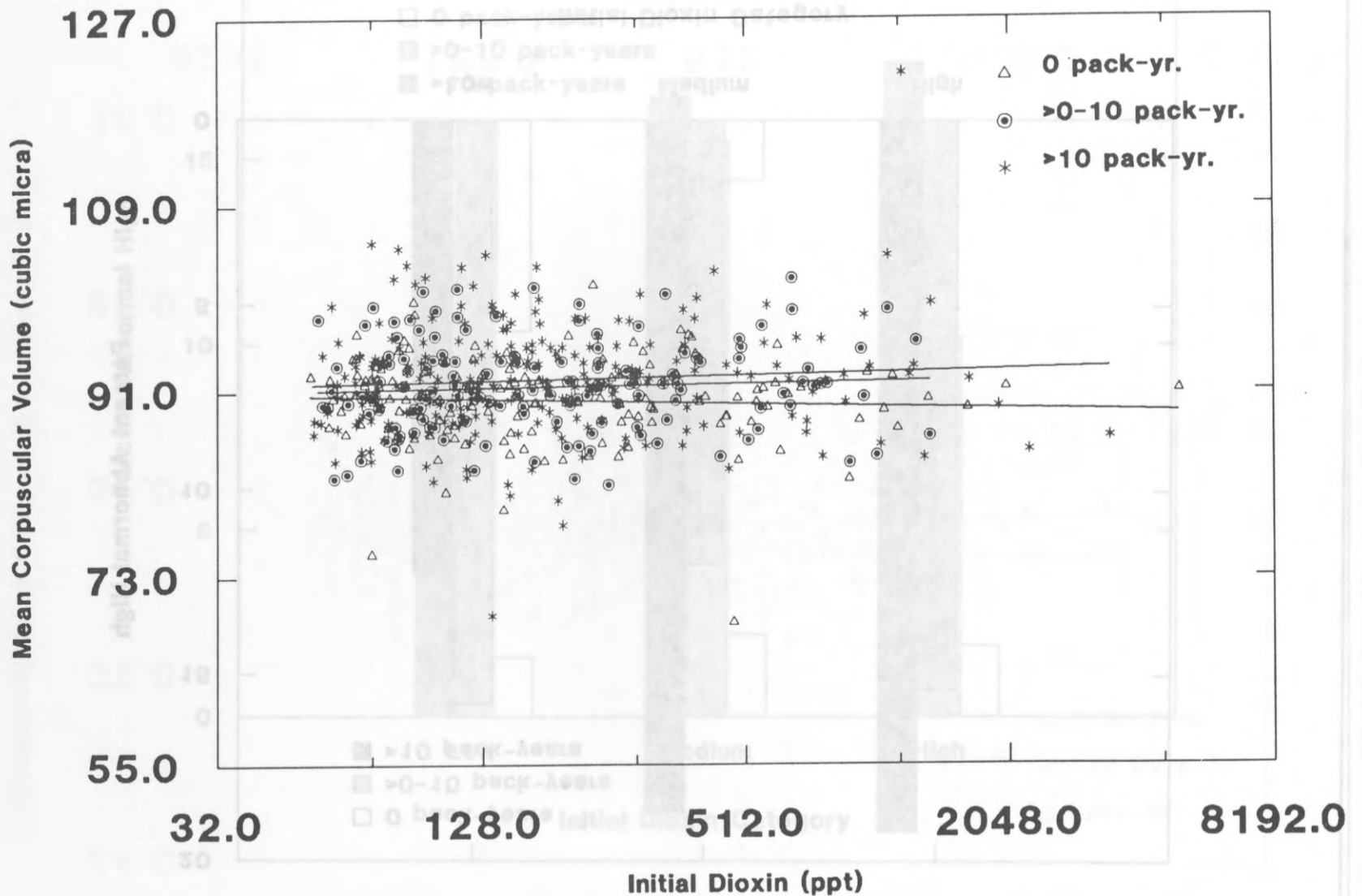


FIGURE L-2-7. Interaction of Initial Dioxin and Lifetime Cigarette Smoking History for Mean Corpuscular Volume (Continuous - Ranch Hands, Minimal Assumption)

Percent Abnormal High

20

15

10

5

0

- 0 pack-years
- ▨ >0-10 pack-years
- >10 pack-years

Low

Medium

High

Initial Dioxin Category

FIGURE L-2-8. Interaction of Initial Dioxin and Lifetime Cigarette Smoking History for Mean Corpuscular Volume (Discrete - Ranch Hands, Minimal Assumption)

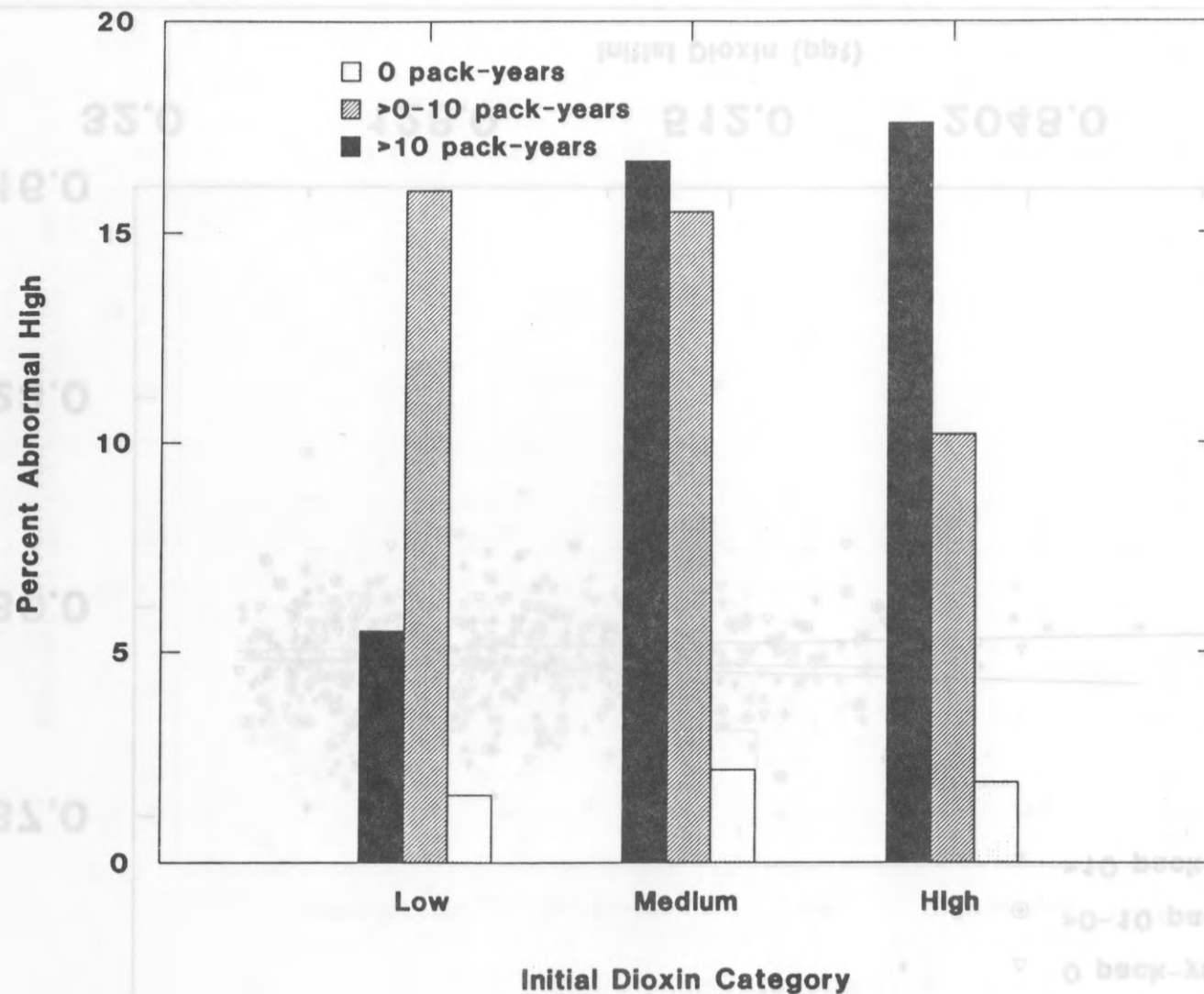


FIGURE L-2-9. Interaction of Initial Dioxin and Lifetime Cigarette Smoking History for Mean Corpuscular Volume (Discrete - Ranch Hands, Maximal Assumption)

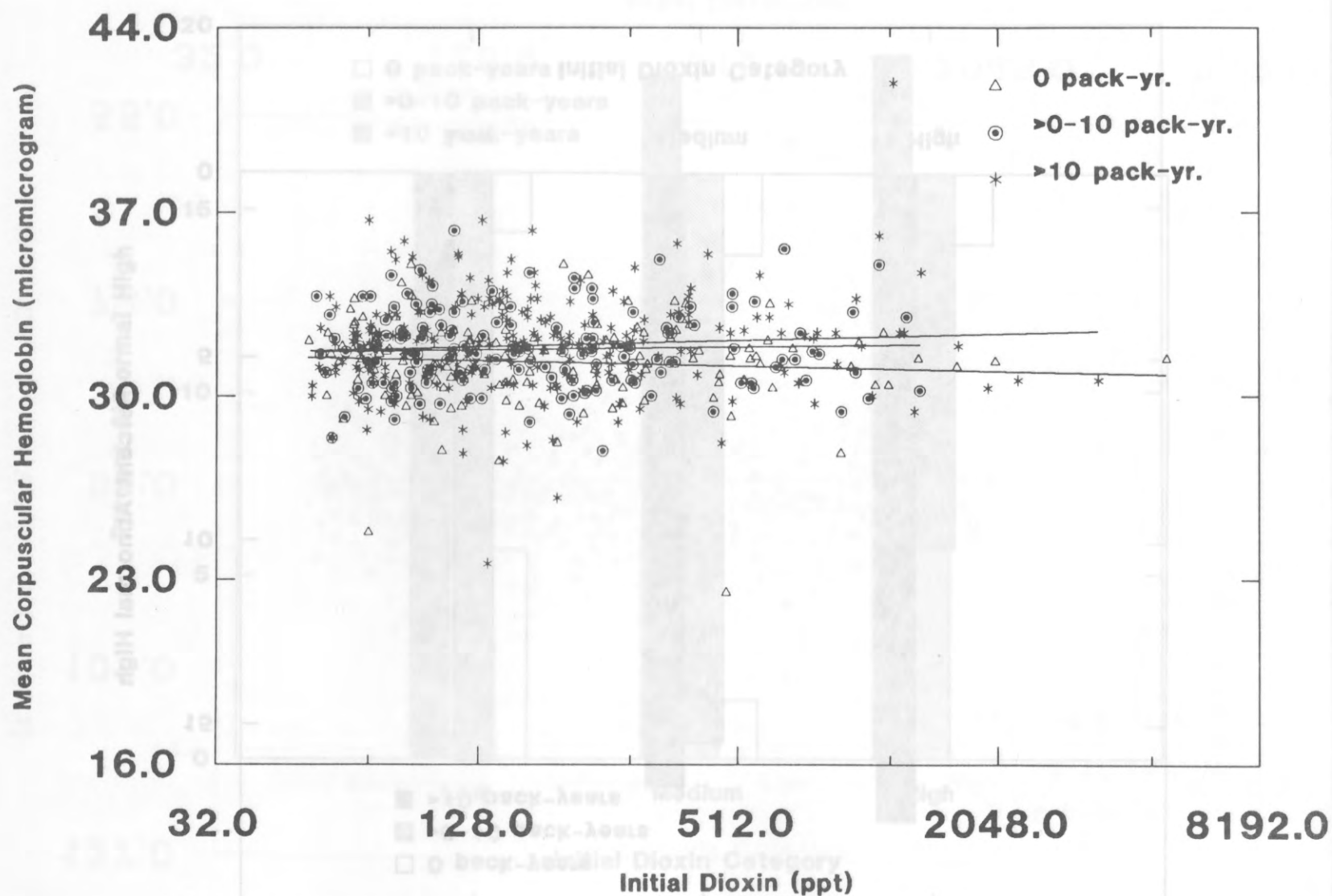


FIGURE L-2-10. Interaction of Initial Dioxin and Lifetime Cigarette Smoking History for Mean Corpuscular Hemoglobin (Continuous - Ranch Hands, Minimal Assumption)

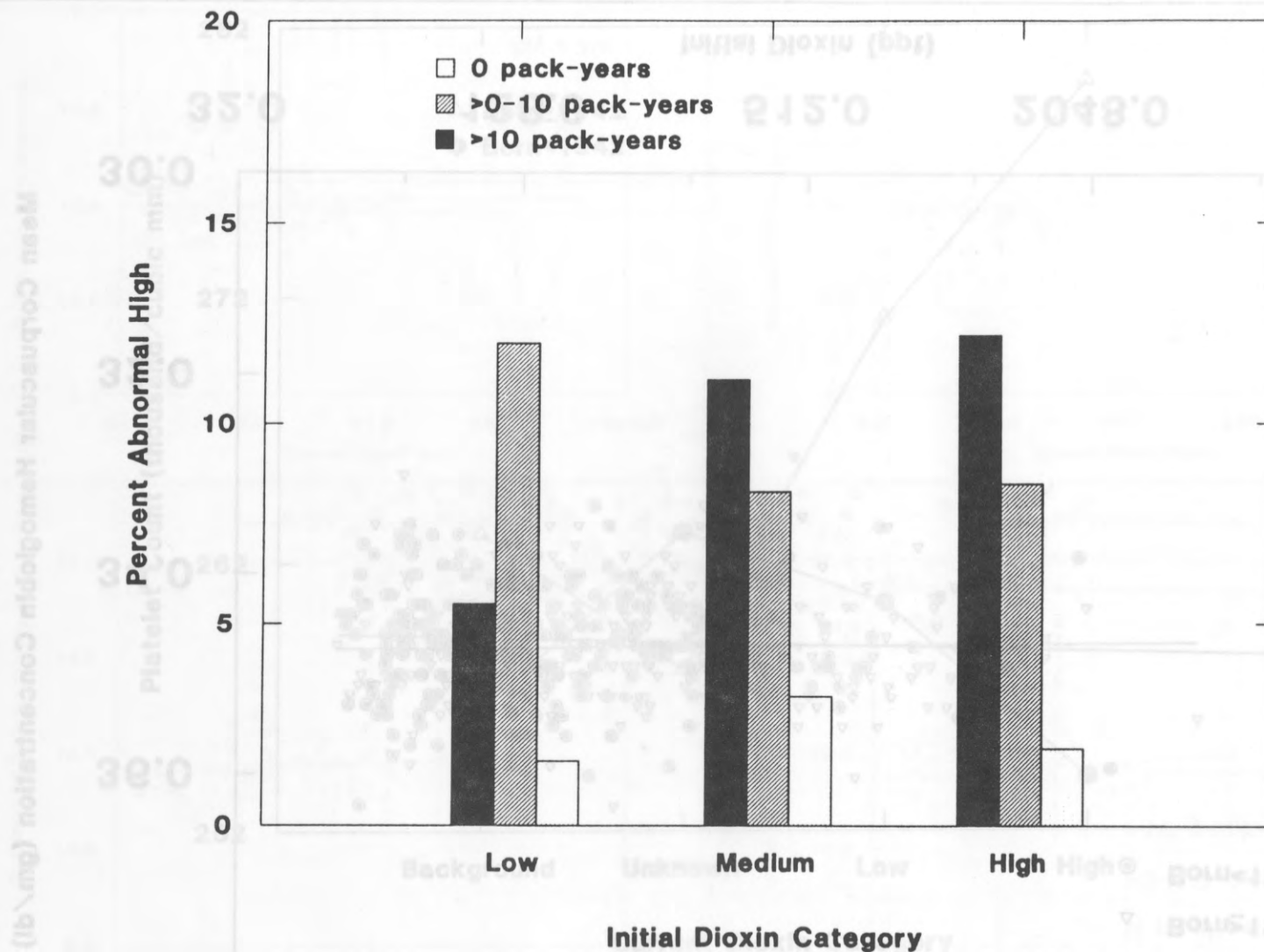


FIGURE L-2-11. Interaction of Initial Dioxin and Lifetime Cigarette Smoking History for Mean Corpuscular Hemoglobin (Discrete - Ranch Hands, Maximal Assumption)

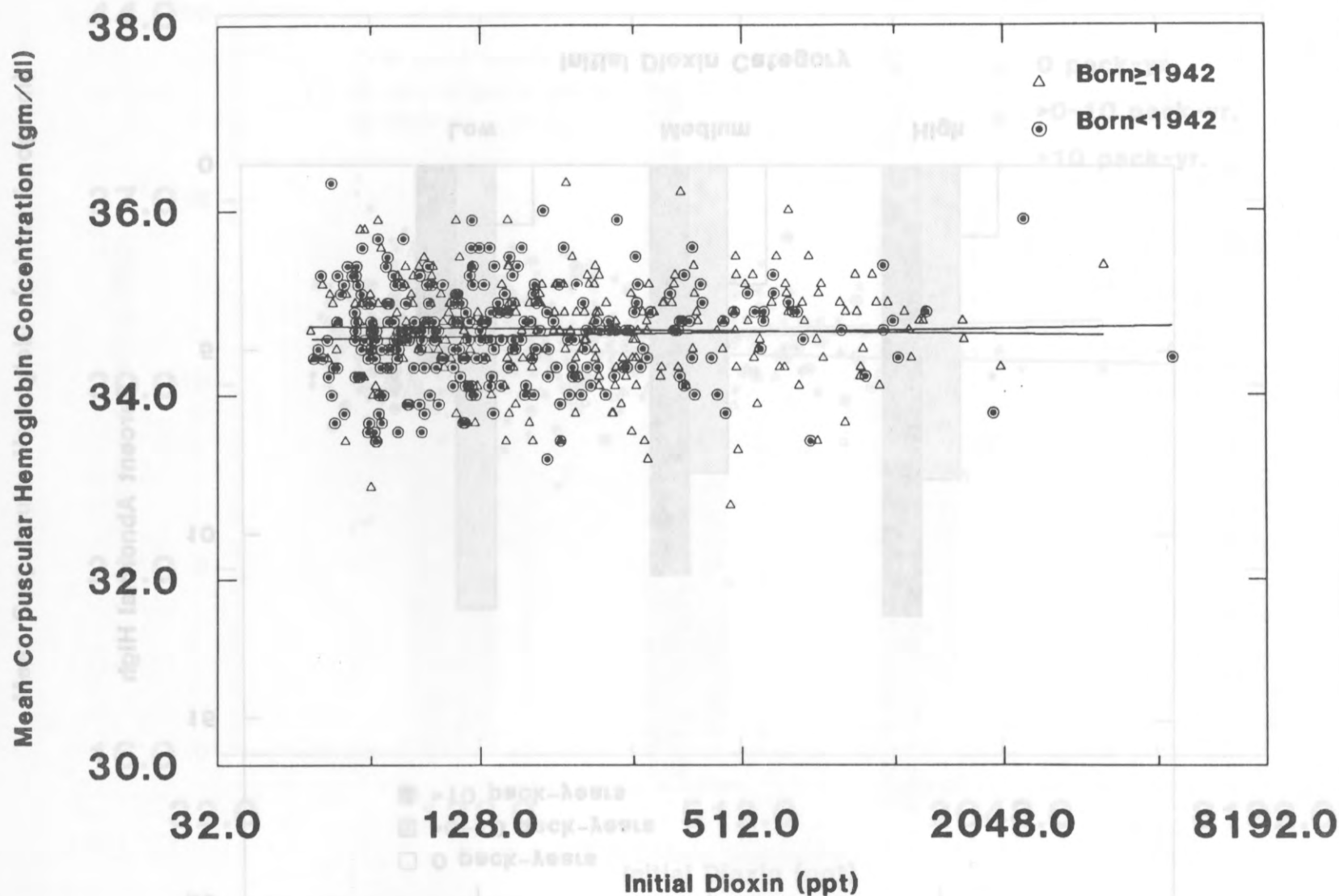


FIGURE L-2-12. Interaction of Initial Dioxin and Age for Mean Corpuscular Hemoglobin Concentration (Continuous - Ranch Hands, Minimal Assumption)

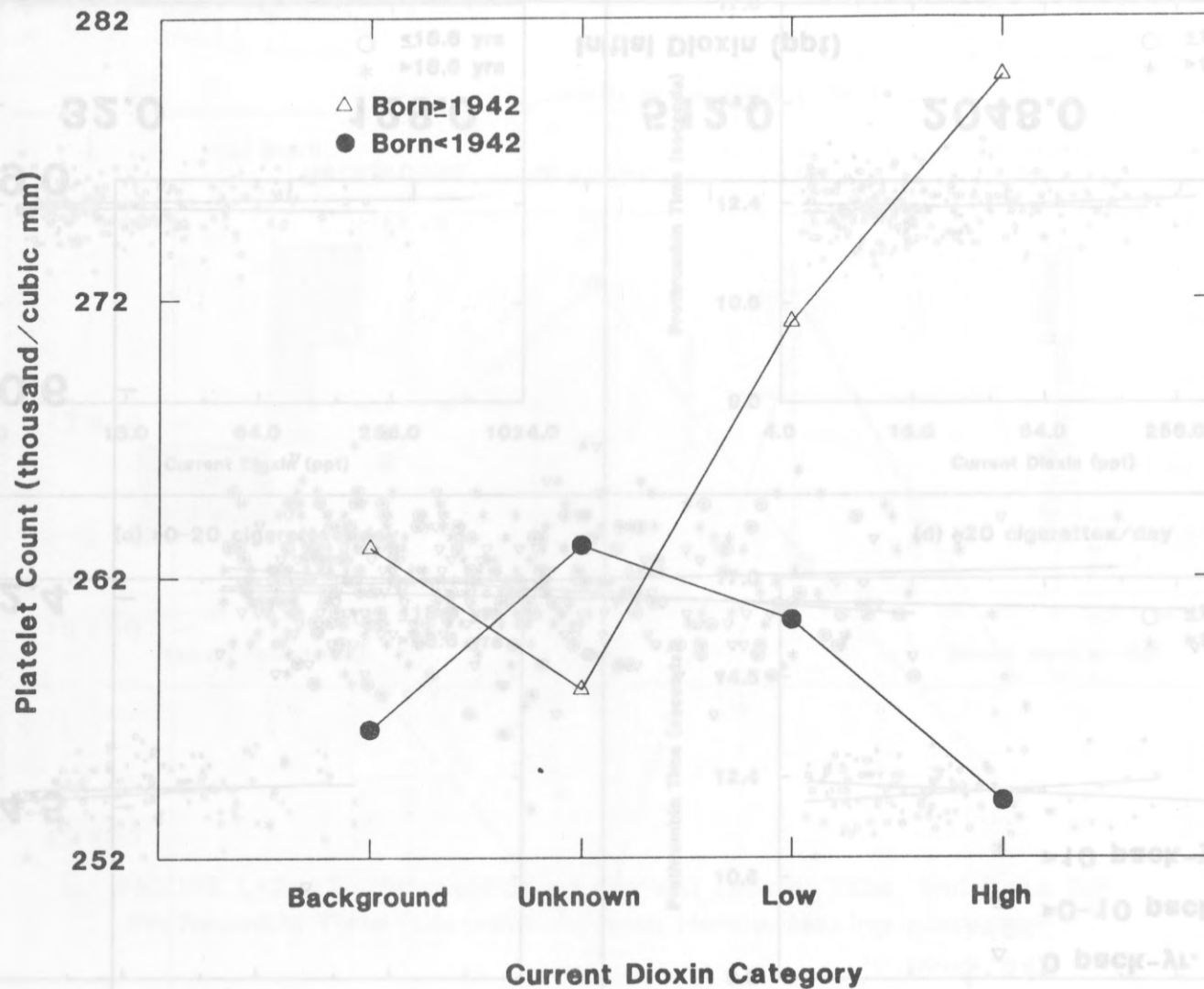


FIGURE L-2-13. Interaction of Categorized Current Dioxin and Age for Platelet Count (Continuous)

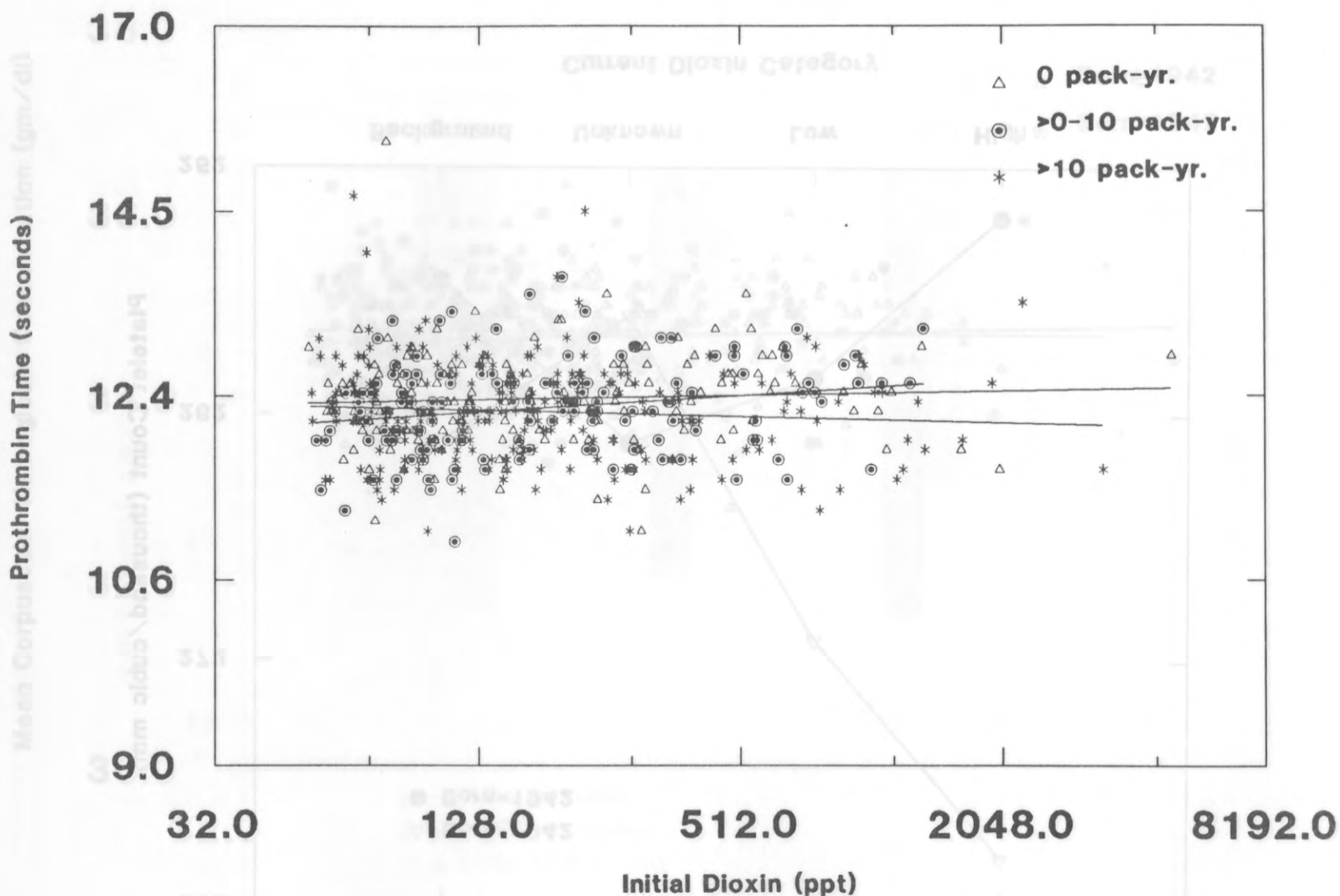


FIGURE L-2-14. Interaction of Initial Dioxin and Lifetime Cigarette Smoking History for Prothrombin Time (Continuous - Ranch Hands, Minimal Assumption)

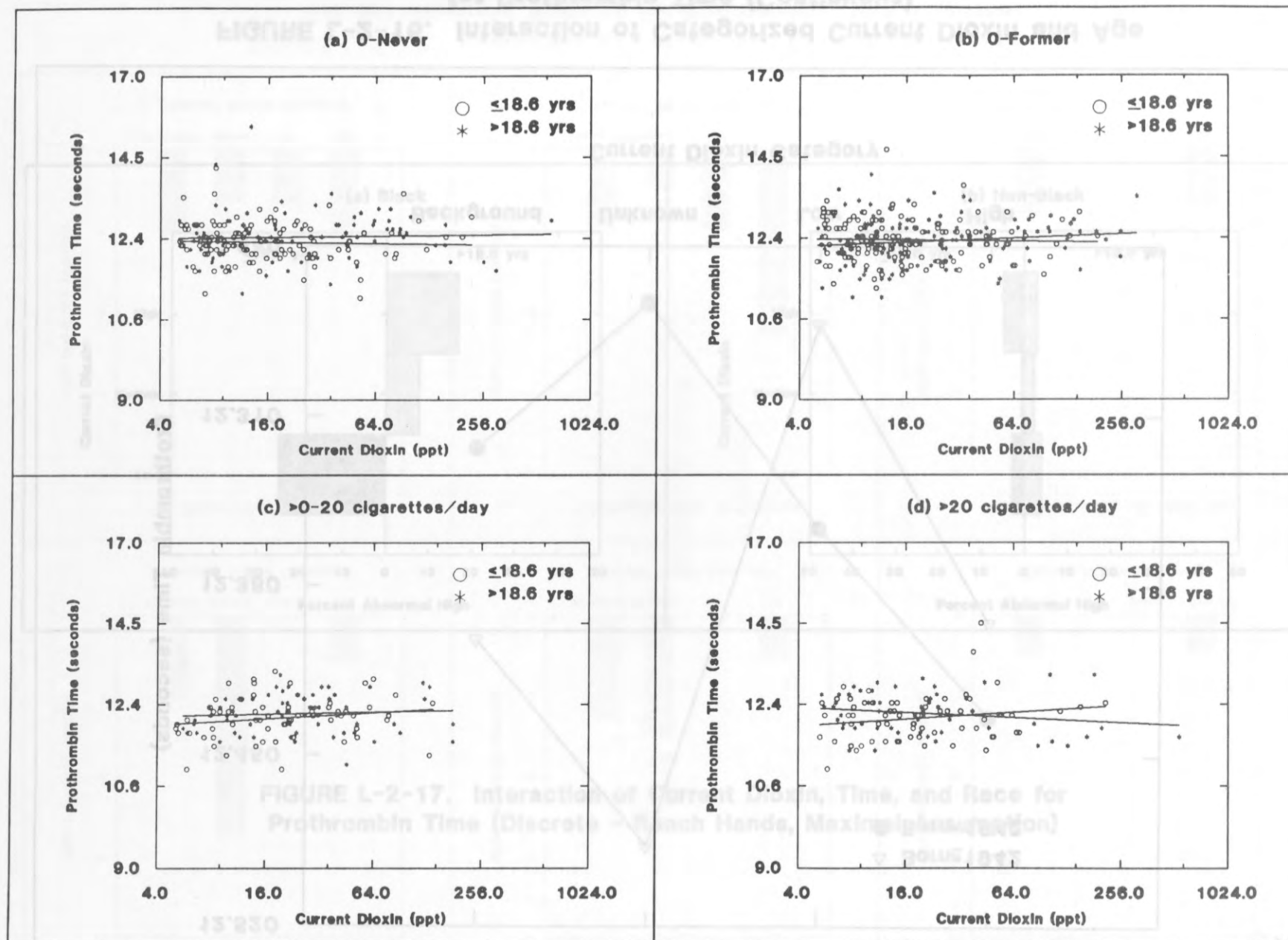


FIGURE L-2-15. Interaction of Current Dioxin, Time, and Current Cigarette Smoking for Prothrombin Time (Continuous - Ranch Hands, Maximal Assumption)

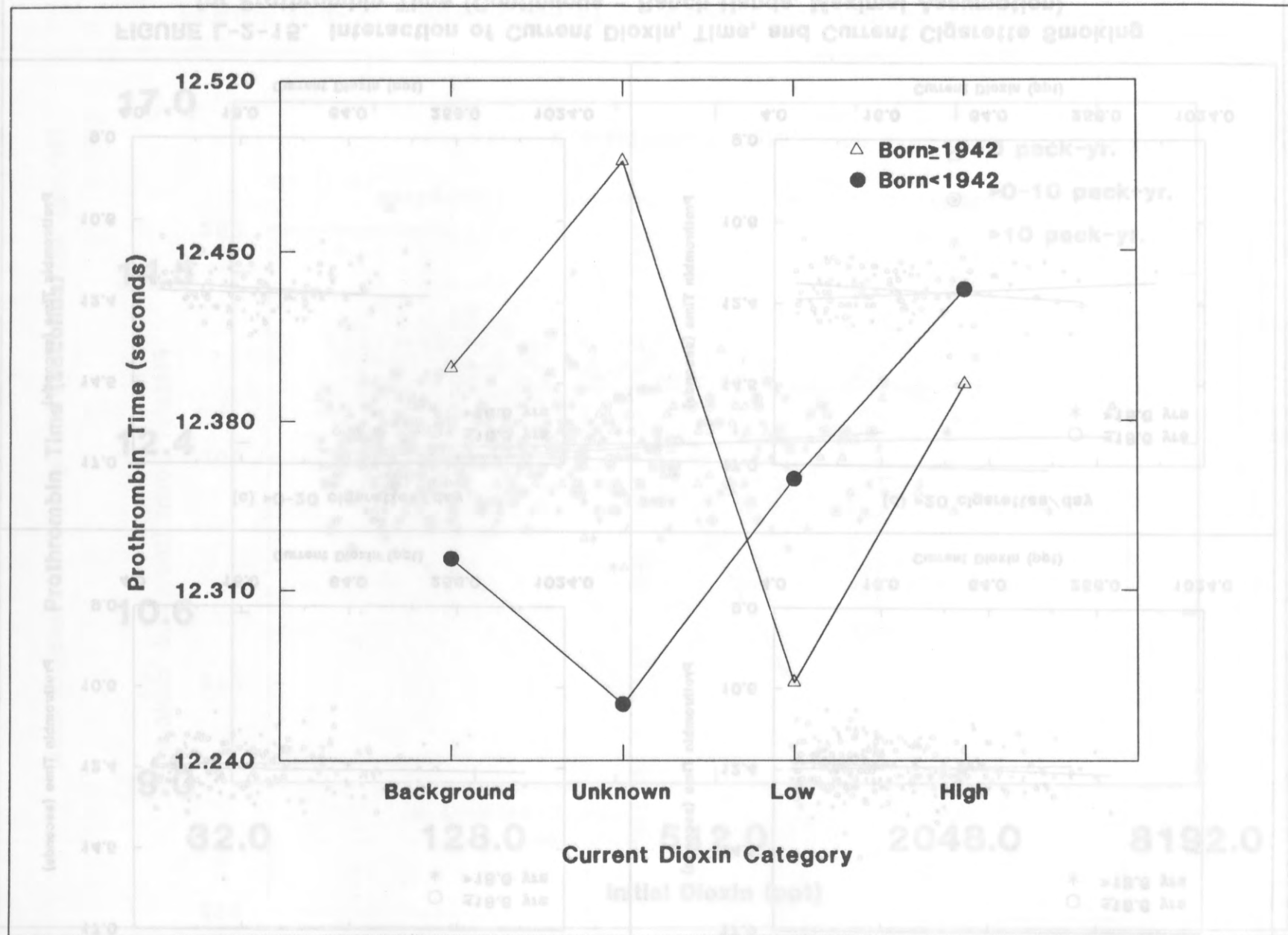


FIGURE L-2-16. Interaction of Categorized Current Dioxin and Age History for Prothrombin Time (Continuous)

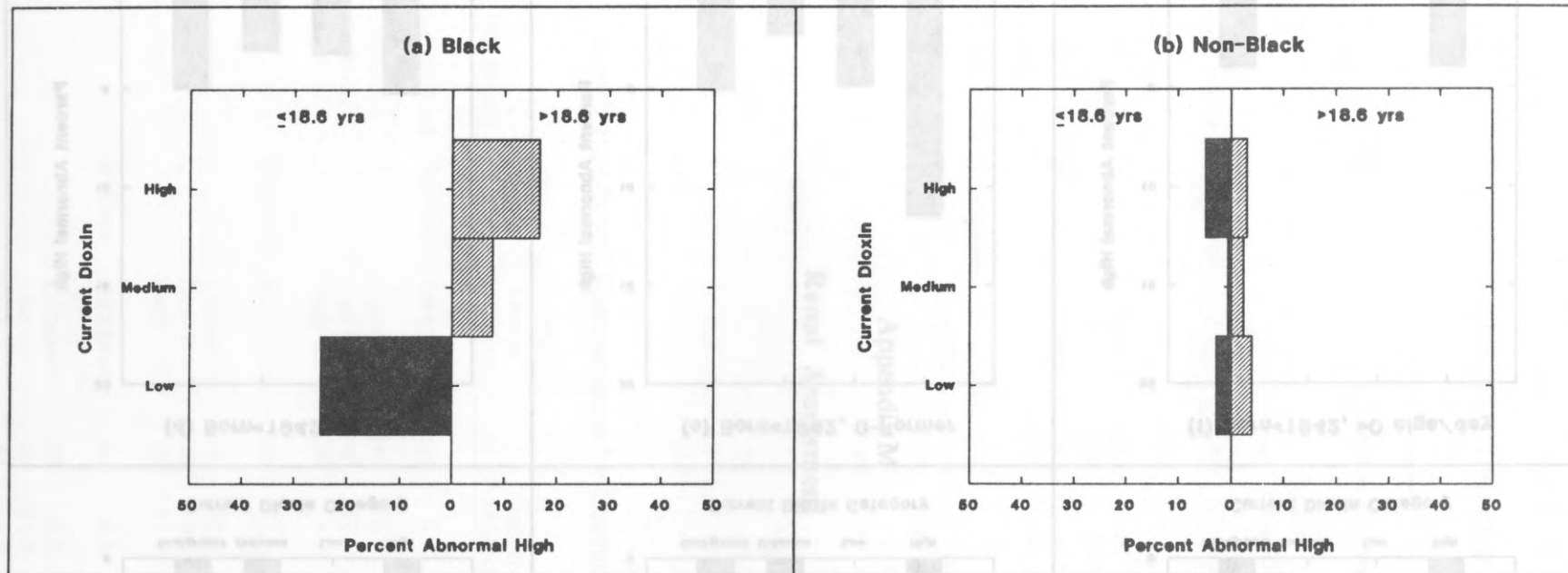


FIGURE L-2-17. Interaction of Current Dioxin, Time, and Race for Prothrombin Time (Discrete - Ranch Hands, Maximal Assumption)

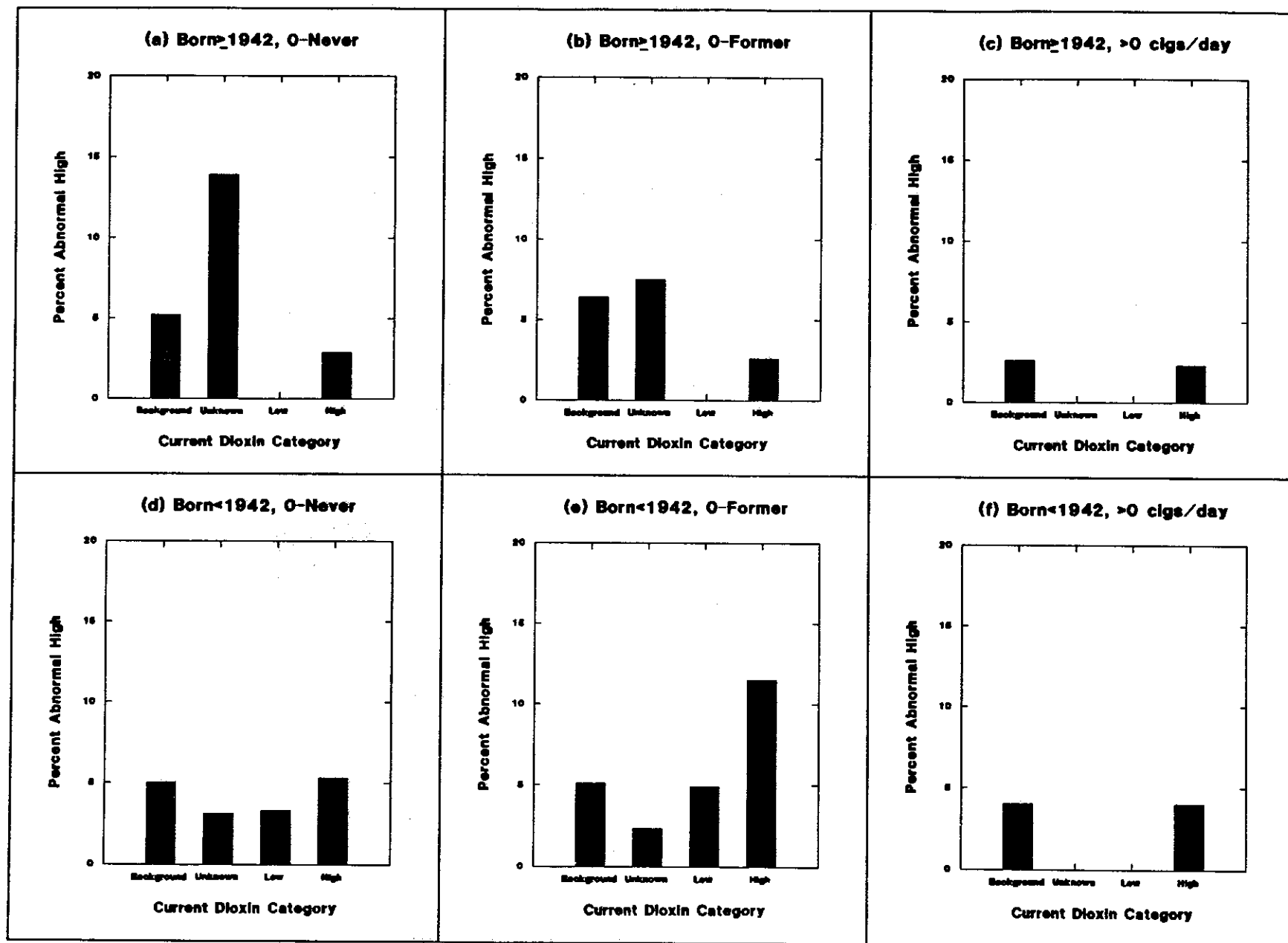


FIGURE L-2-18. Interaction of Categorized Current Dioxin, Age, and Current Cigarette Smoking for Prothrombin Time (Discrete)

Appendix M

Renal Assessment

TABLE M-1.

Summary of Dioxin-by-Covariate Interactions for Renal Variables

Ranch Hands - Log₂ (Current Dioxin) and Time

Variable/ Assumption-- (Table Ref.)	Interaction	Stratum	Time (Yrs.)	Percent Yes/(n) Current Dioxin			Adj. Relative Risk (95% C.I.) ^a	p-Value
				Low	Medium	High		
Kidney Disease (Minimal-- 14-3 [g])	Current-by- Time-by- Diabetic Class	Normal						0.412 ^b
			≤18.6	11.8 (51)	11.7 (94)	9.5 (42)	0.99 (0.64,1.52)	0.960 ^c
			>18.6	9.1 (33)	6.6 (91)	12.0 (50)	1.28 (0.83,1.95)	0.263 ^c
		Impaired						0.063 ^b
			≤18.6	0.0 (6)	0.0 (17)	20.0 (5)	5.03 (0.63,40.33)	0.128 ^c
			>18.6	16.7 (18)	9.5 (21)	8.3 (12)	0.57 (0.22,1.49)	0.252 ^c
		Diabetic						0.113 ^b
			≤18.6	44.4 (9)	0.0 (11)	0.0 (6)	0.10 (0.01,2.36)	0.152 ^c
			>18.6	0.0 (6)	11.8 (17)	16.7 (12)	1.35 (0.73,2.50)	0.344 ^c

Ranch Hands and Comparisons by Current Dioxin Category

Variable/ (Table Ref.)	Interaction	Stratum	Current Dioxin Category	n	Percent Abnormal Contrast		Adj. Relative Risk (95% C.I.)	p-Value
Urinary Occult Blood (14-5 [j])	Categorized Current Dioxin-by- Diabetic Class	Normal	Background	610	8.7	All		0.397
			Unknown	277	6.9	U vs. B	0.80 (0.46,1.37)	0.411
			Low	149	12.1	L vs. B	1.43 (0.81,2.53)	0.218
			High	130	9.2	H vs. B	1.11 (0.57,2.14)	0.761
		Impaired	Background	108	3.7	All		0.069
			Unknown	48	10.4	U vs. B	3.23 (0.82,12.65)	0.093
			Low	28	0.0	L vs. B	--	--
			High	26	11.5	H vs. B	3.37 (0.70,16.19)	0.130
		Diabetic	Background	66	6.1	All		0.158
			Unknown	19	0.0	U vs. B	--	--
			Low	17	17.7	L vs. B	3.20 (0.63,16.14)	0.159
			High	31	3.2	H vs. B	0.52 (0.06,4.91)	0.570

TABLE M-1. (Continued)

Summary of Dioxin-by-Covariate Interactions for Renal Variables

Ranch Hands - Log ₂ (Initial Dioxin)							
Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Initial Dioxin	n	Percent Abnormal	Adj. Relative Risk (95% C.I.) ^a	p-Value
Urinary White Blood Cell Count (Minimal-- 14-6 [c])	Initial-by- Age	Born ≥1942	Low	43	7.0	1.40 (0.97,2.04)	0.075
			Medium	111	7.2		
			High	83	8.4		
		Born <1942	Low	87	12.6	0.79 (0.51,1.24)	0.307
			Medium	149	6.7		
			High	48	6.3		
Urinary White Blood Cell Count (Maximal-- 14-6 [d])	Initial-by- Diabetic Class	Normal	Low	149	4.7	1.26 (0.98,1.62)	0.070
			Medium	269	5.2		
			High	128	9.4		
		Impaired	Low	26	15.4	0.53 (0.26,1.06)	0.075
			Medium	57	7.0		
			High	27	3.7		
		Diabetic	Low	10	0.0	1.02 (0.67,1.56)	0.928
			Medium	43	16.3		
			High	31	12.9		

Ranch Hands - Log₂ (Current Dioxin) and Time

Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Time (Yrs.)	Percent Abnormal/(n) Current Dioxin			Adj. Relative Risk (95% C.I.) ^a	p-Value
				Low	Medium	High		
Urinary White Blood Cell Count (Minimal-- 14-6 [g])	Current-by- Time-by-Race	Black						0.063 ^b
			≤18.6	42.9 (7)	0.0 (7)	0.0 (0)	0.04 (0.00,16.46)	0.293 ^c
			>18.6	0.0 (4)	9.1 (11)	33.3 (3)		
							1.99 (0.32,12.40)	0.462 ^c
		Non-Black						0.711 ^b
			≤18.6	12.3 (65)	5.0 (120)	11.1 (54)	1.01 (0.67,1.54)	0.950 ^c
			>18.6	5.6 (54)	7.5 (120)	6.8 (74)		

TABLE M-1. (Continued)

Summary of Dioxin-by-Covariate Interactions for Renal Variables

Ranch Hands - Log₂ (Current Dioxin) and Time								
Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Time (Yrs.)	Adj. Mean/(n) Current Dioxin			Adj. Slope (Std. Error)	p-Value
				Low	Medium	High		
Blood Urea Nitrogen ^d (Maximal-- 14-7 [h])	Current-by- Time-by- Diabetic Class	Normal						0.052 ^e
			≤18.6	13.8 (89)	14.6 (146)	14.6 (61)	0.015 (0.022)	0.501 ^f
			>18.6	15.0 (64)	13.2 (117)	13.8 (69)	-0.043 (0.021)	0.039 ^f
		Impaired						0.115 ^e
			≤18.6	14.7 (14)	13.9 (24)	13.0 (8)	-0.074 (0.054)	0.171 ^f
			>18.6	13.6 (8)	13.2 (38)	13.5 (18)	0.032 (0.041)	0.428 ^f
		Diabetic						0.344 ^e
			≤18.6	14.6 (3)	14.3 (20)	13.4 (14)	-0.047 (0.059)	0.442 ^f
			>18.6	14.6 (7)	13.4 (23)	14.9 (17)	0.020 (0.039)	0.613 ^f

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Initial Dioxin	n	Adj. Mean	Adj. Slope (Std. Error)	p-Value
Urine Specific Gravity (Maximal-- 14-8 [d])	Initial-by- Race	Black	Low	4	1.0234	-0.0018 (0.0010)	0.063
			Medium	27	1.0205		
			High	7	1.0163		
		Non-Black	Low	181	1.0199	0.0002 (0.0002)	0.326
			Medium	344	1.0200		
			High	179	1.0201		

TABLE M-1. (Continued)

Summary of Dioxin-by-Covariate Interactions for Renal Variables

Ranch Hands - Log ₂ (Current Dioxin) and Time								
Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Time (Yrs.)	Adj. Mean/(n) Current Dioxin			Adj. Slope (Std. Error)	p-Value
				Low	Medium	High		
Urine Specific Gravity (Minimal-- 14-8 [g])	Current-by- Time-by-Age	Born ≥1942						0.645 ^e
			≤18.6	1.0221 (24)	1.0200 (66)	1.0215 (41)	-0.0002 (0.0004)	0.721 ^f
			>18.6	1.0228 (12)	1.0205 (50)	1.0215 (44)	0.0001 (0.0004)	0.769 ^f
		Born <1942						0.053 ^e
			≤18.6	1.0182 (48)	1.0205 (62)	1.0205 (13)	0.0009 (0.0006)	0.125 ^f
			>18.6	1.0190 (46)	1.0197 (82)	1.0193 (33)	-0.0005 (0.0004)	0.237 ^f
Urine Specific Gravity (Maximal-- 14-8 [h])	Current-by- Time-by-Age	Born ≥1942						0.540 ^e
			≤18.6	1.0221 (47)	1.0205 (84)	1.0209 (57)	-0.00003 (0.00031)	0.925 ^f
			>18.6	1.0198 (13)	1.0204 (53)	1.0216 (60)	0.00025 (0.00034)	0.459 ^f
		Born <1942						0.046 ^e
			≤18.6	1.0185 (59)	1.0196 (107)	1.0201 (26)	0.00065 (0.00041)	0.111 ^f
			>18.6	1.0202 (66)	1.0194 (126)	1.0187 (44)	-0.00037 (0.00030)	0.226 ^f

TABLE M-1. (Continued)

Summary of Dioxin-by-Covariate Interactions for Renal Variables

^aRelative risk for a twofold increase in dioxin.

^bTest of significance for homogeneity of relative risks (current dioxin continuous, time categorized).

^cTest of significance for relative risk equal to 1 (current dioxin continuous, time categorized).

^dAdjusted means transformed from square root scale; adjusted slope and standard error based on square root blood urea nitrogen versus log₂ dioxin.

^eTest of significance for homogeneity of slopes (current dioxin continuous, time categorized).

^fTest of significance for slope equal to 0 (current dioxin continuous, time categorized).

--: Analysis not performed due to category with no abnormalities.

Note: Initial Dioxin: Minimal--Low: 52-93 ppt; Medium: >93-292 ppt; High: >292 ppt.

Maximal--Low: 25-56.9 ppt; Medium: >56.9-218 ppt; High: >218 ppt.

Current Dioxin: Minimal--Low: >10-14.65 ppt; Medium: >14.65-45.75 ppt; High: >45.75 ppt.

Maximal--Low: >5-9.01 ppt; Medium: >9.01-33.3 ppt; High: >33.3 ppt.

All: All categories.

Background (B) (Comparisons): Current Dioxin ≤10 ppt.

Unknown (U) (Ranch Hands): Current Dioxin ≤10 ppt.

Low (L) (Ranch Hands): 15 ppt < Current Dioxin ≤33.3 ppt.

High (H) (Ranch Hands): Current Dioxin >33.3 ppt.

TABLE M-2.

**Summary of Models Without Adjustment for Diabetic
Class for Renal Variables**

Ranch Hands and Comparisons by Current Dioxin Category						
Variable/ (Table Ref.)	Current Dioxin Category	n	Contrast	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Urinary Protein (14-4 [j])	Background	786	All Categories		0.919	AGE (p=0.021) RACE (p=0.002)
	Unknown	345	Unknown vs. Background	0.84 (0.45,1.58)	0.589	
	Low	196	Low vs. Background	0.82 (0.37,1.79)	0.612	
	High	187	High vs. Background	1.01 (0.46,2.23)	0.981	
	Total	1,514				

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Table Ref.)	Assumption	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Urinary Occult Blood (14-5 [c])	Minimal (n=521)	1.21 (0.95,1.55)	0.130	RACE (p=0.002)

Ranch Hands - Log₂ (Current Dioxin) and Time

Variable/ (Table Ref.)	Assumption	Time (Yrs.)	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Urinary Occult Blood (14-5 [g])	Minimal (n=521)			0.471 ^b	RACE (p=0.003)
		≤18.6	1.31 (0.82,2.09)	0.251 ^c	
		>18.6	1.07 (0.79,1.45)	0.663 ^c	

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Table Ref.)	Assumption	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Urinary White Blood Cell Count (14-6 [d])	Maximal (n=742)	1.11 (0.91,1.35)	0.323	RACE (p=0.059)

TABLE M-2. (Continued)

**Summary of Models Without Adjustment for Diabetic
Class for Renal Variables**

Ranch Hands - Log₂ (Current Dioxin) and Time					
Variable/ (Table Ref.)	Assumption	Time (Yrs.)	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Urinary White Blood Cell Count (14-6 [g])	Minimal (n=521)	≤18.6	0.94 (0.62,1.44)**	0.345** ^b	CURR*TIME*RACE (p=0.033)
		>18.6	1.23 (0.86,1.74)**	0.789** ^c	
				0.253** ^c	
Urinary White Blood Cell Count (14-6 [h])	Maximal (n=742)	≤18.6	1.05 (0.78,1.42)	0.342 ^b	RACE (p=0.055)
		>18.6	1.28 (0.97,1.70)	0.739 ^c	
				0.083 ^c	

Ranch Hands and Comparisons by Current Dioxin Category

Variable/ (Table Ref.)	Current Dioxin Category	n	Adj. Mean	Contrast	Difference of Adj. Means (95% C.I.) ^e	p-Value ^f	Covariate Remarks
Blood Urea Nitrogen ^d (14-7 [j])	Background	786	14.2	All Categories		0.548	AGE (p<0.001) RACE (p=0.002)
	Unknown	345	14.0	Unknown vs. Background	-0.2 --	0.413	
	Low	196	13.8	Low vs. Background	-0.4 --	0.174	
	High	187	14.1	High vs. Background	-0.1 --	0.812	
	Total	1,514					

^aRelative risk for a twofold increase in dioxin.

^bTest of significance for homogeneity of relative risks (current dioxin continuous, time categorized).

^cTest of significance for relative risk equal to 1 (current dioxin continuous, time categorized).

^dMeans transformed from square root scale.

^eDifference of means after transformation to original scale; confidence interval on difference of means not given because analysis was performed on square root scale.

^fP-value based on difference of means on square root scale.

**Log₂ (current dioxin)-by-time-by-covariate interaction (0.01<p≤0.05); adjusted relative risk, confidence interval, and p-value derived from a model after deletion of this interaction.

Note: Background (Comparisons): Current Dioxin ≤10 ppt.

Unknown (Ranch Hands): Current Dioxin ≤10 ppt.

Low (Ranch Hands): 15 ppt < Current Dioxin ≤33.3 ppt.

High (Ranch Hands): Current Dioxin >33.3 ppt.

TABLE M-3.

**Summary of Dioxin-by-Covariate Interactions Without Adjustment for
Diabetic Class for Renal Variables**

Ranch Hands - Log₂ (Current Dioxin) and Time

Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Time (Yrs.)	Percent Abnormal/(n) Current Dioxin			Adj. Relative Risk (95% C.I.) ^a	p-Value
				Low	Medium	High		
Urinary White Blood Cell Count (Minimal-- 14-6 [g])	Current-by- Time-by-Race	Black						0.024 ^b
			≤18.6	42.9 (7)	0.0 (7)	0.0 (0)	0.02 (0.00,9.20)	0.216 ^c
			>18.6	0.0 (4)	9.1 (11)	33.3 (3)	2.50 (0.43,14.51)	0.307 ^c
		Non-Black						0.633 ^b
			≤18.6	12.3 (65)	5.0 (121)	11.1 (54)	1.03 (0.67,1.57)	0.896 ^c
			>18.6	5.6 (54)	7.4 (121)	6.8 (74)	1.18 (0.82,1.69)	0.373 ^c

^aRelative risk for a twofold increase in dioxin.

^bTest of significance for homogeneity of relative risks (current dioxin continuous, time categorized).

^cTest of significance for relative risk equal to 1 (current dioxin continuous, time categorized).

Note: Current Dioxin: Minimal--Low: >10-14.65 ppt; Medium: >14.65-45.75 ppt; High: >45.75 ppt.
Maximal--Low: >5-9.01 ppt; Medium: >9.01-33.3 ppt; High: >33.3 ppt.

APPENDIX M-1.

Data Displays for the Renal Assessment

The following figures graphically display relationships between the dependent variables and measures of dioxin for the renal assessment. The panels are arranged as follows:

Panel	Group	Assumption	Dioxin Measure
a	Ranch Hand	Minimal	Initial
b	Ranch Hand	Maximal	Initial
c	Comparison	--	Current
d	Ranch Hand	--	Current

Dioxin measures are presented in original units, but spacing of intervals is based on the logarithm (base 2) scale, similar to the statistical analysis. The dependent variable is also presented in original units (or a multiple thereof), but spacing is based on the scale used for analysis, as described in the chapter. For continuous variables, current dioxin values of 0.0 ppt are displayed as 0.3 ppt. For these variables, the reference line indicates the general relationship between the (transform of the) dependent variable and $\log_2$ dioxin. For discrete variables, the percent of participants that exhibited an abnormal condition is displayed on the vertical axis for given intervals of dioxin. The intervals of dioxin and the sample sizes (assuming no missing data or exclusions) for each of these intervals are given below. A list of figures found in this appendix follows the table.

Dioxin Interval	Dioxin Scale Midpoint	Panel			
		a	b	c	d
		Sample Size			
0.0-0.5	0.25	0	0	42	8
>0.5-2.0	1	0	0	28	8
>2.0-8.0	4	0	0	681	249
>8.0-32.0	16	0	23	52	408
>32.0-128.0	64	219	417	1	158
>128.0-512.0	256	234	234	0	33
>512.0-2,048.0	1024	65	65	0	2
>2,048.0	4096	3	3	0	0

M-1-1	Kidney Disease versus Dioxin.....	M-1-3
M-1-2	Urinary Protein versus Dioxin.....	M-1-4
M-1-3	Urinary Occult Blood versus Dioxin.....	M-1-5
M-1-4	Urinary White Blood Cell Count versus Dioxin.....	M-1-6
M-1-5	Blood Urea Nitrogen versus Dioxin	M-1-7
M-1-6	Urine Specific Gravity versus Dioxin.....	M-1-8

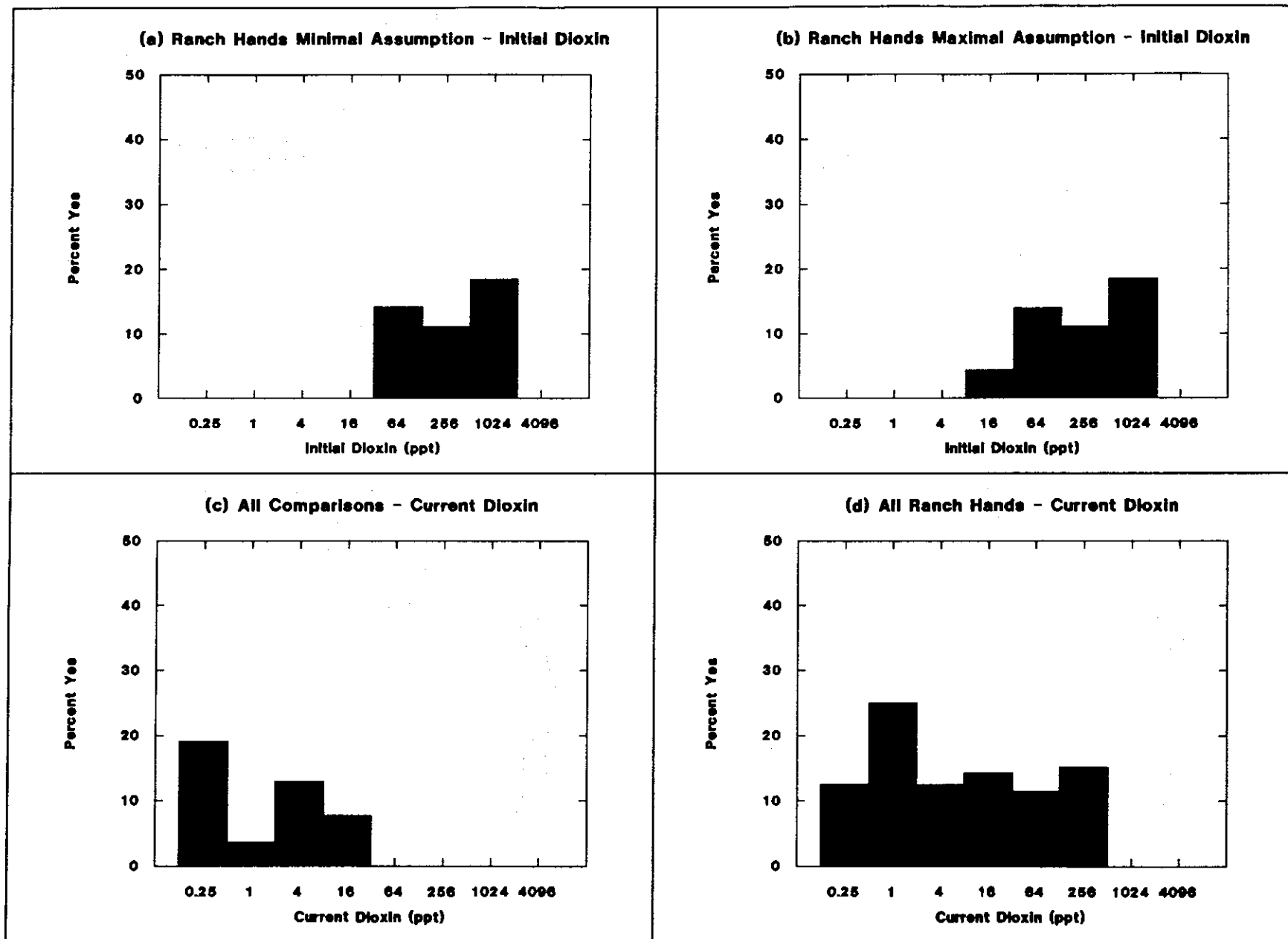


FIGURE M-1-1. Kidney Disease versus Dioxin

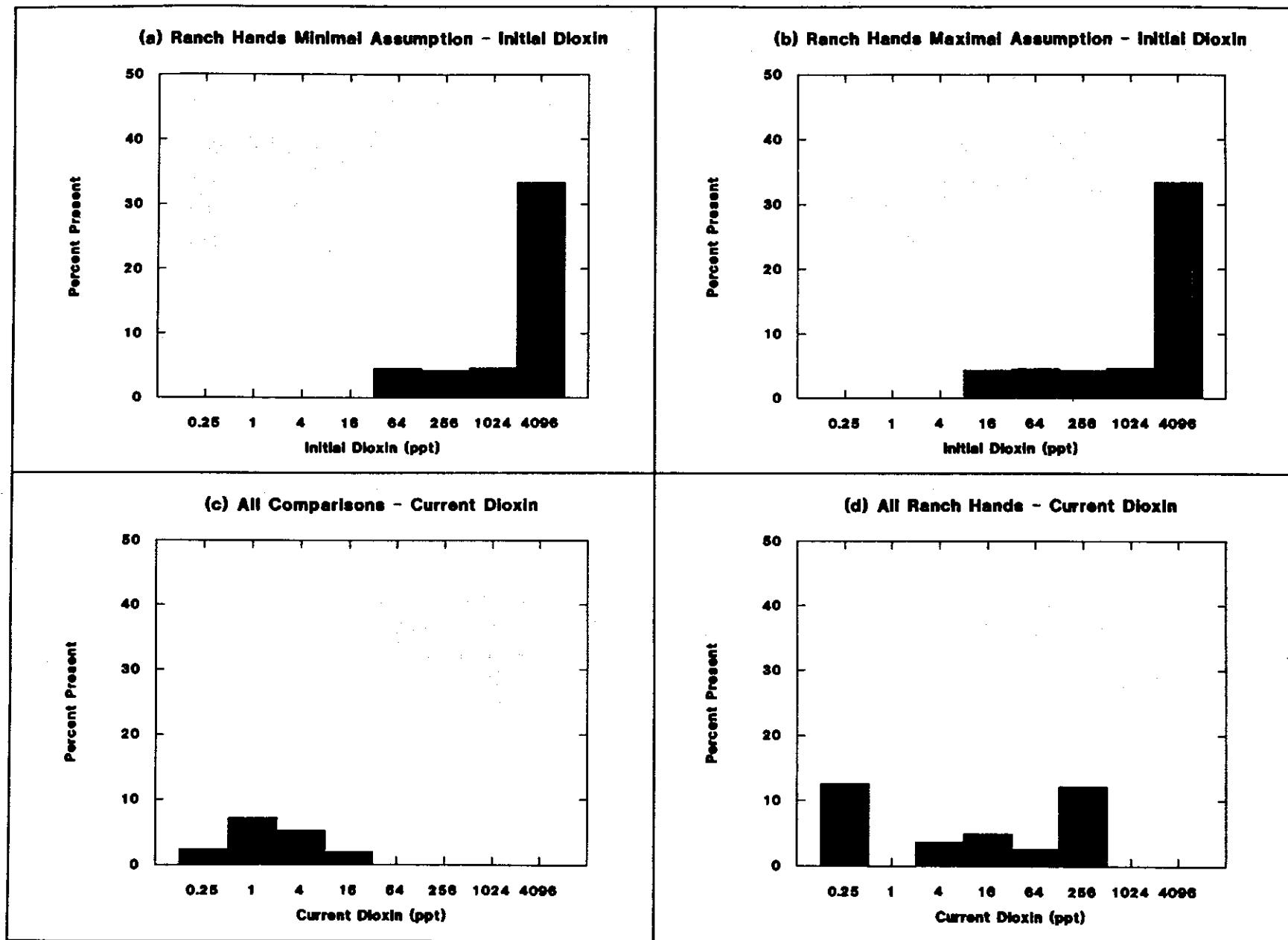


FIGURE M-1-2. Urinary Protein versus Dioxin

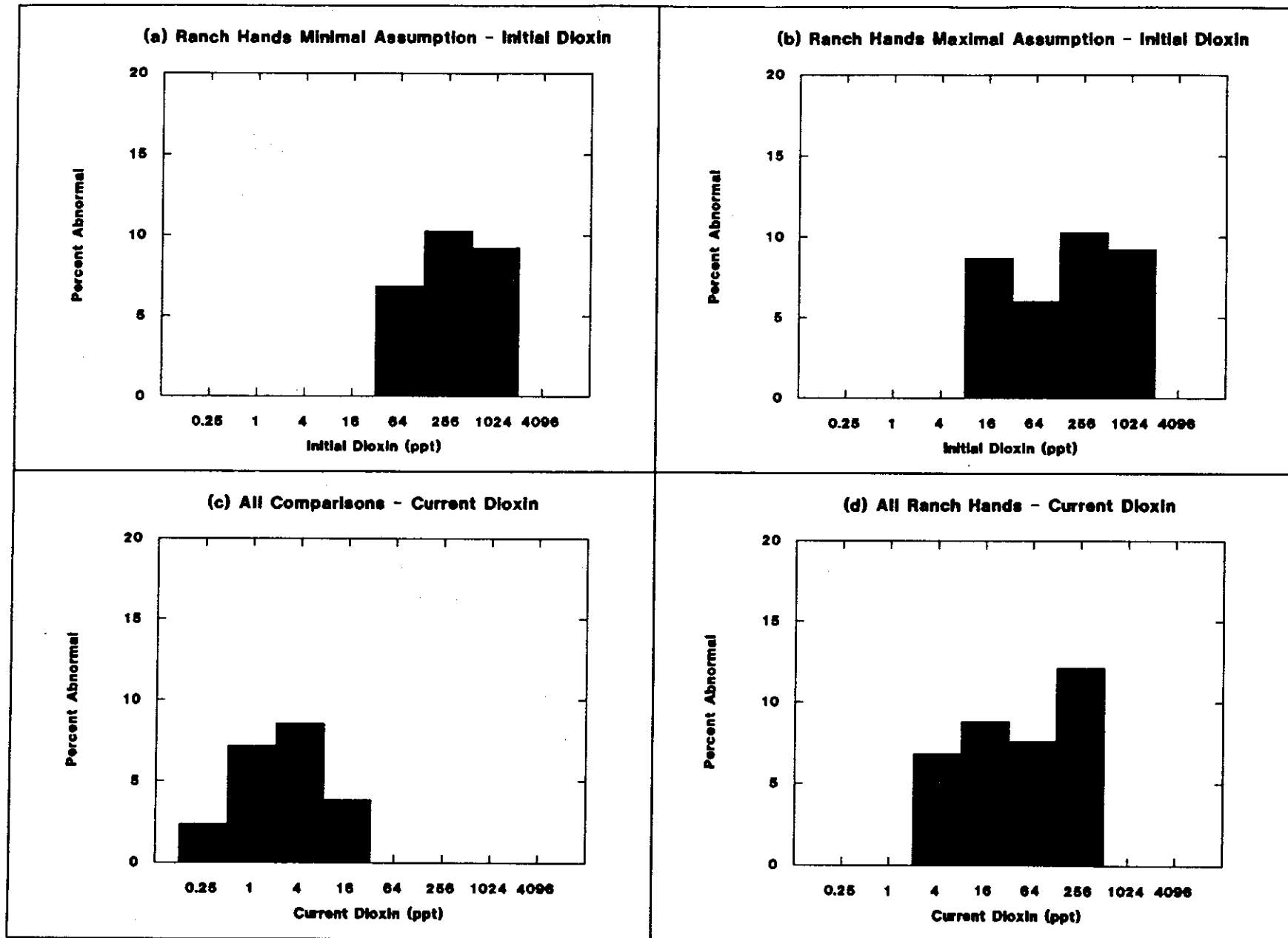


FIGURE M-1-3. Urinary Occult Blood versus Dioxin

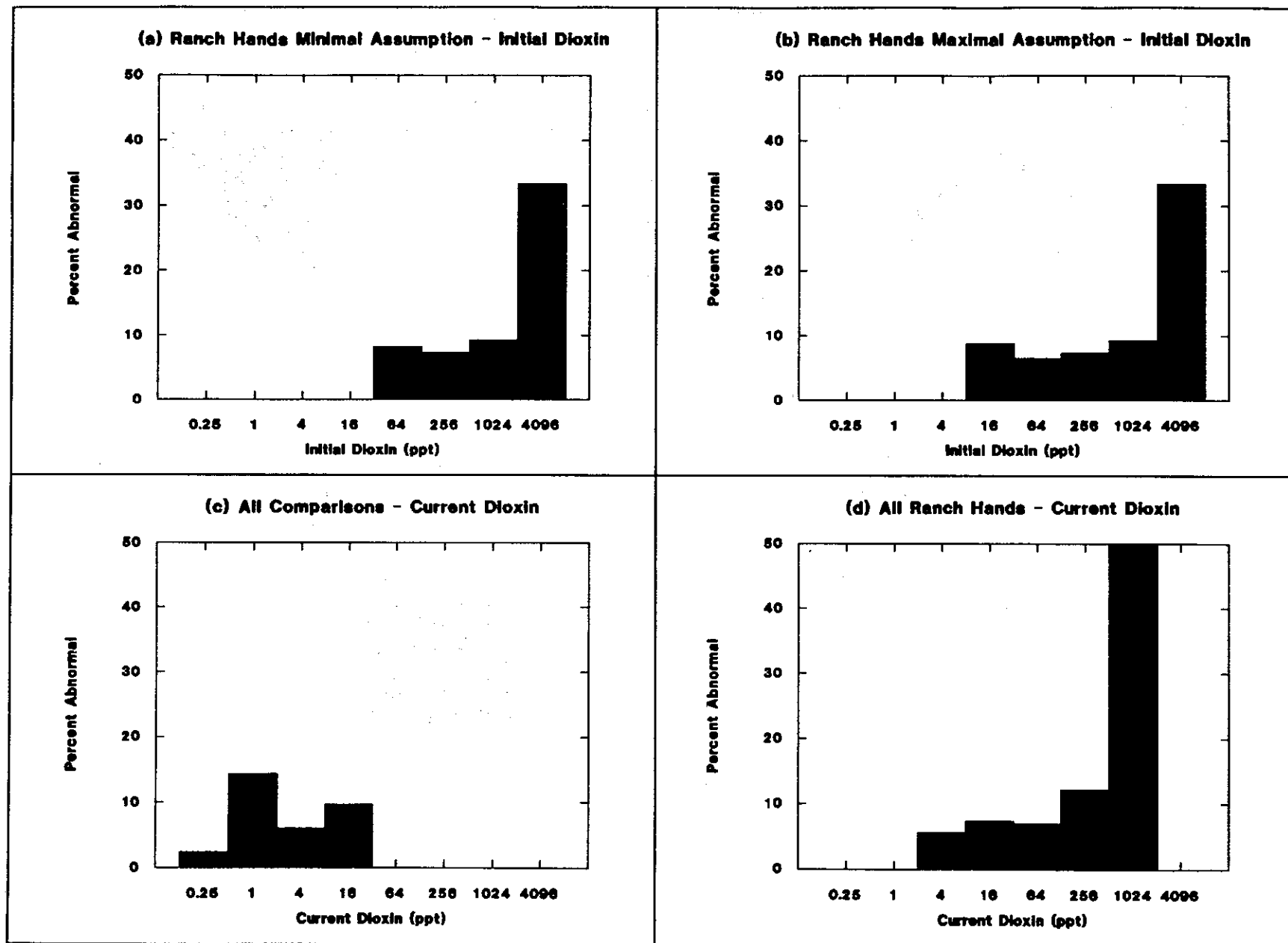


FIGURE M-1-4. Urinary White Blood Cell Count versus Dioxin

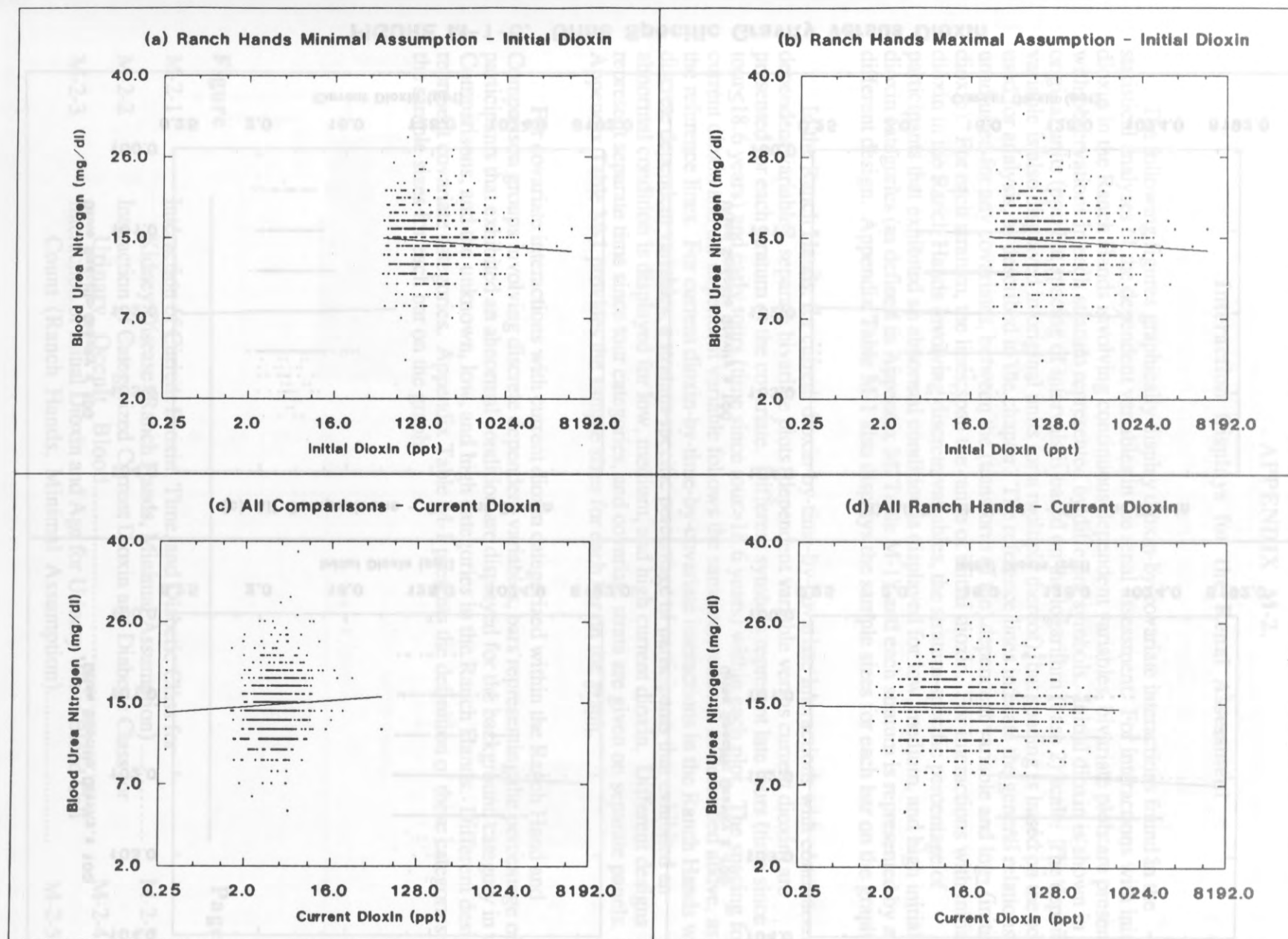
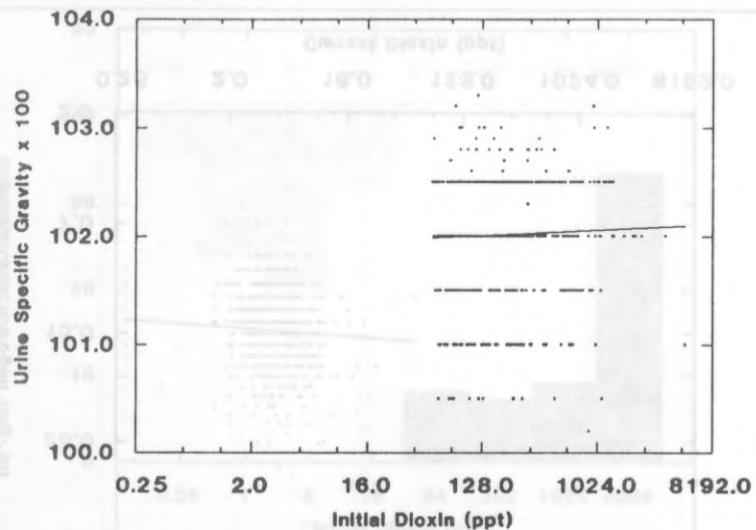
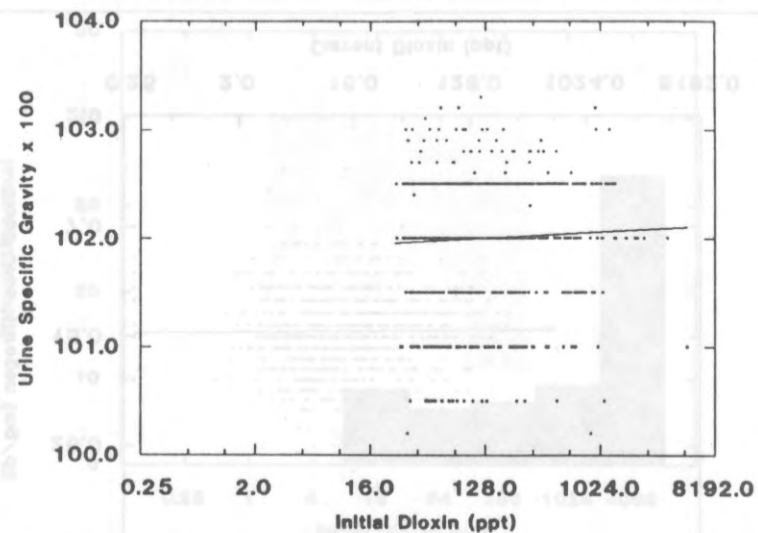


FIGURE M-1-5. Blood Urea Nitrogen versus Dioxin

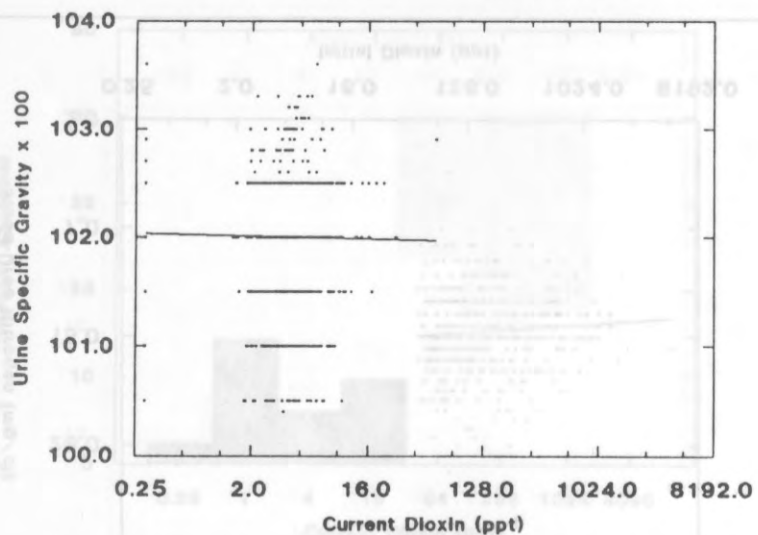
(a) Ranch Hands Minimal Assumption - Initial Dioxin



(b) Ranch Hands Maximal Assumption - Initial Dioxin



(c) All Comparisons - Current Dioxin



(d) All Ranch Hands - Current Dioxin

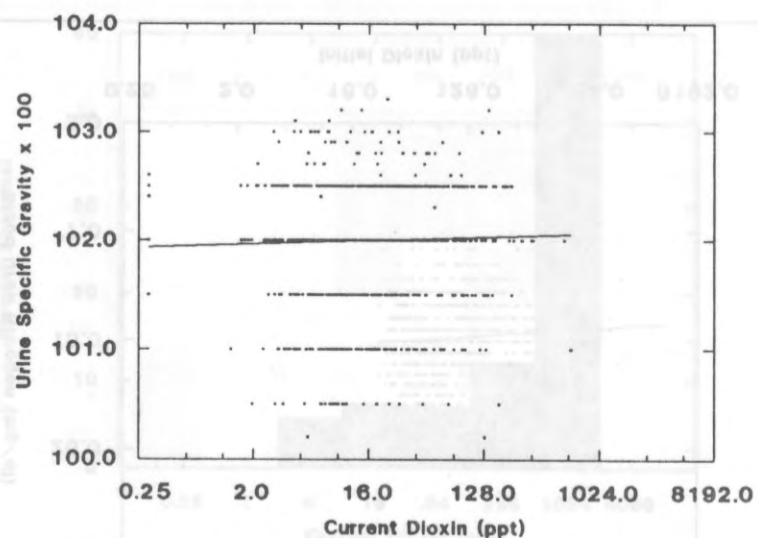


FIGURE M-1-6. Urine Specific Gravity versus Dioxin

APPENDIX M-2.

Interaction Displays for the Renal Assessment

The following figures graphically display dioxin-by-covariate interactions found in the statistical analyses of the dependent variables in the renal assessment. For interactions with initial dioxin in the Ranch Hands involving continuous dependent variables, bivariate plots are presented with observations in each stratum represented by different symbols. Initial dioxin is shown in original units (ppt) but spacing of intervals is based on the logarithm (base 2) scale. The dependent variable is also displayed in original units (or a multiple thereof), but spacing is based on the scale used for analysis, as described in the chapter. The reference lines indicate the general relationship, unadjusted for any covariates, between the (transform of the) dependent variable and $\log_2$ (initial dioxin). For each stratum, the lines span the range of initial dioxin. For interactions with initial dioxin in the Ranch Hands involving discrete variables, the stratum-specific percentage of participants that exhibited an abnormal condition is displayed for low, medium, and high initial dioxin categories (as defined in Appendix M, Table M-1), and each stratum is represented by a different design. Appendix Table M-1 also displays the sample sizes for each bar on the graph.

In the Ranch Hands, for current dioxin-by-time-by-covariate interactions with continuous dependent variables, separate bivariate plots (dependent variable versus current dioxin) are presented for each stratum of the covariate. Different symbols represent late tours (time since tour ≤ 18.6 years) and early tours (time since tour > 18.6 years) within each plot. The spacing for current dioxin and the dependent variable follows the same conventions as described above, as do the reference lines. For current dioxin-by-time-by-covariate interactions in the Ranch Hands with discrete dependent variables, a stratum-specific percentage of participants that exhibited an abnormal condition is displayed for low, medium, and high current dioxin. Different designs represent separate time since tour categories, and covariate strata are given on separate panels. Appendix Table M-1 provides the sample sizes for each bar on the graph.

For covariate interactions with current dioxin categorized within the Ranch Hand and Comparison groups involving discrete dependent variables, bars representing the percentage of participants that exhibited an abnormal condition are displayed for the background category in the Comparisons, and the unknown, low, and high categories in the Ranch Hands. Different designs represent covariate categories. Appendix Table M-1 presents the definition of these categories and the sample sizes for each bar on the graph.

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M-2-3	Interaction of Initial Dioxin and Age for Urinary White Blood Cell Count (Ranch Hands, Minimal Assumption).....	M-2-5

Figure		Page
M-2-4	Interaction of Initial Dioxin and Diabetic Class for Urinary White Blood Cell Count (Ranch Hands, Maximal Assumption).....	M-2-6
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M-2-6	Interaction of Current Dioxin, Time, and Diabetic Class for Blood Urea Nitrogen (Ranch Hands, Maximal Assumption)	M-2-8
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M-2-9	Interaction of Current Dioxin, Time, and Age for Urine Specific Gravity (Ranch Hands, Maximal Assumption)	M-2-11

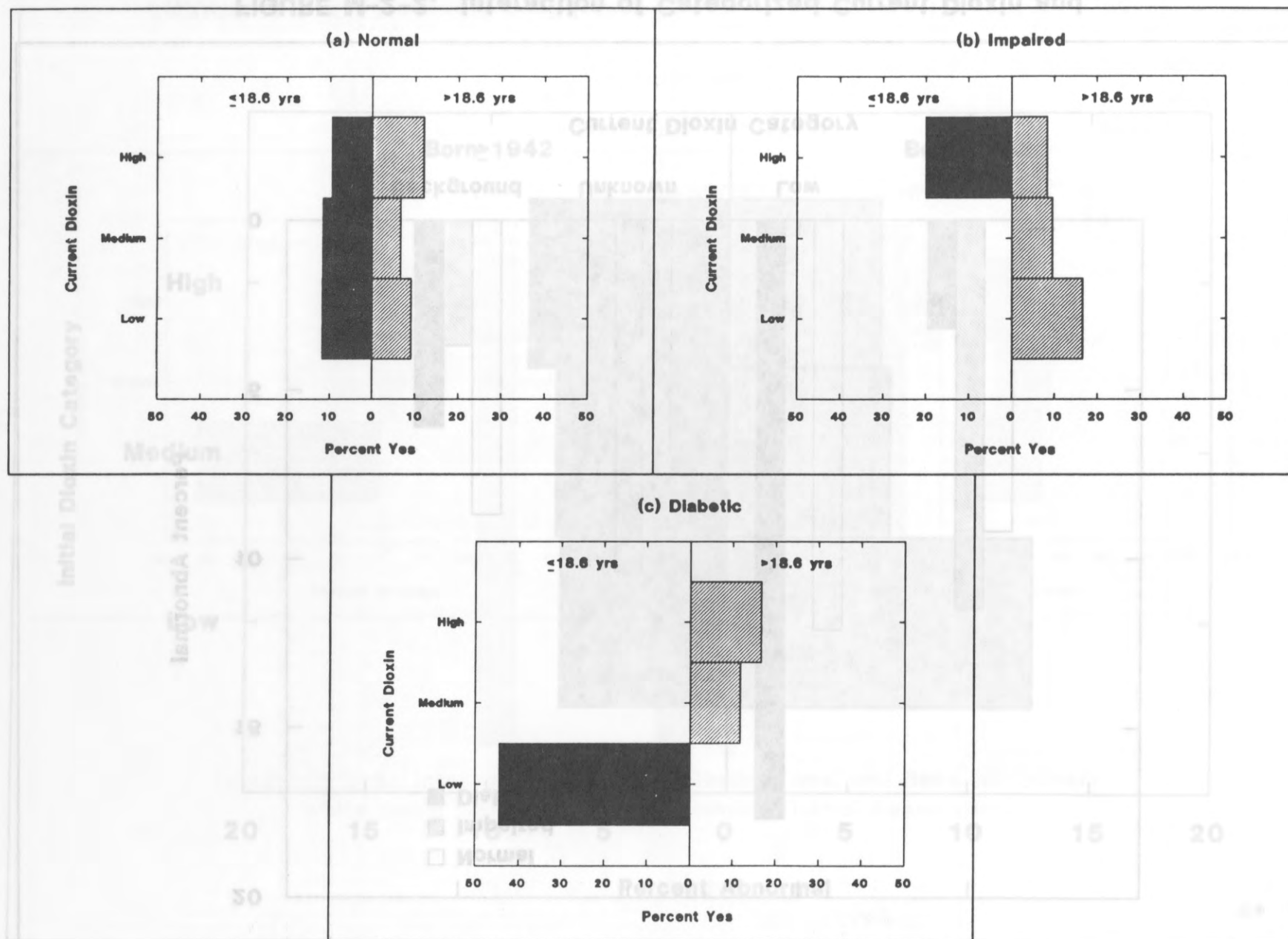


FIGURE M-2-1. Interaction of Current Dioxin, Time, and Diabetic Class for Kidney Disease (Ranch Hands, Minimal Assumption)

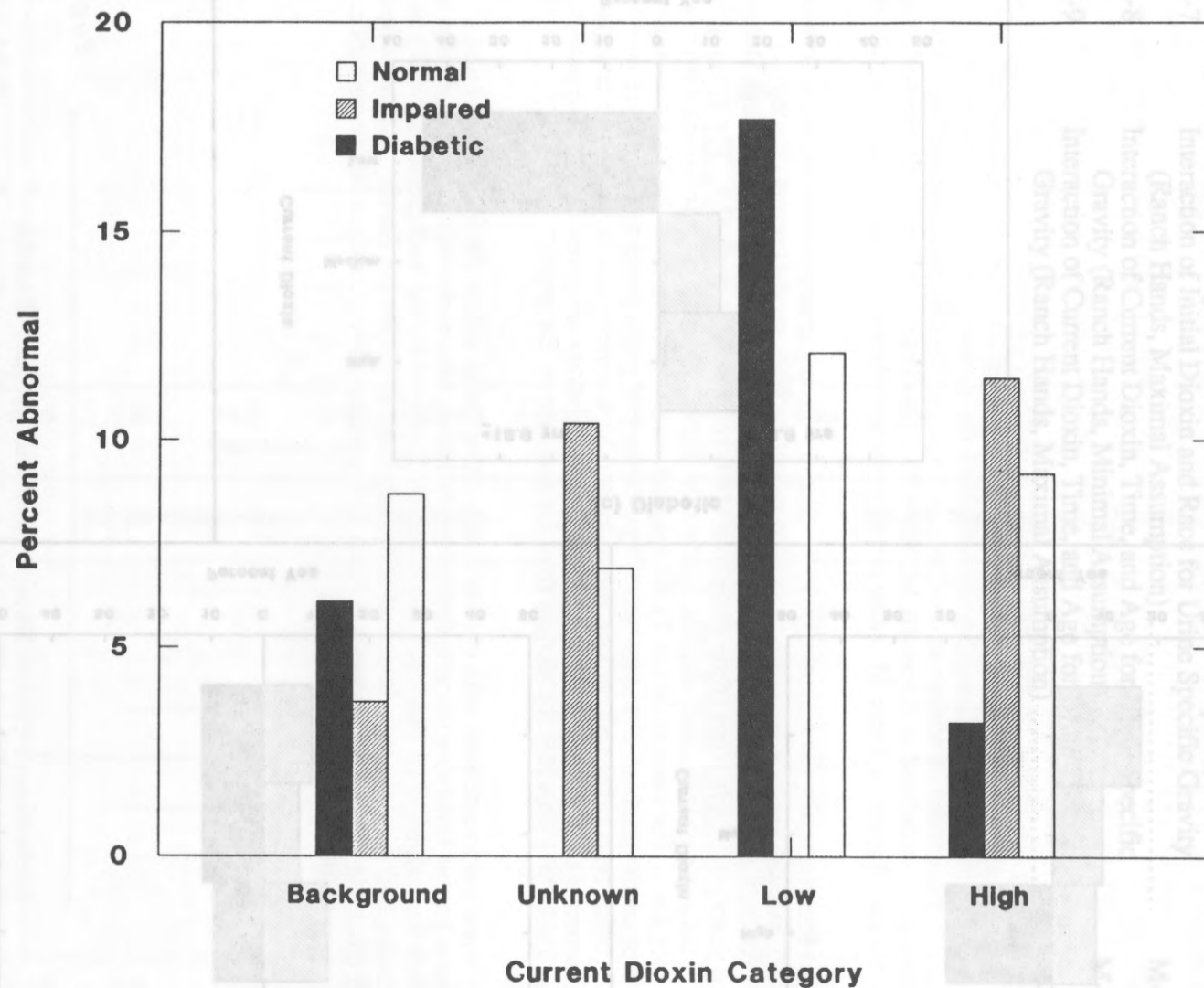


FIGURE M-2-2. Interaction of Categorized Current Dioxin and Diabetic Class for Urinary Occult Blood

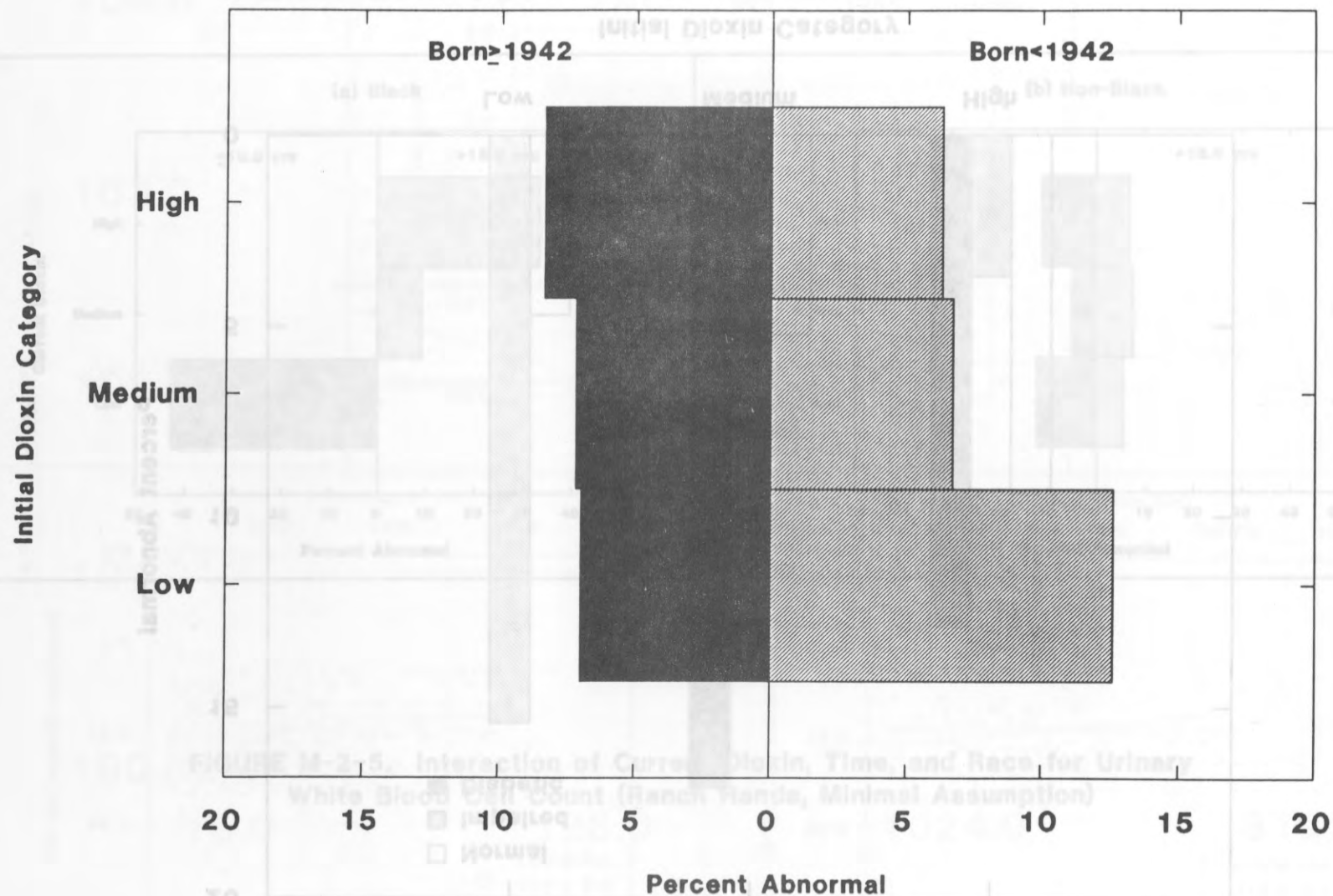


FIGURE M-2-3. Interaction of Initial Dioxin and Age for Urinary White Blood Cell Count (Ranch Hands, Minimal Assumption)

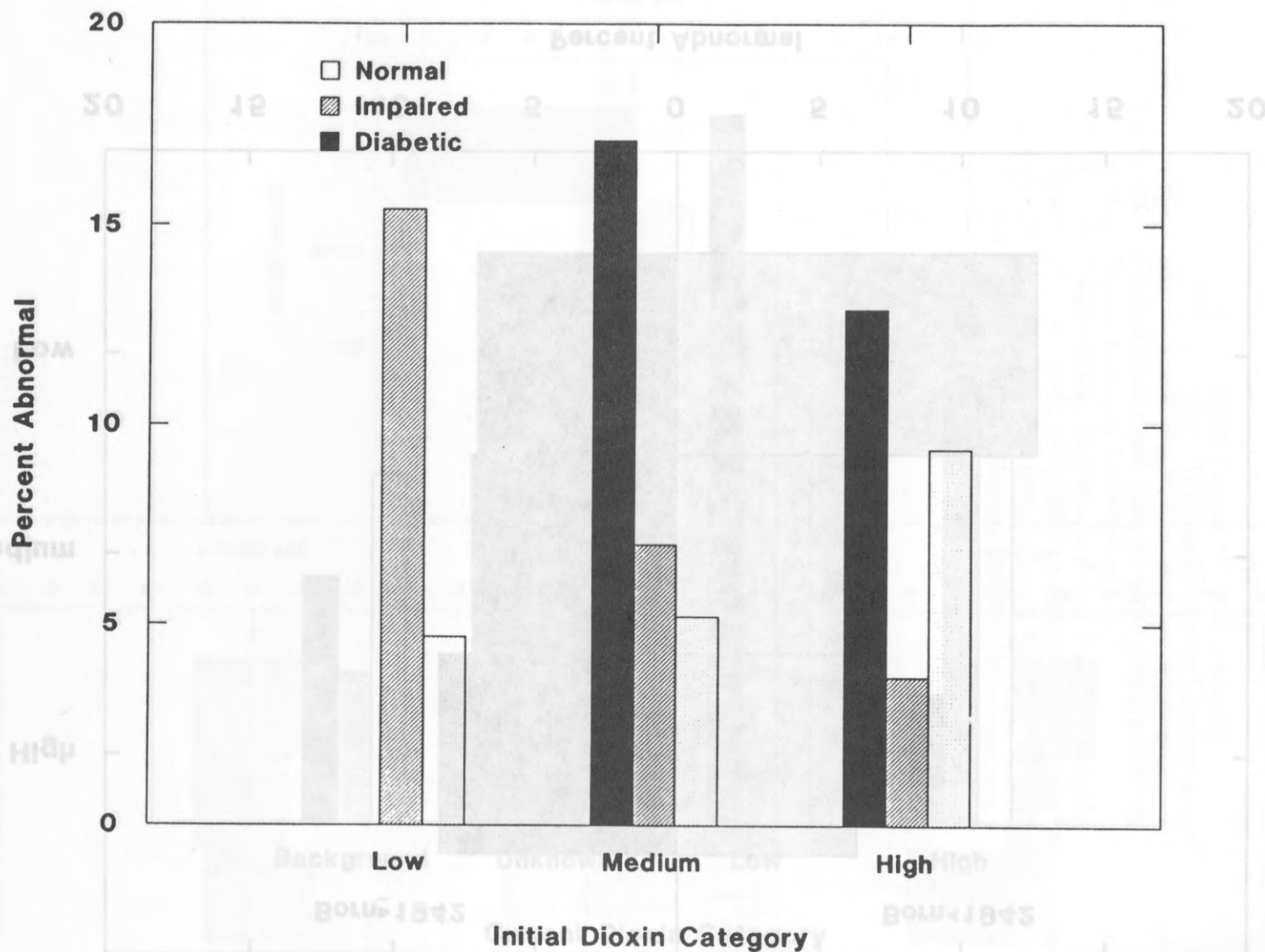


FIGURE M-2-4. Interaction of Initial Dioxin and Diabetic Class for Urinary White Blood Cell Count (Ranch Hands, Maximal Assumption)

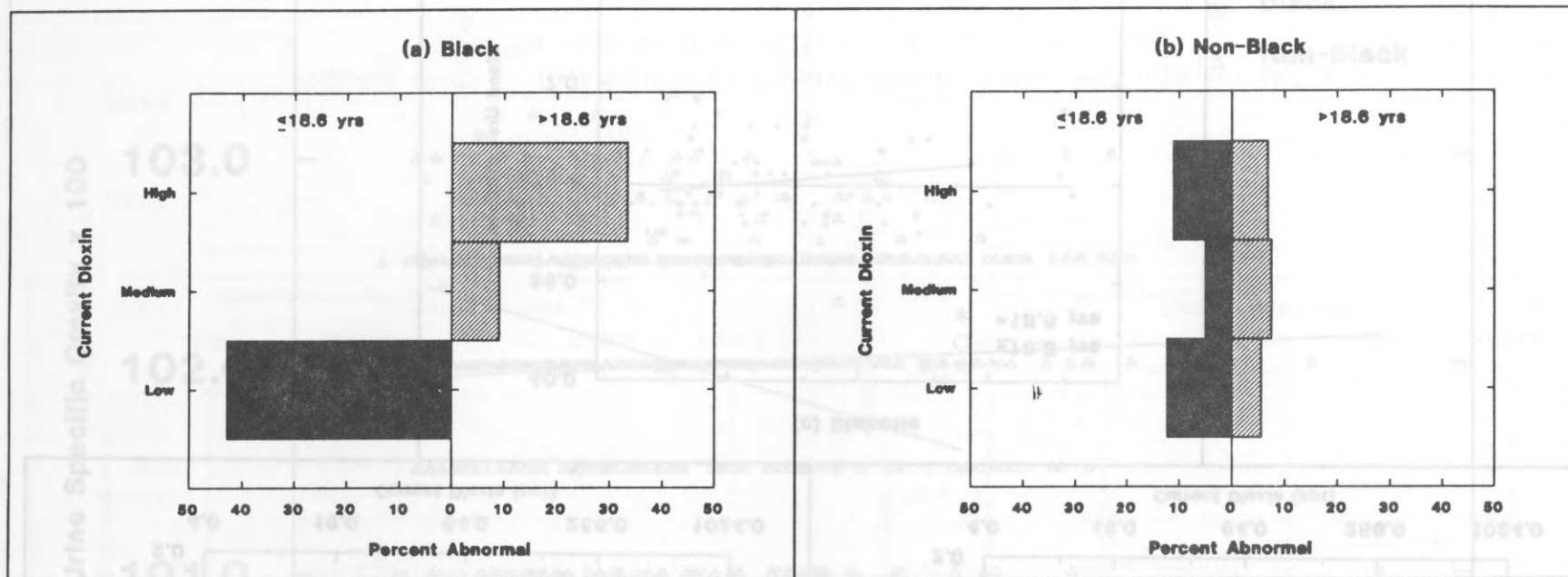


FIGURE M-2-5. Interaction of Current Dioxin, Time, and Race for Urinary White Blood Cell Count (Ranch Hands, Minimal Assumption)

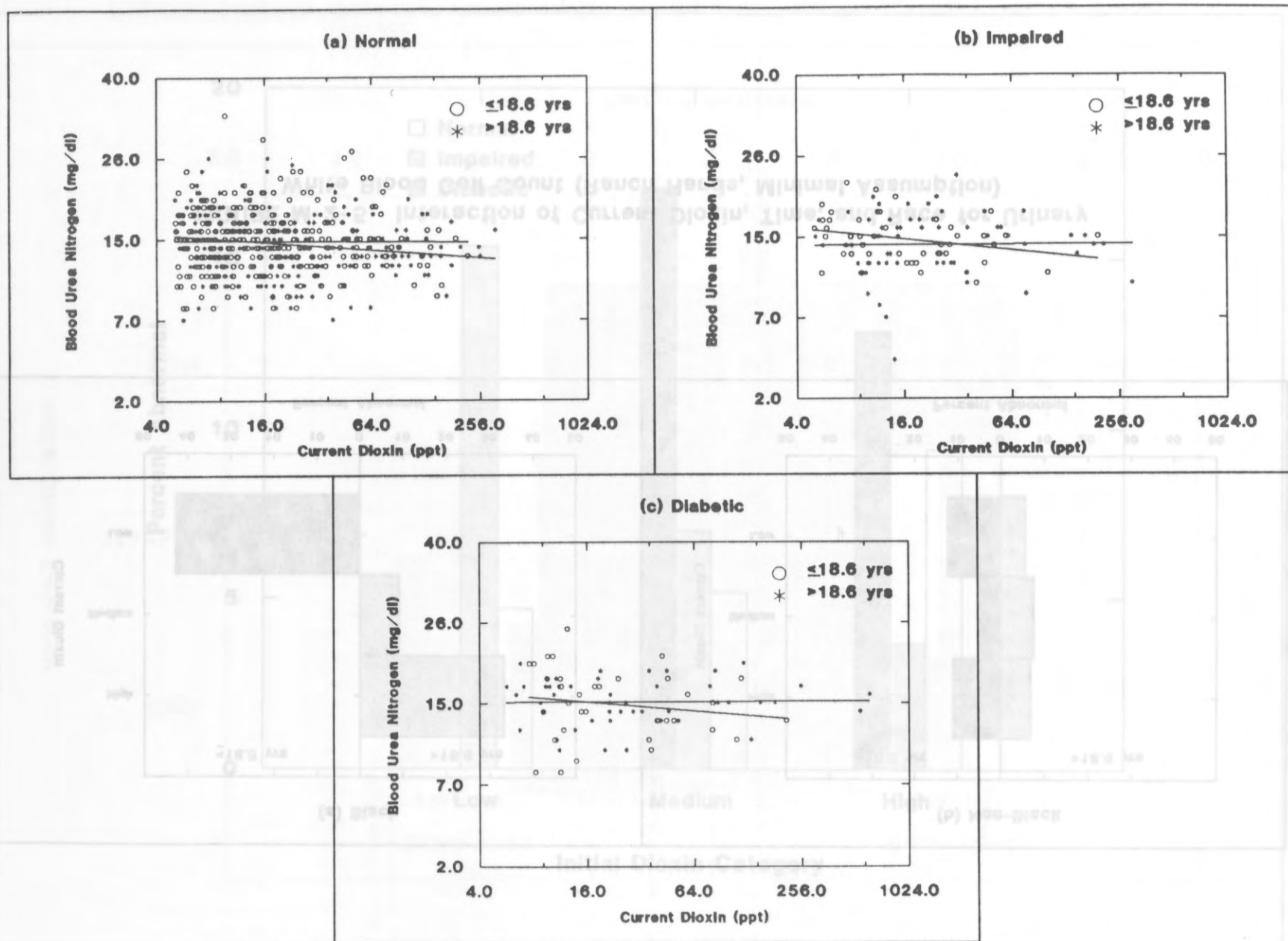


FIGURE M-2-6. Interaction of Current Dioxin, Time, and Diabetic Class for Blood Urea Nitrogen (Ranch Hands, Maximal Assumption)

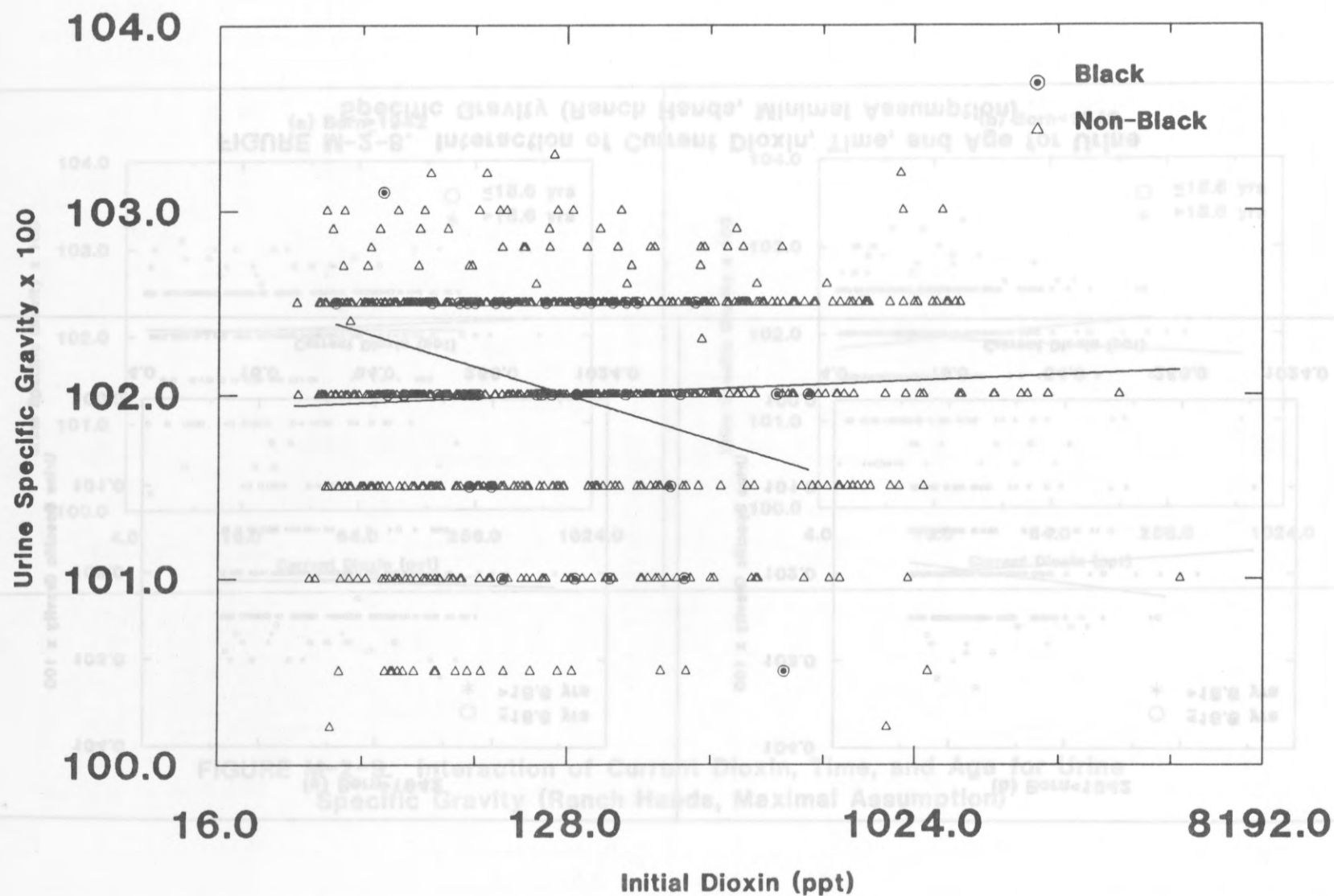


FIGURE M-2-7. Interaction of Initial Dioxin and Race for Urine Specific Gravity (Ranch Hands, Maximal Assumption)

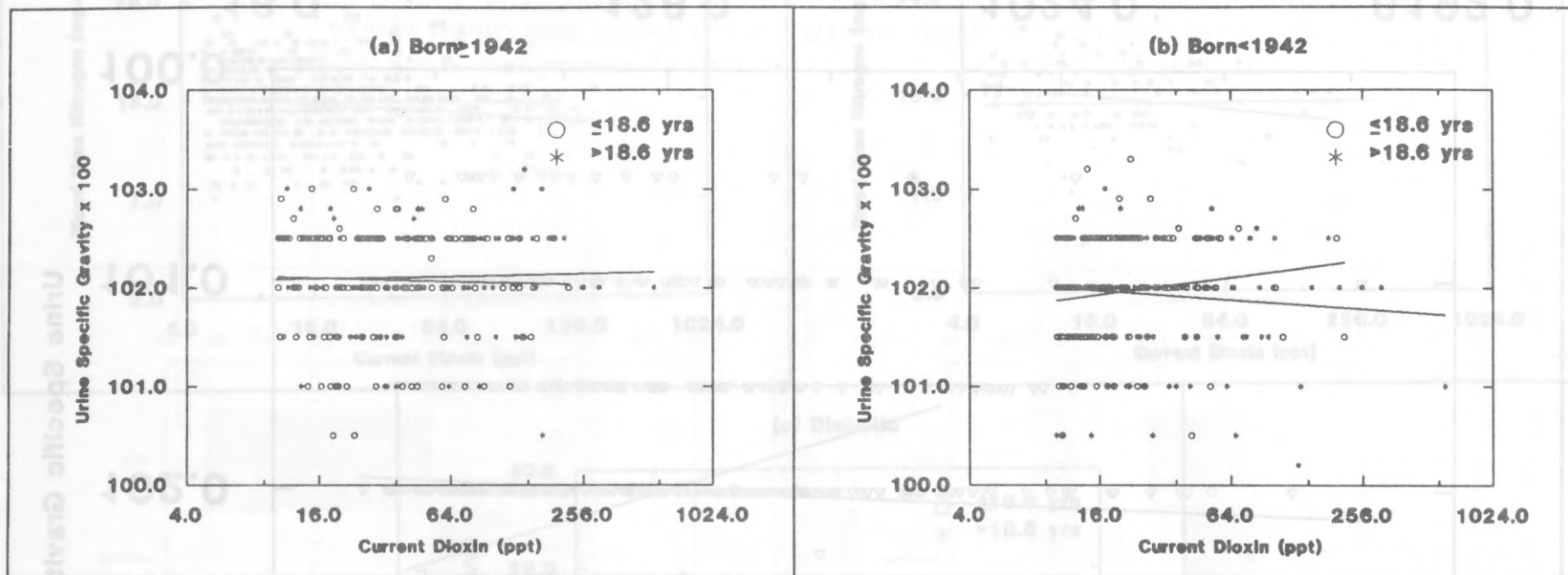


FIGURE M-2-8. Interaction of Current Dioxin, Time, and Age for Urine Specific Gravity (Ranch Hands, Minimal Assumption)

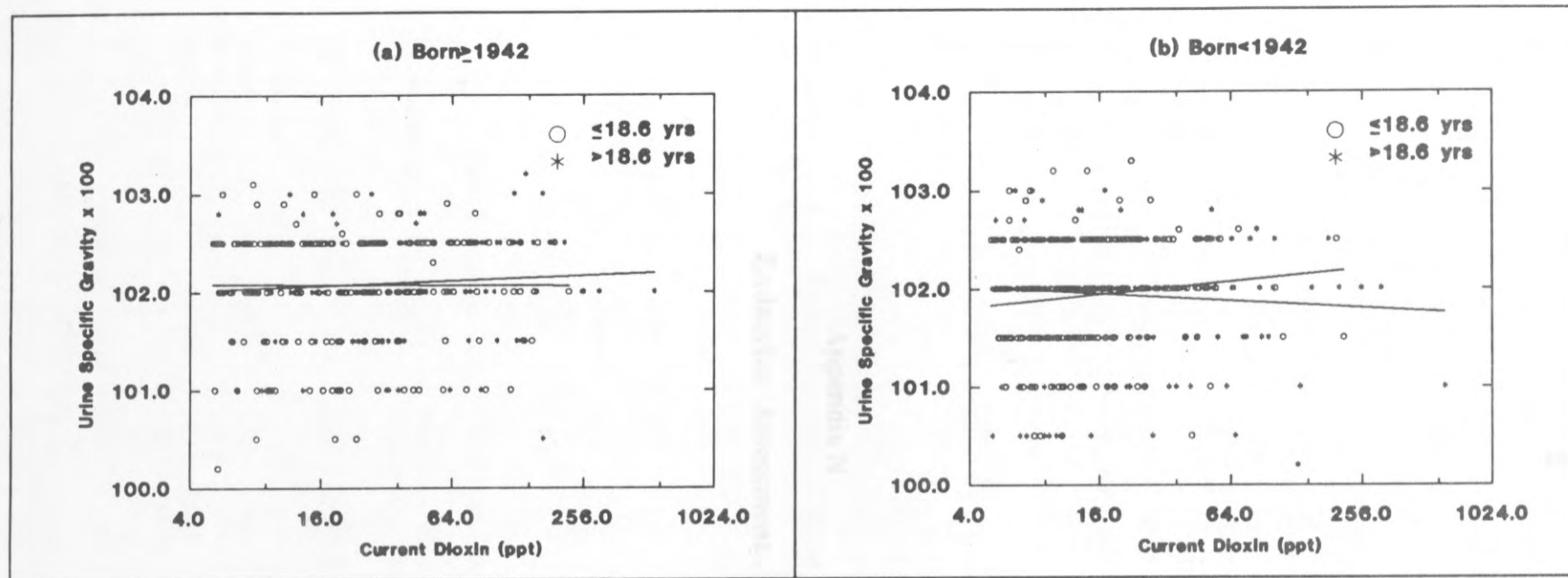


FIGURE M-2-9. Interaction of Current Dioxin, Time, and Age for Urine Specific Gravity (Ranch Hands, Maximal Assumption)

Appendix N

Endocrine Assessment

TABLE N-1.
Summary of Dioxin-by-Covariate Interactions for Endocrine Variables

Ranch Hands and Comparisons by Current Dioxin Category								
Variable/ (Table Ref.)	Interaction	Stratum	Current Dioxin Category	n	Adj. Mean	Contrast	Difference of Adj. Means (95% C.I.) ^a	p-Value
T ₃ % Uptake ^b (15-7 [jl])	Categorized Current Dioxin-by- Age	Born ≥1942	Background	319	30.59	A11		0.030
			Unknown	116	30.83	U vs. B	0.24 --	0.357
			Low	80	31.12	L vs. B	0.53 --	0.081
			High	114	30.13	H vs. B	-0.46 --	0.083
		Born <1942	Background	453	30.69	A11		<0.001
			Unknown	222	30.57	U vs. B	-0.12 --	0.543
			Low	114	29.82	L vs. B	-0.87 --	<0.001
			High	67	29.87	H vs. B	-0.82 --	0.009

Ranch Hands and Comparisons by Current Dioxin Category								
Variable/ (Table Ref.)	Interaction	Stratum	Current Dioxin Category	n	Percent Abnormal High	Contrast	Adj. Relative Risk (95% C.I.)	p-Value
T ₃ % Uptake (15-8 [jj])	Categorized Current Dioxin-by- Age	Born ≥1942	Background	319	2.5	A11		0.289
			Unknown	116	4.3	U vs. B	1.75 (0.56,5.47)	0.335
			Low	80	6.3	L vs. B	2.59 (0.82,8.15)	0.103
			High	114	1.8	H vs. B	0.69 (0.15,3.32)	0.647
		Born <1942	Background	453	4.9	A11		0.319
			Unknown	222	4.5	U vs. B	0.92 (0.43,1.99)	0.840
			Low	114	1.8	L vs. B	0.35 (0.08,1.51)	0.159
			High	67	1.5	H vs. B	0.30 (0.04,2.24)	0.239

Ranch Hands - Log₂ (Current Dioxin) and Time								
Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Time (Yrs.)	Percent Abnormal High/(n) Current Dioxin			Adj. Relative Risk (95% C.I.) ^c	p-Value
				Low	Medium	High		
TSH (Maximal-- 15-10 [h])	Current-by- Time-by- Personality Type	Type A	≤18.6	2.0 (50)	0.0 (85)	6.3 (32)	1.70 (0.68,4.26)	0.026 ^d
			>18.6	12.1 (33)	2.5 (80)	0.0 (44)	0.40 (0.14,1.15)	0.256 ^e
								0.089 ^e
		Type B	≤18.6	2.0 (49)	1.0 (97)	2.2 (46)	0.94 (0.36,2.44)	0.382 ^d
			>18.6	0.0 (42)	2.2 (92)	5.6 (54)	1.50 (0.89,2.53)	0.904 ^e
								0.132 ^e

TABLE N-1. (Continued)
Summary of Dioxin-by-Covariate Interactions for Endocrine Variables

Ranch Hands - Log₂ (Initial Dioxin)							
Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Initial Dioxin	n	Adj. Mean	Adj. Slope (Std. Error)	p-Value
Testosterone ^f (Minimal-- 15-13 [c])	Initial-by- Personality Type	Type A	Low	59	538.3	-0.4928 (0.1801)	0.006
			Medium	107	514.8		
			High	53	472.1		
		Type B	Low	65	516.3	0.1281 (0.1468)	0.383
			Medium	143	522.2		
			High	74	530.1		
Testosterone ^f (Maximal-- 15-13 [d])	Initial-by- Personality Type	Type A	Low	92	562.4	-0.3794 (0.1318)	0.004
			Medium	156	551.1		
			High	79	502.7		
		Type B	Low	83	524.6	0.1494 (0.1142)	0.191
			Medium	200	544.8		
			High	101	548.5		

Ranch Hands and Comparisons by Current Dioxin Category

Variable/ (Table Ref.)	Interaction	Stratum	Current Dioxin Category	n	Percent Abnormal Low	Contrast	Adj. Relative Risk (95% C.I.)	p-Value
Testosterone (15-14 [j])	Categorized Current Dioxin-by- Personality Type	Type A	Background	316	0.6	A11		0.096
			Unknown	158	1.3	U vs. B	3.11 (0.42,23.27)	0.268
			Low	80	0.0	L vs. B	--	--
			High	78	3.8	H vs. B	6.72 (1.06,42.73)	0.044
		Type B	Background	434	2.5	A11		0.350
			Unknown	168	0.6	U vs. B	0.30 (0.04,2.39)	0.256
			Low	109	2.8	L vs. B	1.07 (0.29,4.04)	0.916
			High	103	1.0	H vs. B	0.32 (0.04,2.79)	0.303

TABLE N-1. (Continued)
Summary of Dioxin-by-Covariate Interactions for Endocrine Variables

Ranch Hands - Log₂ (Current Dioxin) and Time

Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Time (Yrs.)	Adj. Mean/(n) Current Dioxin			Adj. Slope (Std. Error)	p-Value
				Low	Medium	High		
Fasting Glucose ^b (Maximal-- 15-15 [h])	Current-by- Time-by-Age	Born ≥1942	≤18.6	95.9 (46)	94.7 (81)	96.7 (55)	0.0017 (0.0095)	0.031 ^b 0.854 ^c
			>18.6	94.3 (13)	95.3 (53)	100.1 (59)	0.0319 (0.0104)	0.002 ^c
		Born <1942	≤18.6	103.4 (58)	109.1 (107)	122.8 (25)	0.0370 (0.0124)	0.451 ^b 0.003 ^c
			>18.6	105.1 (65)	109.0 (123)	114.8 (43)	0.0254 (0.0093)	0.006 ^c

Ranch Hands and Comparisons by Current Dioxin Category

Variable/ (Table Ref.)	Interaction	Stratum	Current Dioxin Category	n	Adj. Mean	Contrast	Difference of Adj. Means (95% C.I.) ^a	p-Value
Fasting Glucose ^b (15-15 [j])	Categorized Current Dioxin-by- Age	Born ≥1942	Background	321	96.1	All		0.017
			Unknown	115	95.5	U vs. B	-0.6 --	0.601
			Low	79	96.5	L vs. B	0.4 --	0.830
			High	114	100.0	H vs. B	3.9 --	0.004
	Categorized Current Dioxin-by- Lifetime Alcohol History	Born <1942 0	Background	35	101.4	All		0.567
			Unknown	15	101.6	U vs. B	0.2 --	0.957
			Low	10	102.2	L vs. B	0.8 --	0.883
			High	15	108.5	H vs. B	7.1 --	0.172
		Born <1942 >0-40	Background	285	102.5	All		0.003
			Unknown	160	100.7	U vs. B	-1.8 --	0.285
			Low	74	106.1	L vs. B	3.6 --	0.091
			High	29	112.2	H vs. B	9.7 --	0.004
		Born <1942 >40	Background	136	107.2	All		<0.001
			Unknown	48	105.4	U vs. B	-1.8 --	0.543
			Low	28	105.8	L vs. B	-1.4 --	0.692
			High	24	127.4	H vs. B	20.2 --	<0.001

TABLE N-1. (Continued)
Summary of Dioxin-by-Covariate Interactions for Endocrine Variables

Ranch Hands - Log₂ (Current Dioxin) and Time

Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Time (Yrs.)	Percent Abnormal High/(n) Current Dioxin			Adj. Relative Risk (95% C.I.) ^c	p-Value
				Low	Medium	High		
Fasting Glucose (Maximal-- 15-16 [h])	Current-by- Time-by-Race	Black					--	--
			≤18.6	0.0 (4)	0.0 (10)	50.0 (2)	--	--
			>18.6	100.0 (1)	25.0 (12)	33.3 (6)	0.65 (0.17,2.50)	0.533 ^j
		Non-Black						0.477 ⁱ
			≤18.6	6.0 (100)	13.5 (178)	16.7 (78)	1.39 (1.07,1.82)	0.015 ^j
			>18.6	10.4 (77)	14.0 (164)	21.9 (96)	1.57 (1.27,1.94)	0.001 ^j

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Initial Dioxin	n	Adj. Mean	Adj. Slope (Std. Error)	p-Value
2-Hour Post- Prandial Glucose ^b (Minimal-- 15-17 [c])	Initial-by- Percent Body Fat	Normal	Low	94	107.7	0.0169 (0.0126)	0.181
			Medium	182	110.5		
			High	81	109.6		
		Obese	Low	23	123.8	0.0287 (0.0199)	0.150
			Medium	49	121.6		
			High	38	129.2		

Ranch Hands - Log₂ (Current Dioxin) and Time

Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Time (Yrs.)	Adj. Mean/(n) Current Dioxin			Adj. Slope (Std. Error)	p-Value
				Low	Medium	High		
2-Hour Post- Prandial Glucose ^b (Minimal-- 15-17 [g])	Current-by- Time-by- Personality Type	Type A						0.221 ^g
			≤18.6	110.7 (33)	107.6 (45)	106.4 (19)	-0.0175 (0.0280)	0.534 ^h
			>18.6	120.7 (21)	109.3 (51)	120.1 (30)	0.0250 (0.0216)	0.248 ^h
		Type B						0.074 ^g
			≤18.6	104.6 (27)	114.7 (69)	115.8 (29)	0.0358 (0.0220)	0.104 ^h
			>18.6	127.6 (30)	110.8 (62)	116.4 (37)	-0.0155 (0.0189)	0.411 ^h

TABLE N-1. (Continued)
Summary of Dioxin-by-Covariate Interactions for Endocrine Variables

Ranch Hands and Comparisons by Current Dioxin Category								
Variable/ (Table Ref.)	Interaction	Stratum	Current Dioxin Category	n	Percent Diabetic	Contrast	Adj. Relative Risk (95% C.I.)	p-Value
Composite Diabetes Indicator (15-18 [j])	Categorized Current Dioxin-by- Age	Born ≥1942	Background	321	5.3	All		0.595
			Unknown	118	3.4	U vs. B	0.95 (0.31,2.93)	0.924
			Low	80	2.5	L vs. B	0.50 (0.11,2.28)	0.374
			High	117	9.4	H vs. B	1.49 (0.65,3.41)	0.341
		Born <1942	Background	461	10.2	All		0.002
			Unknown	226	6.6	U vs. B	0.78 (0.42,1.44)	0.420
			Low	113	12.4	L vs. B	1.15 (0.60,2.22)	0.668
			High	70	28.6	H vs. B	3.09 (1.64,5.82)	<0.001

^aDifference of means after transformation to original scale; confidence interval on difference of means not given because analysis was performed on natural logarithm scale; p-value based on difference of means on natural logarithm scale.

^bAdjusted means transformed from natural logarithm scale; adjusted slope and standard error based on natural logarithm of the dependent variable versus log₂ dioxin.

^cRelative risk for a twofold increase in dioxin.

^dTest of significance for homogeneity of relative risks (current dioxin continuous, time categorized).

^eTest of significance for relative risk equal to 1 (current dioxin continuous, time categorized).

^fAdjusted means transformed from square root scale; adjusted slope and standard error based on square root of the dependent variable versus log₂ dioxin.

^gTest of significance for homogeneity of slopes (current dioxin continuous, time categorized).

^hTest of significance for slope equal to 0 (current dioxin continuous, time categorized).

--: Analysis not performed due to category with no abnormalities; confidence interval on difference of means not given because analysis was performed on natural logarithm scale.

Notes: Initial Dioxin: Minimal--Low: 52-93 ppt; Medium: >93-292 ppt; High: >292 ppt.

Maximal--Low: 25-56.9 ppt; Medium: >56.9-218 ppt; High: >218 ppt.

Current Dioxin: Minimal--Low: >10-14.65 ppt; Medium: >14.65-45.75 ppt; High: >45.75 ppt.

Maximal--Low: >5-9.01 ppt; Medium: >9.01-33.3 ppt; High: >33.3 ppt.

All: All categories.

Background (B) (Comparisons): Current Dioxin ≤10 ppt.

Unknown (U) (Ranch Hands): Current Dioxin ≤10 ppt.

Low (L) (Ranch Hands): 15 ppt < Current Dioxin ≤33.3 ppt.

High (H) (Ranch Hands): Current Dioxin >33.3 ppt.