

FIGURE F-1-43. Other Malignant Neoplasms of Lymphoid and Histiocytic Tissue versus Dioxin

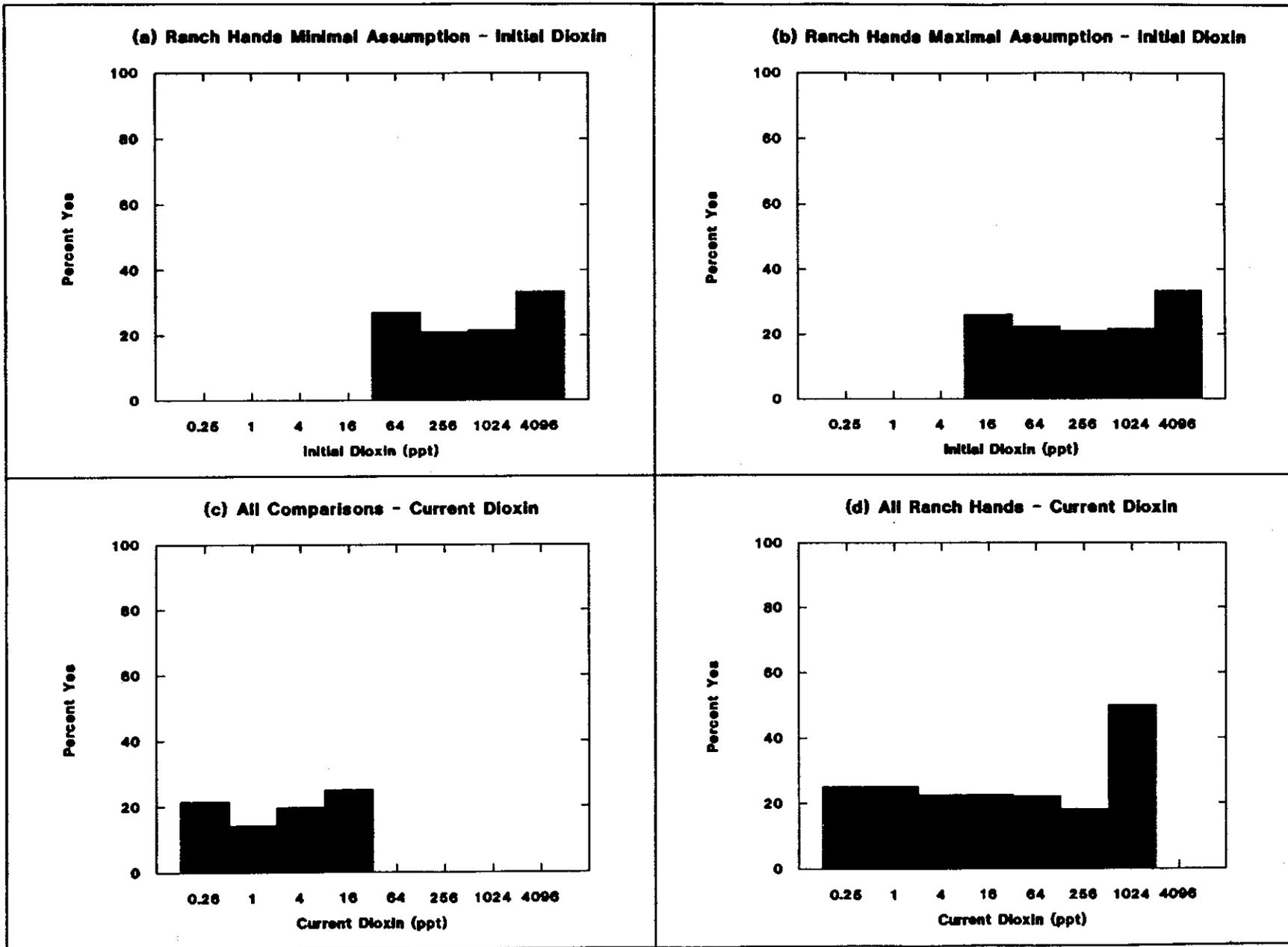


FIGURE F-1-44. All Skin and Systemic Neoplasms versus Dioxin

APPENDIX F-2.

Interaction Displays for the Malignancy Assessment

The following figures graphically display dioxin-by-covariate interactions found in the statistical analyses of the dependent variables in the malignancy assessment. For interactions with initial dioxin in the Ranch Hands involving discrete variables, the stratum-specific percentage of participants that exhibited a specified neoplasm is displayed for low, medium, and high initial dioxin categories (as defined in Appendix Table F-1), and each stratum is represented by a different design. Appendix Table F-1 also displays the sample sizes for each bar on the graph.

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F-2-2	Interaction of Initial Dioxin and Ionizing Radiation for Sun Exposure-Related Malignant Skin Neoplasms (Ranch Hands, Minimal Assumption)	F-2-3

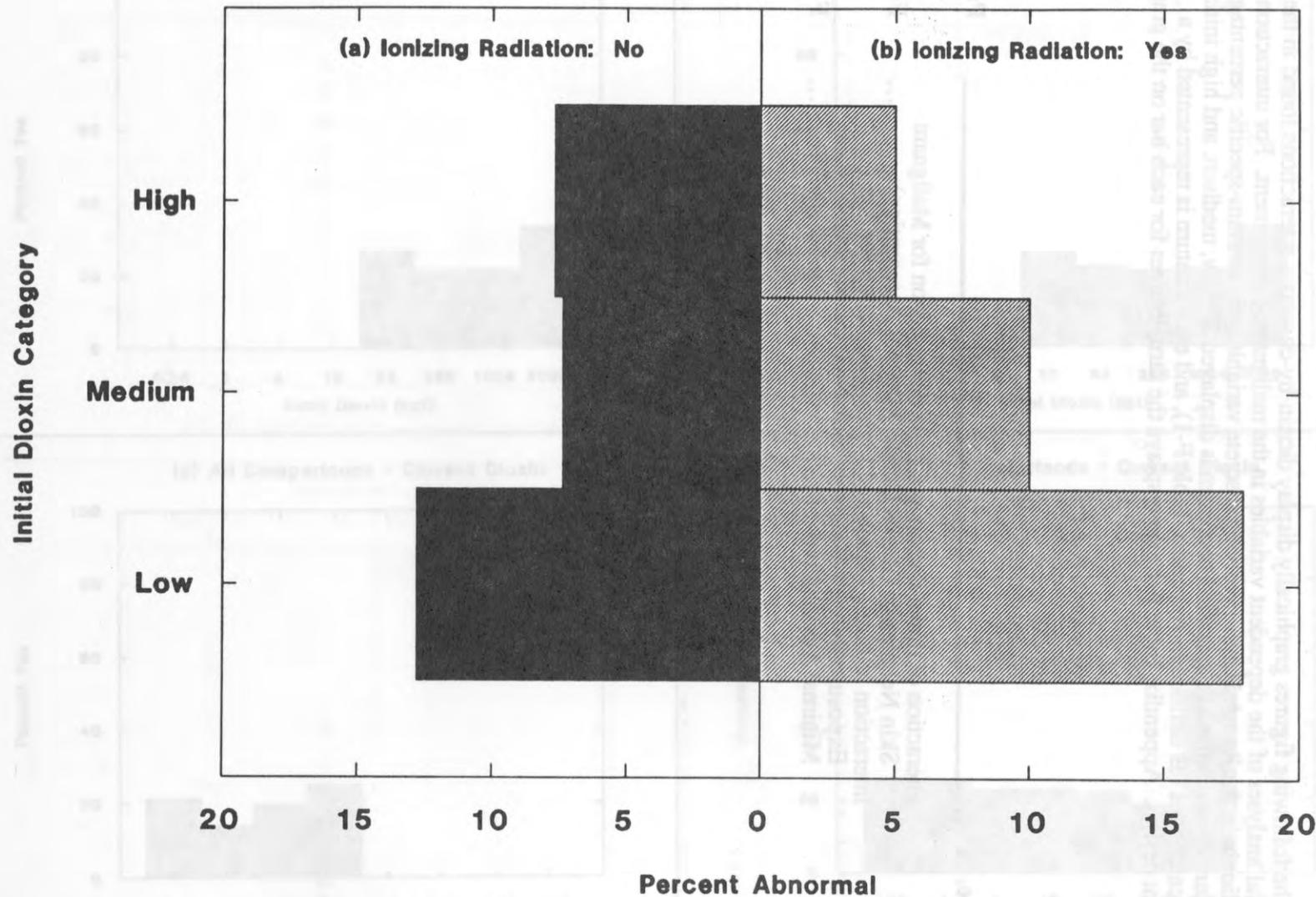


FIGURE F-2-1. Interaction of Initial Dioxin and Ionizing Radiation for Malignant Skin Neoplasms (Ranch Hands, Minimal Assumption)

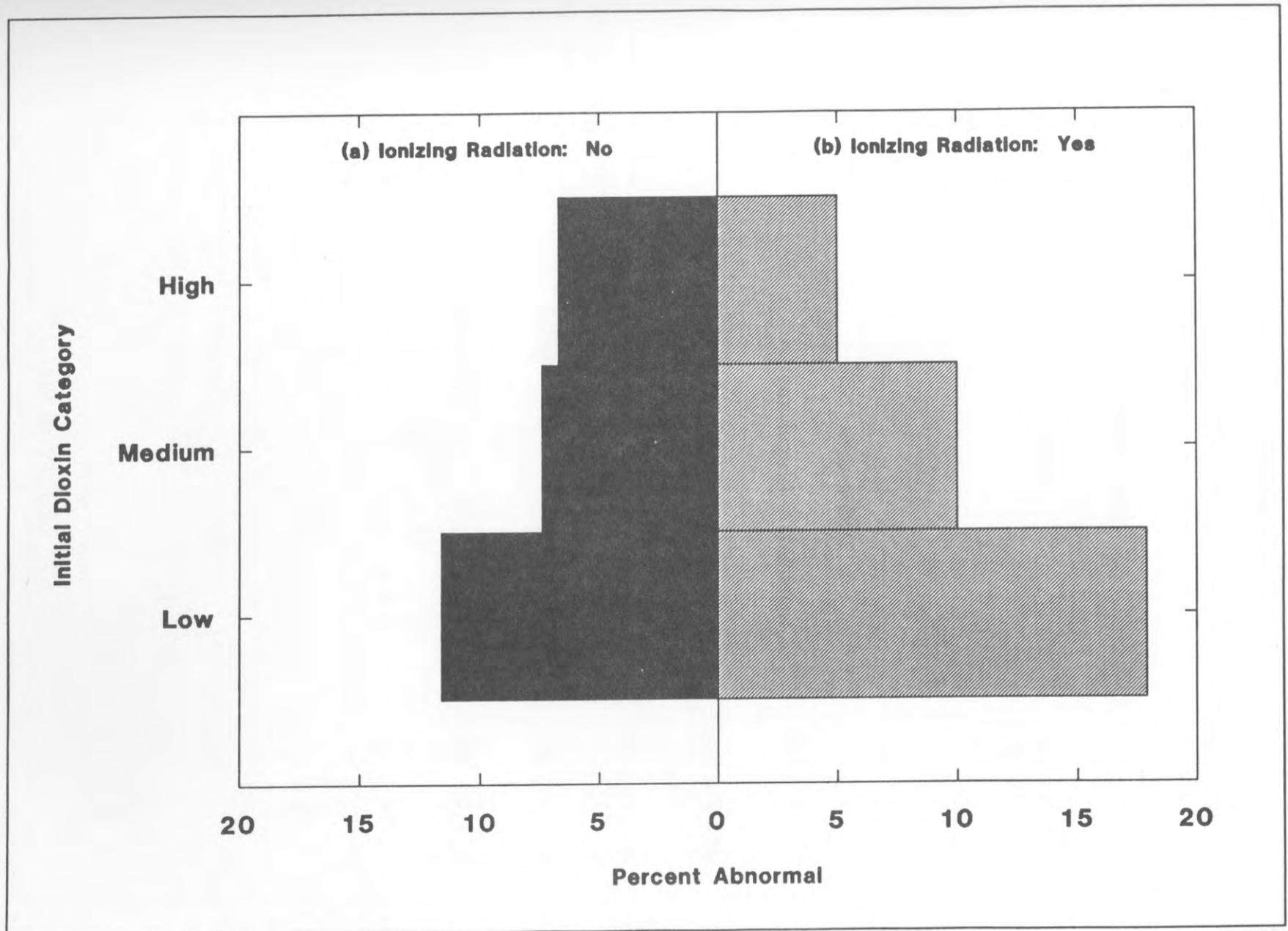


FIGURE F-2-2. Interaction of Initial Dioxin and Ionizing Radiation for Sun Exposure-Related Malignant Skin Neoplasms (Ranch Hands, Minimal Assumption)

Appendix G

Neurological Assessment

TABLE G-1.

Summary of Dioxin-by-Covariate Interactions for Neurological Variables

Ranch Hands - Log₂ (Initial Dioxin)									
Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Initial Dioxin	n	Percent Abnormal	Adj. Relative Risk (95% C.I.) ^a	p-Value		
Neck Range of Motion (Minimal-- 8-20 [c])	Initial-by- Race	Black	Low	12	8.3	--	--		
		--	Medium	17	0.0				
		--	High	3	0.0				
	Initial-by- Diabetic Class	Non-Black Normal	Low	86	7.0	1.20 (0.87,1.64)	0.267		
			Medium	169	11.8				
			High	93	8.6				
		Non-Black Impaired	Low	19	21.1	0.52 (0.18,1.49)	0.221		
			Medium	43	9.3				
			High	16	0.0				
		Non-Black Diabetic	Low	13	7.7	2.20 (1.33,3.64)	0.002		
			Medium	29	17.2				
			High	19	21.1				
Neck Range of Motion (Maximal-- 8-20 [d])	Initial-by- Diabetic Class	Normal	Low	148	13.5	1.01 (0.80,1.27)	0.956		
			Medium	271	10.7				
			High	128	7.8				
		Impaired	Low	26	19.2			0.61 (0.33,1.14)	0.122
			Medium	57	14.0				
			High	27	0.0				
	Diabetic	Low	10	10.0	1.85 (1.21,2.82)	0.004			
		Medium	41	12.2					
		High	31	19.4					

TABLE G-1. (Continued)

Summary of Dioxin-by-Covariate Interactions for Neurological Variables

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
Neck Range of Motion (8-20 [j])	Categorized Current Dioxin-by- Diabetic Class	Normal	Background	608	11.3	All		0.631
			Unknown	275	10.9	U vs. B	0.97 (0.60,1.58)	0.901
			Low	149	13.4	L vs. B	1.42 (0.79,2.54)	0.237
			High	130	7.7	H vs. B	1.22 (0.58,2.58)	0.593
		Impaired	Background	108	12.0	All		0.240
			Unknown	48	18.8	U vs. B	1.46 (0.53,4.05)	0.464
			Low	28	10.7	L vs. B	0.92 (0.22,3.85)	0.913
			High	26	0.0	H vs. B	--	--
		Diabetic	Background	66	15.2	All		0.094
			Unknown	19	10.5	U vs. B	0.35 (0.07,1.90)	0.226
			Low	17	5.9	L vs. B	0.18 (0.02,1.63)	0.127
			High	31	22.6	H vs. B	2.05 (0.65,6.48)	0.221

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Initial Dioxin	n	Percent Abnormal	Adj. Relative Risk (95% C.I.) ^a	p-Value
Cranial Nerve Index (Maximal-- 8-21 [d])	Initial-by- Diabetic Class	Normal	Low	147	17.7	0.99 (0.81,1.21)	0.916
			Medium	268	14.9		
			High	124	9.7		
		Impaired	Low	26	19.2	0.89 (0.57,1.38)	0.603
			Medium	56	17.9		
			High	27	7.4		
		Diabetic	Low	10	10.0	1.69 (1.14,2.50)	0.009
			Medium	41	12.2		
			High	31	22.6		

TABLE G-1. (Continued)

Summary of Dioxin-by-Covariate Interactions for Neurological Variables

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		
Cranial Nerve Index Without Range of Motion (8-22 [j])	Categorized Without Current Dioxin-by- Insecticide Exposure	No	Background	335	2.7	A11		0.056		
			Unknown	98	2.0	U vs. B	0.72 (0.15,3.41)	0.684		
			Low	51	9.8	L vs. B	3.76 (1.20,11.76)	0.023		
					High	53	7.5	H vs. B	3.34 (0.98,11.34)	0.053
		Yes	Background	438	6.8	A11		0.113		
			Unknown	243	3.3	U vs. B	0.46 (0.21,1.02)	0.056		
			Low	143	4.2	L vs. B	0.62 (0.13,3.04)	0.554		
			High	130	2.3	H vs. B	0.38 (0.06,2.48)	0.310		

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Initial Dioxin	n	Percent Abnormal	Adj. Relative Risk (95% C.I.) ^a	p-Value
Pin Prick (Minimal-- 8-23 [c])	Initial-by- Diabetic Class	Normal	Low	94	9.6	0.92 (0.62,1.37)	0.682
			Medium	180	6.1		
			High	93	4.3		
		Impaired	Low	21	9.5	0.20 (0.02,2.07)	0.175
			Medium	44	2.3		
			High	17	0.0		
		Diabetic	Low	13	7.7	1.58 (0.97,2.60)	0.069
			Medium	29	6.9		
			High	19	21.1		
Pin Prick (Maximal-- 8-23 [d])	Initial-by- Diabetic Class	Normal	Low	147	5.4	1.06 (0.80,1.40)	0.678
			Medium	269	5.9		
			High	125	6.4		
		Impaired	Low	26	7.7	0.44 (0.17,1.15)	0.093
			Medium	57	7.0		
			High	27	0.0		
		Diabetic	Low	10	10.0	1.40 (0.93,2.10)	0.111
			Medium	35	8.6		
			High	31	16.1		

TABLE G-1. (Continued)

Summary of Dioxin-by-Covariate Interactions for Neurological 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			
Pin Prick (Minimal-- 8-23 [g])	Current-by- Time-by- Lifetime Alcohol History	≤40	≤18.6	13.1 (61)	4.9 (103)	4.7 (43)	0.73 (0.38,1.40)	0.013 ^b	
			>18.6	2.6 (38)	4.3 (94)	10.7 (56)		1.81 (1.15,2.86)	0.011 ^c
			>40						
		≤18.6	10.0 (10)	14.3 (21)	10.0 (10)	1.24 (0.49,3.11)	0.648 ^c		
			>18.6	15.8 (19)	3.0 (33)		0.0 (18)	0.34 (0.07,1.65)	0.181 ^c
			>40						
Pin Prick (Maximal-- 8-23 [h])	Current-by- Time-by- Lifetime Alcohol History	≤40	≤18.6	3.5 (86)	8.1 (160)	4.8 (63)	0.99 (0.66,1.51)	0.203 ^b	
			>18.6	6.3 (64)	4.1 (122)	9.2 (76)		1.39 (0.99,1.93)	0.055 ^c
			>40						
		≤18.6	5.6 (18)	10.7 (28)	12.5 (16)	1.43 (0.74,2.78)	0.285 ^c		
			>18.6	15.4 (13)	10.0 (50)		0.0 (24)	0.42 (0.15,1.14)	0.089 ^c
			>40						

TABLE G-1. (Continued)

Summary of Dioxin-by-Covariate Interactions for Neurological Variables

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		
Muscle Status (8-25 [jj])	Categorized Current Dioxin-by- Diabetic Class	Normal	Background	606	2.3	All		0.467		
			Unknown	272	1.1	U vs. B	0.45 (0.13,1.58)	0.214		
			Low	148	1.4	L vs. B	0.59 (0.13,2.63)	0.488		
					High	126	2.4	H vs. B	1.32 (0.36,4.79)	0.672
		Impaired	Background	107	0.0	All		0.022		
			Unknown	47	6.4	U vs. B	--	--		
			Low	27	0.0	L vs. B	--	--		
			High	26	0.0	H vs. B	--	--		
			Diabetic	Background	66	4.5	All		0.328	
				Unknown	19	0.0	U vs. B	--	--	
		Low		17	11.8	L vs. B	2.26 (0.29,17.38)	0.434		
			High	31	3.2	H vs. B	0.60 (0.05,6.73)	0.675		

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
Achilles Reflex (8-28 [jj])	Categorized Current Dioxin-by- Race	Black	Background	47	6.4	All		0.078
			Unknown	12	16.7	U vs. B	4.11 (0.57,29.48)	0.160
			Low	11	0.0	L vs. B	--	--
			High	8	0.0	H vs. B	--	--
		Non-Black	Background	735	5.6	All		0.123
			Unknown	329	3.3	U vs. B	0.58 (0.29,1.15)	0.115
			Low	182	8.2	L vs. B	1.52 (0.81,2.87)	0.193
			High	179	5.6	H vs. B	1.16 (0.55,2.45)	0.702

TABLE G-1. (Continued)

Summary of Dioxin-by-Covariate Interactions for Neurological 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		
Tremor (Maximal-- 8-31 [h])	Current-by- Time-by-Age	Born ≥ 1942	≤ 18.6	0.0 (47)	3.6 (84)	0.0 (57)	0.82 (0.33,2.02)	0.954 ^b
			> 18.6	7.7 (13)	3.8 (53)	5.0 (60)		0.670 ^c
								0.440 ^c
		Born < 1942	≤ 18.6	0.0 (59)	0.9 (107)	11.5 (26)	2.96 (1.38,6.32)	0.008 ^b
			> 18.6	4.6 (65)	0.8 (126)	2.3 (44)		0.005 ^c
								0.432 ^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
Coordination (8-32 [j])	Categorized Current Dioxin-by- Age	Born ≥ 1942	Background	321	0.3	All		0.317
			Unknown	117	0.9	U vs. B	2.71 (0.17,44.41)	0.485
			Low	80	2.5	L vs. B	7.66 (0.67,87.19)	0.101
			High	117	0.9	H vs. B	3.59 (0.21,59.97)	0.374
		Born < 1942	Background	460	0.2	All		0.003
			Unknown	224	1.3	U vs. B	6.23 (0.64,60.79)	0.115
			Low	114	0.0	L vs. B	--	--
			High	70	5.7	H vs. B	32.71 (3.50,306.0)	0.002

TABLE G-1. (Continued)

Summary of Dioxin-by-Covariate Interactions for Neurological Variables

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			
Gait (8-34 [j])	Categorized Current Dioxin-by- Diabetic Class	Normal	Background	606	2.3	All		0.095			
			Unknown	272	0.7	U vs. B	0.32 (0.07,1.43)	0.136			
			Low	148	2.7	L vs. B	1.24 (0.40,3.84)	0.709			
					High	126	4.0	H vs. B	2.14 (0.74,6.22)	0.163	
		Impaired	Background	107	1.9	All		0.052			
				Unknown	47	8.5	U vs. B	5.27 (0.92,30.11)	0.062		
				Low	27	0.0	L vs. B	--	--		
						High	26	0.0	H vs. B	--	--
			Diabetic	Background	66	1.5	All		0.630		
					Unknown	19	5.3	U vs. B	1.85 (0.09,37.28)	0.688	
		Low			17	5.9	L vs. B	3.48 (0.20,59.47)	0.388		
					High	31	6.5	H vs. B	4.16 (0.36,48.21)	0.255	

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Assumption-- Table Ref.)	Interaction	Stratum	Initial Dioxin	n	Percent Abnormal	Adj. Relative Risk (95% C.I.) ^a	p-Value
CNS Index (Minimal-- 8-35 [c])	Initial-by- Age	Born ≥ 1942	Low	43	4.7	0.87 (0.56,1.34)	0.523
			Medium	111	8.1		
			High	83	4.8		
		Born < 1942	Low	87	2.3	1.66 (1.13,2.45)	0.010
			Medium	149	4.0		
			High	48	12.5		
CNS Index (Maximal-- 8-35 [d])	Initial-by- Age	Born ≥ 1942	Low	68	4.4	1.00 (0.73,1.38)	0.976
			Medium	126	7.1		
			High	114	5.3		
		Born < 1942	Low	113	2.7	1.53 (1.11,2.10)	0.009
			Medium	242	3.3		
			High	68	10.3		

TABLE G-1. (Continued)

Summary of Dioxin-by-Covariate Interactions for Neurological Variables

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		
CNS Index (8-35 [j])	Categorized Current Dioxin-by- Age	Born ≥ 1942	Background	322	3.4	All		0.401		
			Unknown	117	5.1	U vs. B	1.46 (0.53,4.07)	0.466		
			Low	81	8.6	L vs. B	2.50 (0.93,6.72)	0.069		
					High	117	6.0	H vs. B	1.69 (0.63,4.49)	0.294
		Born < 1942	Background	461	5.9	All		0.017		
			Unknown	225	5.3	U vs. B	0.85 (0.42,1.71)	0.647		
Low	115		1.7	L vs. B	0.27 (0.06,1.16)	0.079				
			High	70	12.9	H vs. B	2.39 (1.07,5.34)	0.034		

^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: 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 G-2.

Summary of Models Without Adjustment for Diabetic Class for Neurological Variables

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Table Ref.)	Assumption	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Palpebral Fissure (8-17 [c])	Minimal (n=521)	1.34 (0.79,2.25)	0.299	AGE (p=0.334) INS (p=0.569)

Ranch Hands - Log₂ (Current Dioxin) and Time

Variable/ (Table Ref.)	Assumption	Time (Yrs.)	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Palpebral Fissure (8-17 [g])	Minimal (n=521)	≤18.6	0.86 (0.20,3.73)	0.570 ^b	AGE (p=0.478) INS (p=0.563)
		>18.6	1.31 (0.73,2.37)	0.835 ^c	
				0.366 ^c	

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
Neck Range of Motion (8-20 [j])	Background	784	All Categories		0.901	AGE (p<0.001) RACE (p=0.004) INS (p=0.979)
	Unknown	343	Unknown vs. Background	0.99 (0.66,1.51)	0.975	
	Low	196	Low vs. Background	1.10 (0.66,1.84)	0.725	
	High	187	High vs. Background	1.23 (0.69,2.20)	0.491	
	Total	1,510				

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
Pin Prick (8-23 [j])	Background	771	All Categories		0.776	AGE*INS (p=0.050)
	Unknown	339	Unknown vs. Background	0.91 (0.52,1.61)	0.744	
	Low	194	Low vs. Background	0.92 (0.45,1.88)	0.826	
	High	183	High vs. Background	1.35 (0.69,2.65)	0.383	
	Total	1,487				

TABLE G-2. (Continued)

Summary of Models Without Adjustment for Diabetic Class for Neurological Variables

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Table Ref.)	Assumption	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Light Touch (8-24 [c])	Minimal (n=512)	1.08 (0.75,1.55)	0.690	AGE*RACE (p=0.028)
Light Touch (8-24 [d])	Maximal (n=729)	1.06 (0.81,1.38)	0.679	AGE*RACE (p=0.028)

Ranch Hands - Log₂ (Current Dioxin) and Time

Variable/ (Table Ref.)	Assumption	Time (Yrs.)	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Light Touch (8-24 [g])	Minimal (n=512)	≤18.6	0.67 (0.33,1.36)	0.272 ^c	AGE*RACE (p=0.052)
		>18.6	1.49 (0.96,2.32)	0.079 ^c	
Light Touch (8-24 [h])	Maximal (n=729)	≤18.6	0.94 (0.60,1.46)	0.771 ^c	AGE*RACE (p=0.030)
		>18.6	1.16 (0.83,1.64)	0.384 ^c	

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
Light Touch (8-24 [j])	Background	771	All Categories		0.999	AGE (p=0.133) INS (p=0.188)
	Unknown	339	Unknown vs. Background	1.00 (0.52,1.90)	0.998	
	Low	194	Low vs. Background	1.03 (0.47,2.28)	0.941	
	High	183	High vs. Background	1.03 (0.44,2.41)	0.939	
	Total	1,487				

TABLE G-2. (Continued)

Summary of Models Without Adjustment for Diabetic Class for Neurological Variables

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Table Ref.)	Assumption	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Muscle Status (8-25 [c])	Minimal (n=521)	1.13 (0.68,1.90)	0.644	AGE (p=0.106)
Muscle Status (8-25 [d])	Maximal (n=740)	1.27 (0.85,1.89)	0.257	AGE (p=0.056)

Ranch Hands - Log₂ (Current Dioxin) and Time

Variable/ (Table Ref.)	Assumption	Time (Yrs.)	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Muscle Status (8-25 [g])	Minimal (n=521)	≤18.6	1.29 (0.60,2.79)	0.796 ^b	AGE (p=0.070)
		>18.6	1.13 (0.52,2.45)	0.509 ^c	
Muscle Status (8-25 [h])	Maximal (n=740)	≤18.6	1.53 (0.85,2.74)	0.564 ^b	AGE (p=0.032)
		>18.6	1.20 (0.65,2.20)	0.154 ^c	

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
Muscle Status (8-25 [j])	Background	781	All Categories		0.890	AGE (p=0.010) DRKYR (p=0.091)
	Unknown	339	Unknown vs. Background	0.76 (0.30,1.95)	0.568	
	Low	194	Low vs. Background	0.94 (0.31,2.85)	0.917	
	High	183	High vs. Background	1.26 (0.41,3.87)	0.686	
	Total		1,497			

TABLE G-2. (Continued)

Summary of Models Without Adjustment for Diabetic Class for Neurological 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
Vibration (8-26 [h])	Maximal (n=729)	≤18.6	1.11 (0.50,2.45)	0.885 ^b 0.804 ^c	AGE*INS (p=0.004)
		>18.6	1.03 (0.61,1.75)	0.906 ^c	

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Table Ref.)	Assumption	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Patellar Reflex (8-27 [c])	Minimal (n=521)	1.17 (0.71,1.93)	0.547	AGE (p=0.453)
Patellar Reflex (8-27 [d])	Maximal (n=741)	1.30 (0.88,1.92)	0.198	AGE (p=0.160)

Ranch Hands - Log₂ (Current Dioxin) and Time

Variable/ (Table Ref.)	Assumption	Time (Yrs.)	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Patellar Reflex (8-27 [g])	Minimal (n=521)	≤18.6	1.24 (0.51,3.05)	0.798 ^b 0.634 ^c	AGE (p=0.505)
		>18.6	1.08 (0.57,2.05)	0.816 ^c	
Patellar Reflex (8-27 [h])	Maximal (n=741)	≤18.6	1.40 (0.71,2.76)	0.752 ^b 0.326 ^c	AGE (p=0.171)
		>18.6	1.23 (0.74,2.03)	0.423 ^c	

TABLE G-2. (Continued)

Summary of Models Without Adjustment for Diabetic Class for Neurological Variables

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Table Ref.)	Assumption	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Achilles Reflex (8-28 [c])	Minimal (n=520)	1.05 (0.77,1.43)	0.771	AGE (p=0.002) RACE (p=0.068)
Achilles Reflex (8-28 [d])	Maximal (n=739)	1.26 (0.99,1.59)	0.063	AGE (p<0.001) RACE (p=0.084)

Ranch Hands - Log₂ (Current Dioxin) and Time

Variable/ (Table Ref.)	Assumption	Time (Yrs.)	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Achilles Reflex (8-28 [g])	Minimal (n=520)	≤18.6	0.69 (0.36,1.33)	0.266 ^c	AGE (p=0.003) RACE (p=0.068)
		>18.6	1.32 (0.92,1.90)	0.131 ^c	
Achilles Reflex (8-28 [h])	Maximal (n=739)	≤18.6	1.12 (0.74,1.70)	0.578 ^c	AGE (p<0.001) RACE (p=0.086)
		>18.6	1.42 (1.05,1.91)	0.022 ^c	

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
Achilles Reflex (8-28 [j])	Background	784	All Categories		0.182	AGE (p<0.001) RACE (p=0.489)
	Unknown	342	Unknown vs. Background	0.65 (0.34,1.23)	0.184	
	Low	195	Low vs. Background	1.44 (0.78,2.67)	0.246	
	High	187	High vs. Background	1.31 (0.64,2.71)	0.464	
	Total	1,508				

TABLE G-2. (Continued)

Summary of Models Without Adjustment for Diabetic Class for Neurological Variables

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Table Ref.)	Assumption	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Coordination (8-32 [c])	Minimal (n=521)	1.41 (0.84,2.37)	0.220	AGE (p=0.050)
Coordination (8-32 [d])	Maximal (n=740)	1.49 (0.97,2.29)	0.085	AGE (p=0.043)

Ranch Hands - Log₂ (Current Dioxin) and Time

Variable/ (Table Ref.)	Assumption	Time (Yrs.)	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Coordination (8-32 [h])	Maximal (n=740)	≤18.6	2.45 (1.18,5.08)	0.100 ^b	AGE (p=0.030)
		>18.6	1.13 (0.60,2.15)	0.016 ^c	
				0.705 ^c	

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
Coordination (8-32 [j])	Background	783	All Categories		0.023	AGE (p=0.106) RACE (p=0.157)
	Unknown	342	Unknown vs. Background	3.38 (0.74,15.35)	0.114	INS (p=0.402)
	Low	196	Low vs. Background	2.86 (0.47,17.39)	0.254	
	High	187	High vs. Background	9.82 (2.23,43.20)	0.003	
	Total	1,508				

Ranch Hands - Log₂ (Initial Dioxin)

Variable/ (Table Ref.)	Assumption	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Gait (8-34 [c])	Minimal (n=515)	1.20 (0.81,1.79)	0.363	AGE (p=0.679) DRKYR (p=0.143) INS (p=0.040)
Gait (8-34 [d])	Maximal (n=731)	1.30 (0.95,1.77)	0.113	AGE (p=0.726) DRKYR (p=0.031)

TABLE G-2. (Continued)

Summary of Models Without Adjustment for Diabetic Class for
Neurological Variables

Ranch Hands - Log ₂ (Current Dioxin) and Time					
Variable/ (Table Ref.)	Assumption	Time (Yrs.)	Adj. Relative Risk (95% C.I.) ^a	p-Value	Covariate Remarks
Gait (8-34 [g])	Minimal (n=521)	≤18.6	1.15 (0.48,2.75)	0.913 ^b 0.755 ^c	AGE (p=0.822) INS (p=0.036)
		>18.6	1.09 (0.67,1.76)	0.729 ^c	
Gait (8-34 [h])	Maximal (n=731)	≤18.6	1.23 (0.63,2.41)	0.902 ^b 0.543 ^c	AGE (p=0.935) DRKYR (p=0.038)
		>18.6	1.17 (0.81,1.70)	0.390 ^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: 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.

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 G-3.

Summary of Models With Adjustment for Occupation for Other Neurological Disorders

Ranch Hands - Log₂ (Initial Dioxin)			
Assumption/ (Table Ref.)	Adj. Relative Risk (95% C.I.)^a	p-Value	Covariate Remarks
Minimal (8-10 [c]) (n=520)	0.97 (0.80,1.17)	0.740	AGE (p<0.001) OCC (p<0.001)
Maximal (8-10 [d]) (n=739)	1.04 (0.90,1.21)	0.567	AGE (p<0.001) OCC (p<0.001)

Ranch Hands - Log₂ (Current Dioxin) and Time				
Assumption/ (Table Ref.)	Time (Yrs.)	Adj. Relative Risk (95% C.I.)^a	p-Value	Covariate Remarks
Minimal (8-10 [g]) (n=520)	≤18.6	1.11 (0.82,1.50)	0.903^b 0.518^c	AGE (p<0.001) OCC (p<0.001)
	>18.6	0.90 (0.70,1.16)	0.432^c	
Maximal (8-10 [h]) (n=739)	≤18.6	1.21 (0.95,1.53)	0.133^b 0.116^c	AGE (p<0.001) OCC (p<0.001)
	>18.6	0.97 (0.80,1.17)	0.725^c	

TABLE G-3. (Continued)

**Summary of Models With Adjustment for Occupation for Other
Neurological Disorders**

Ranch Hands and Comparisons by Current Dioxin Category

Current Dioxin Category/ (Table Ref.)	n	Contrast	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Background	781	All Categories		0.924	AGE (p<0.001) OCC (p<0.001)
Unknown	342	Unknown vs. Background	1.12 (0.78,1.62)	0.545	
Low	195	Low vs. Background	1.09 (0.74,1.62)	0.660	
High	187	High vs. Background	1.06 (0.72,1.58)	0.760	
Total	1,505				

(8-10 [j])

^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: Background (Comparisons): Current Dioxin \leq 10 ppt.

Unknown (Ranch Hands): Current Dioxin \leq 10 ppt.

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

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

APPENDIX G-1.

Data Displays for the Neurological Assessment

The following figures graphically display relationships between the dependent variables and measures of dioxin for the neurological 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. 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 (excluding participants with syphilis, but assuming no missing data or other 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	679	247
>8.0-32.0	16	0	23	52	408
>32.0-128.0	64	219	416	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

G-1-1	Inflammatory Diseases versus Dioxin	G-1-3
G-1-2	Hereditary and Degenerative Diseases versus Dioxin.....	G-1-4
G-1-3	Peripheral Disorders versus Dioxin	G-1-5
G-1-4	Disorders of the Eye versus Dioxin	G-1-6
G-1-5	Tympanic Membrane Disorder versus Dioxin	G-1-7
G-1-6	Otitis versus Dioxin.....	G-1-8
G-1-7	Hearing Loss versus Dioxin	G-1-9
G-1-8	Other Neurological Disorders versus Dioxin.....	G-1-10
G-1-9	Smell versus Dioxin.....	G-1-11
G-1-10	Visual Fields versus Dioxin.....	G-1-12
G-1-11	Light Reaction versus Dioxin	G-1-13
G-1-12	Ocular Movement versus Dioxin	G-1-14
G-1-13	Facial Sensation versus Dioxin	G-1-15
G-1-14	Smile versus Dioxin.....	G-1-16
G-1-15	Palpebral Fissure versus Dioxin.....	G-1-17
G-1-16	Balance versus Dioxin	G-1-18
G-1-17	Speech versus Dioxin.....	G-1-19
G-1-18	Neck Range of Motion versus Dioxin	G-1-20
G-1-19	Cranial Nerve Index versus Dioxin	G-1-21
G-1-20	Cranial Nerve Index Without Range of Motion versus Dioxin	G-1-22
G-1-21	Pin Prick versus Dioxin	G-1-23
G-1-22	Light Touch versus Dioxin.....	G-1-24
G-1-23	Muscle Status versus Dioxin.....	G-1-25
G-1-24	Vibration versus Dioxin	G-1-26
G-1-25	Patellar Reflex versus Dioxin	G-1-27
G-1-26	Achilles Reflex versus Dioxin	G-1-28
G-1-27	Biceps Reflex versus Dioxin.....	G-1-29
G-1-28	Babinski Reflex versus Dioxin	G-1-30
G-1-29	Tremor versus Dioxin.....	G-1-31
G-1-30	Coordination versus Dioxin.....	G-1-32
G-1-31	Romberg Sign versus Dioxin	G-1-33
G-1-32	Gait versus Dioxin	G-1-34
G-1-33	CNS Index versus Dioxin.....	G-1-35

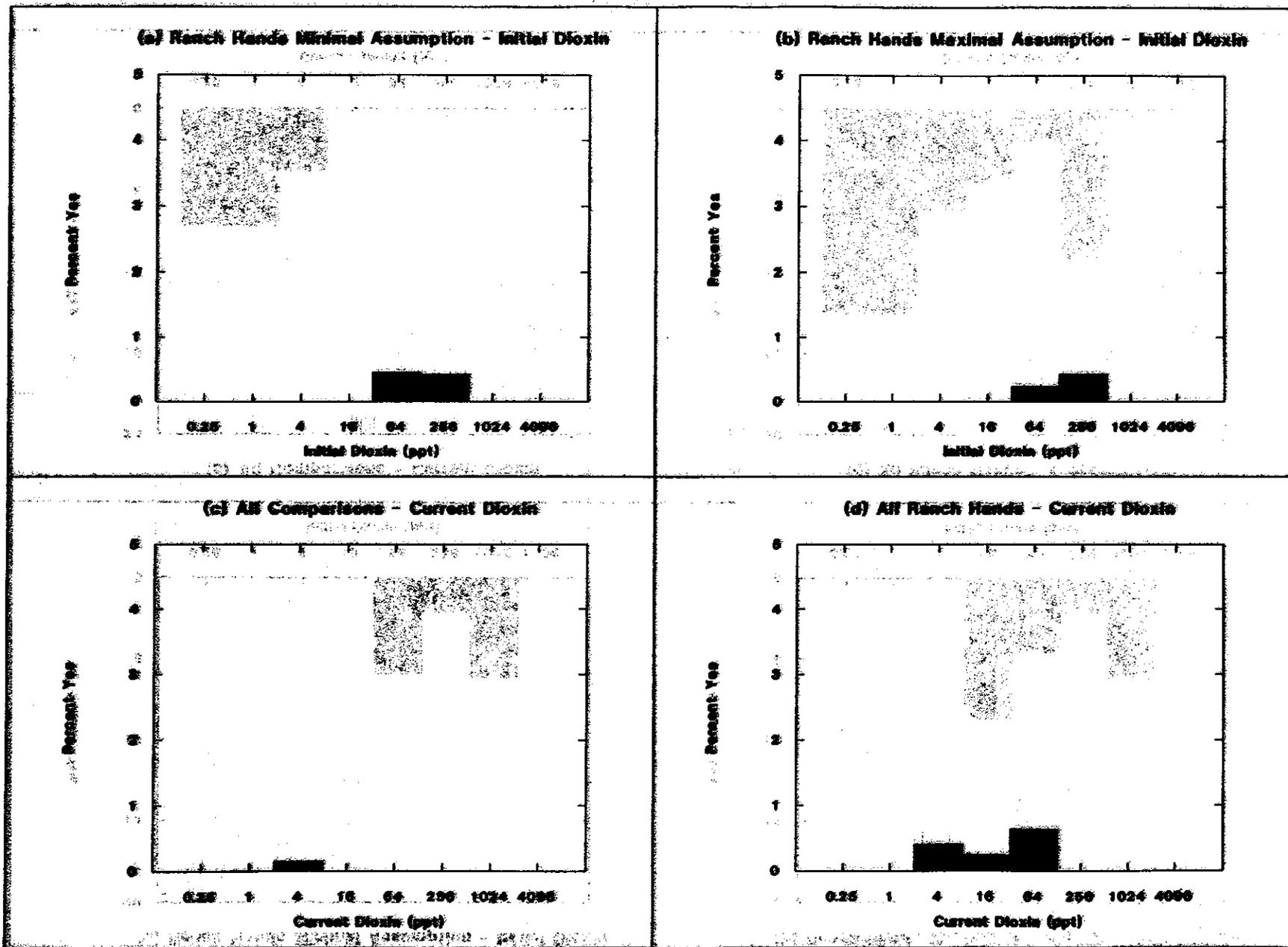


FIGURE G-1-1. Inflammatory Diseases versus Dioxin

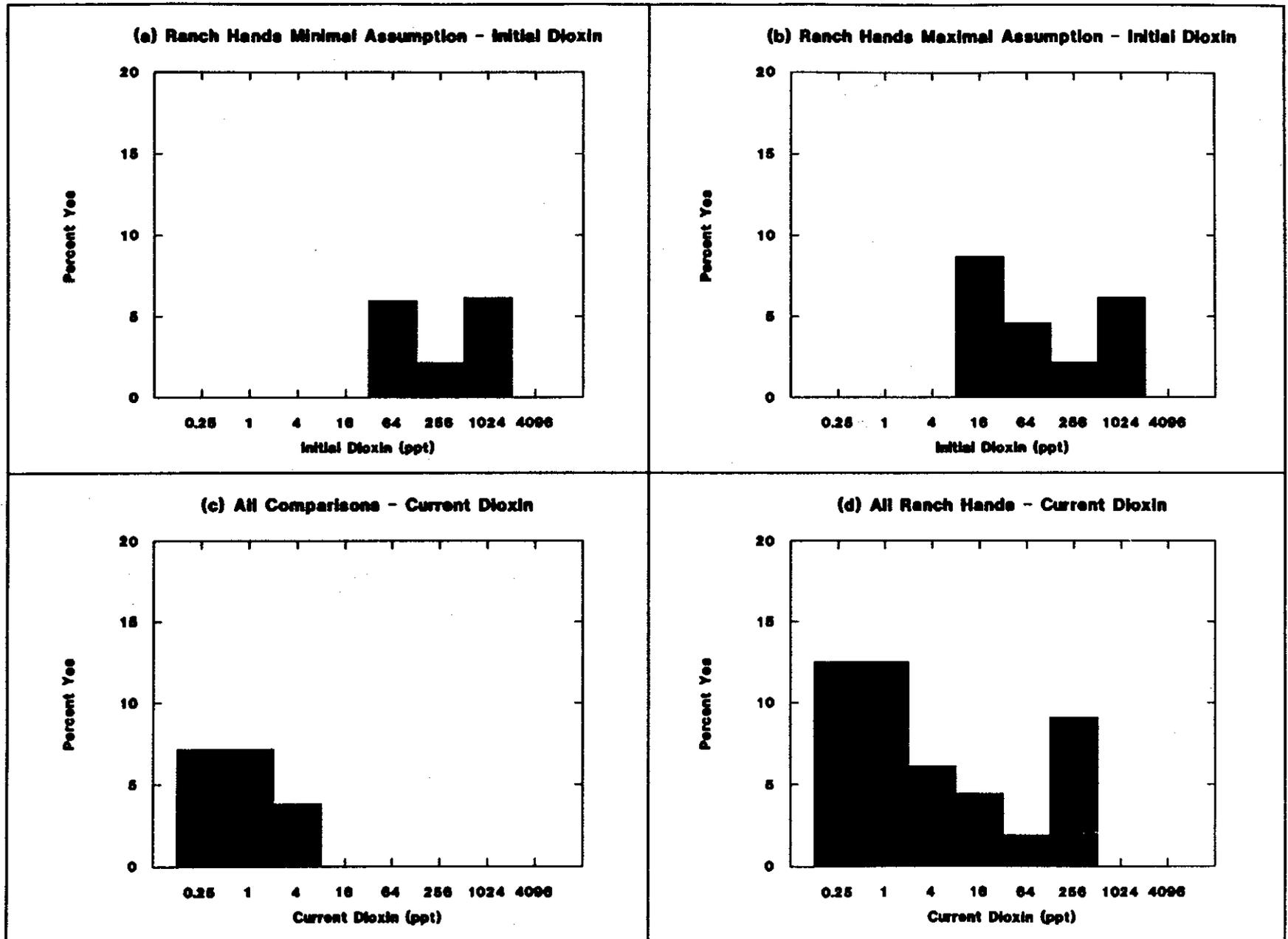


FIGURE G-1-2. Hereditary and Degenerative Diseases versus Dioxin

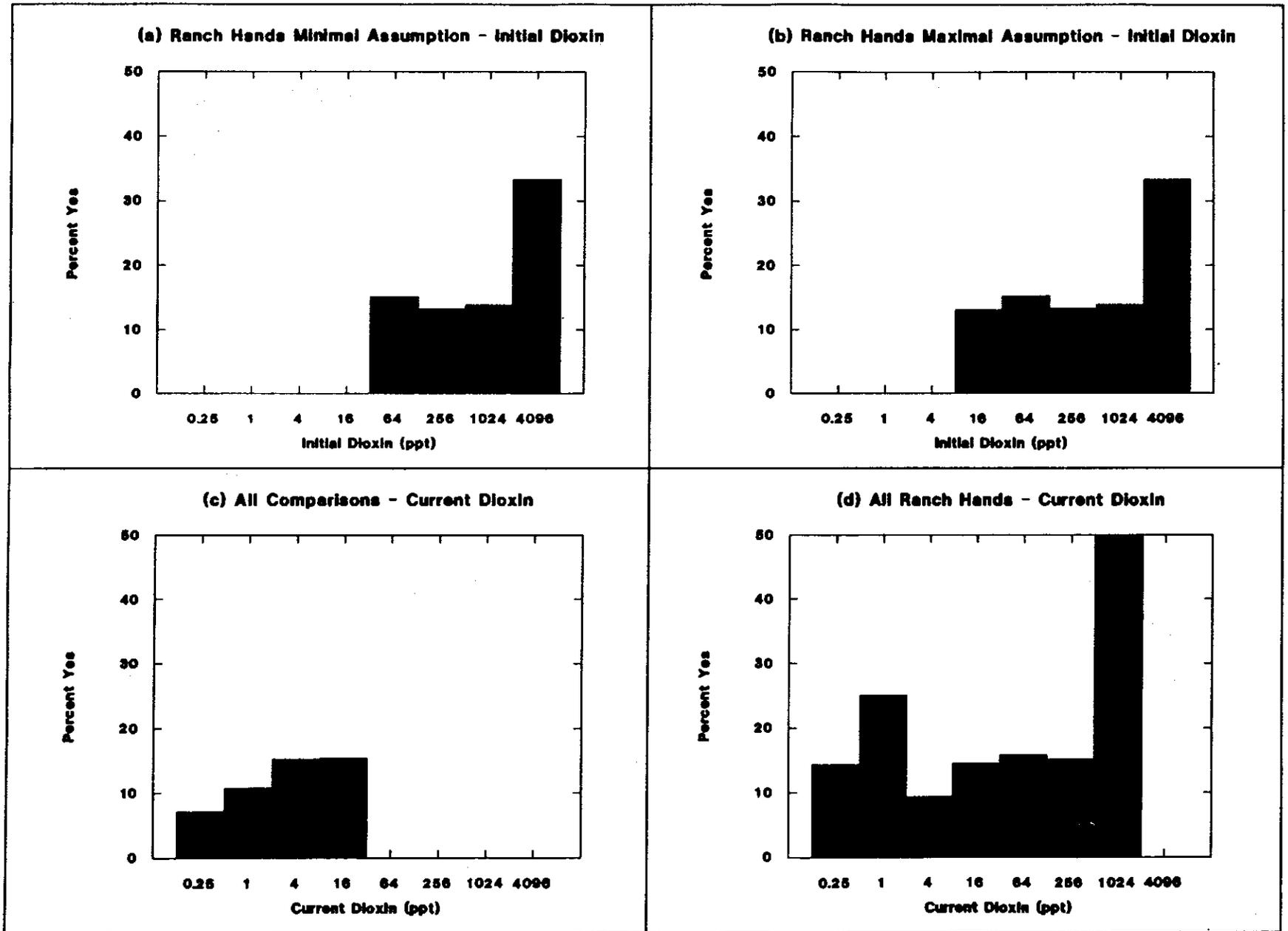


FIGURE G-1-3. Peripheral Disorders versus Dioxin

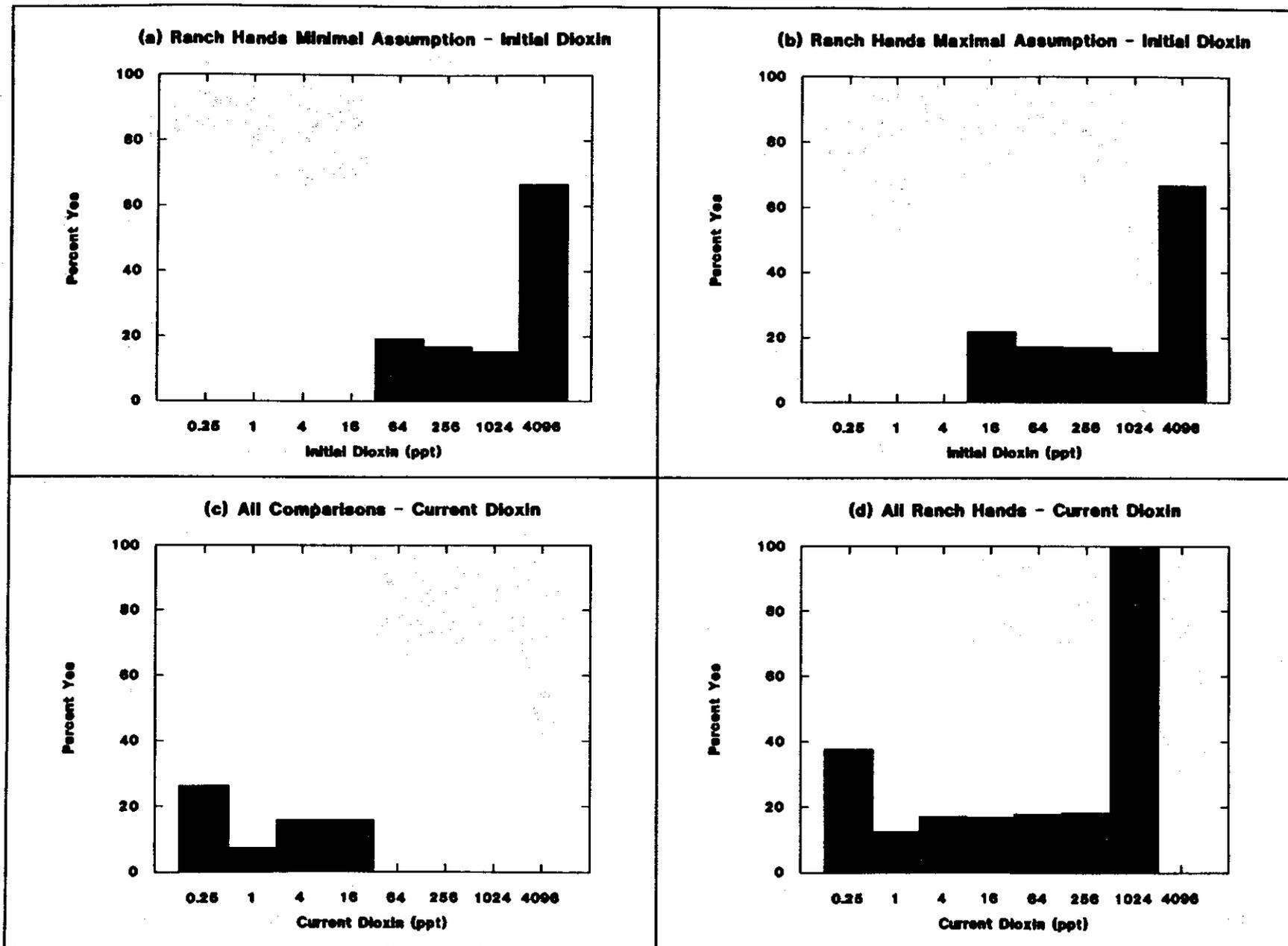


FIGURE G-1-4. Disorders of the Eye versus Dioxin

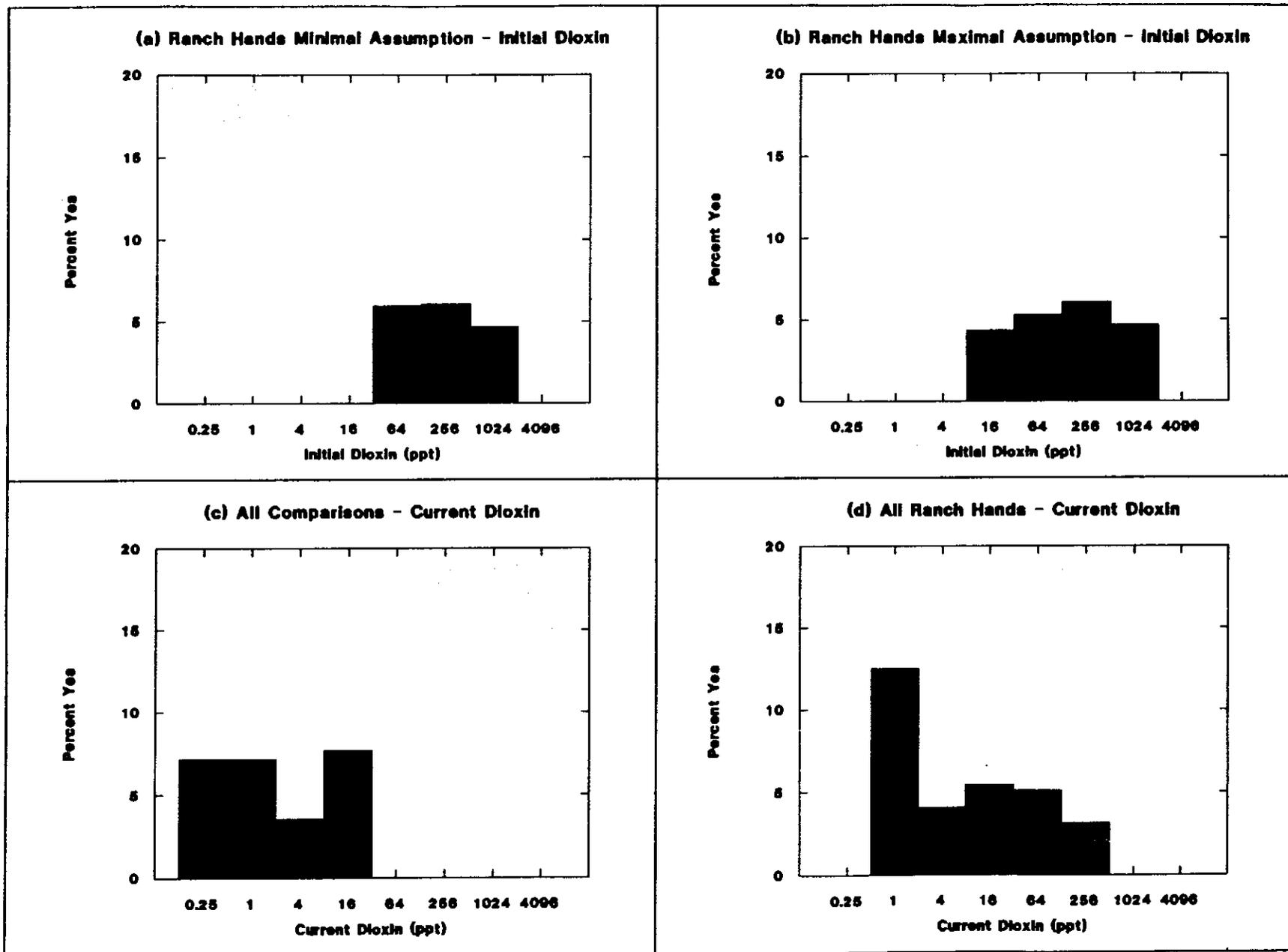


FIGURE G-1-5. Tympanic Membrane Disorder versus Dioxin

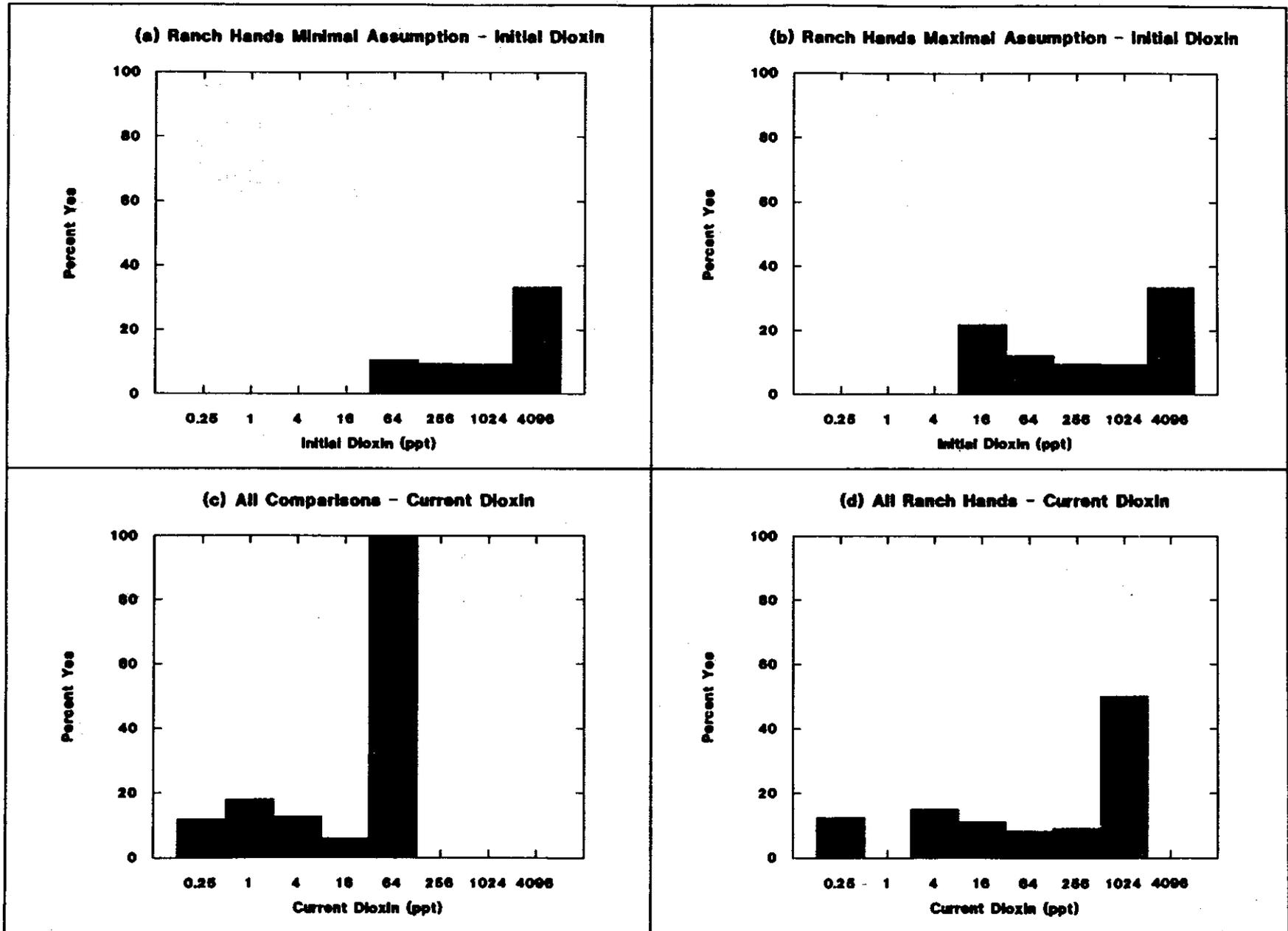


FIGURE G-1-6. Otitis versus Dioxin

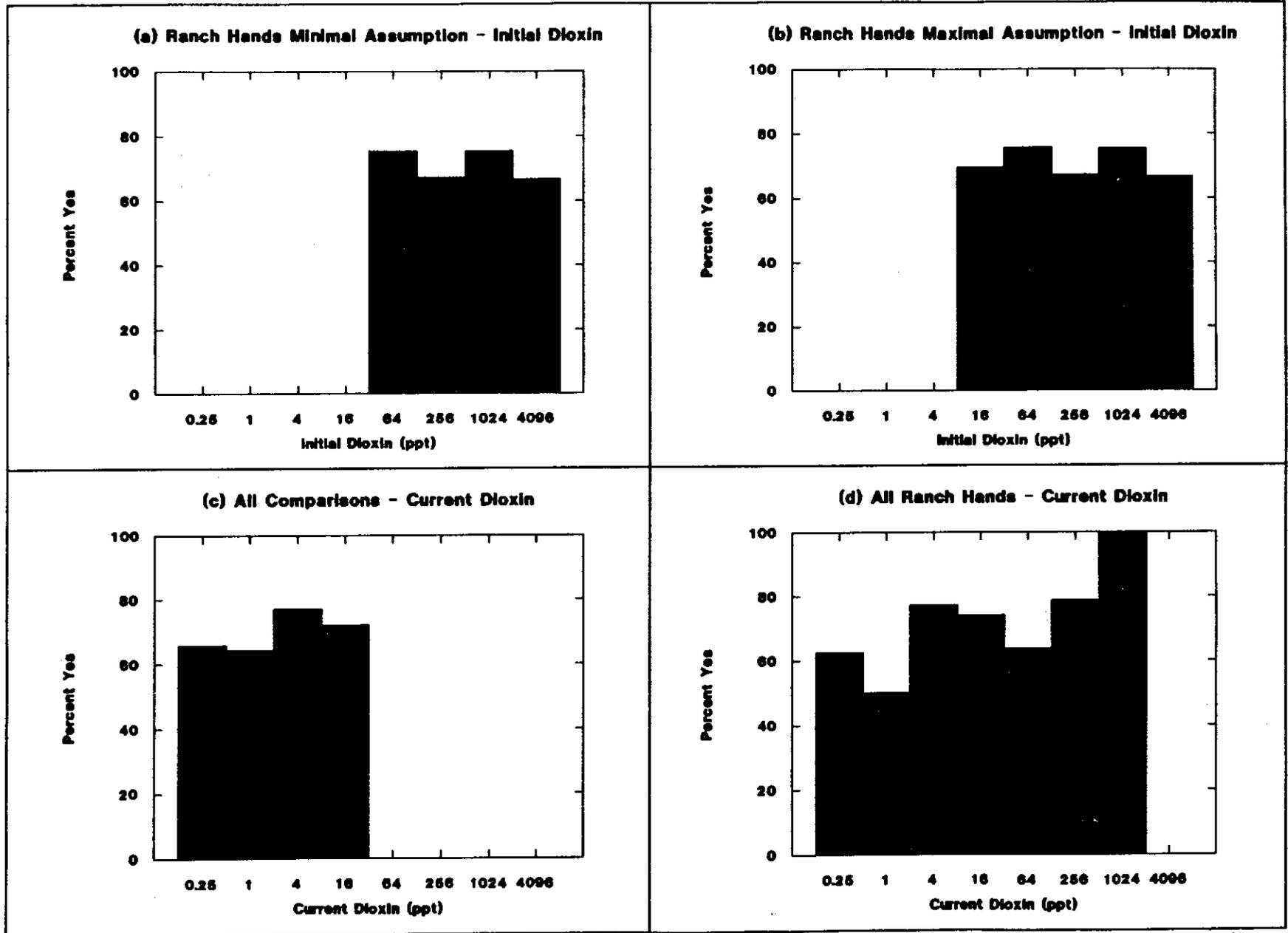


FIGURE G-1-7. Hearing Loss versus Dioxin

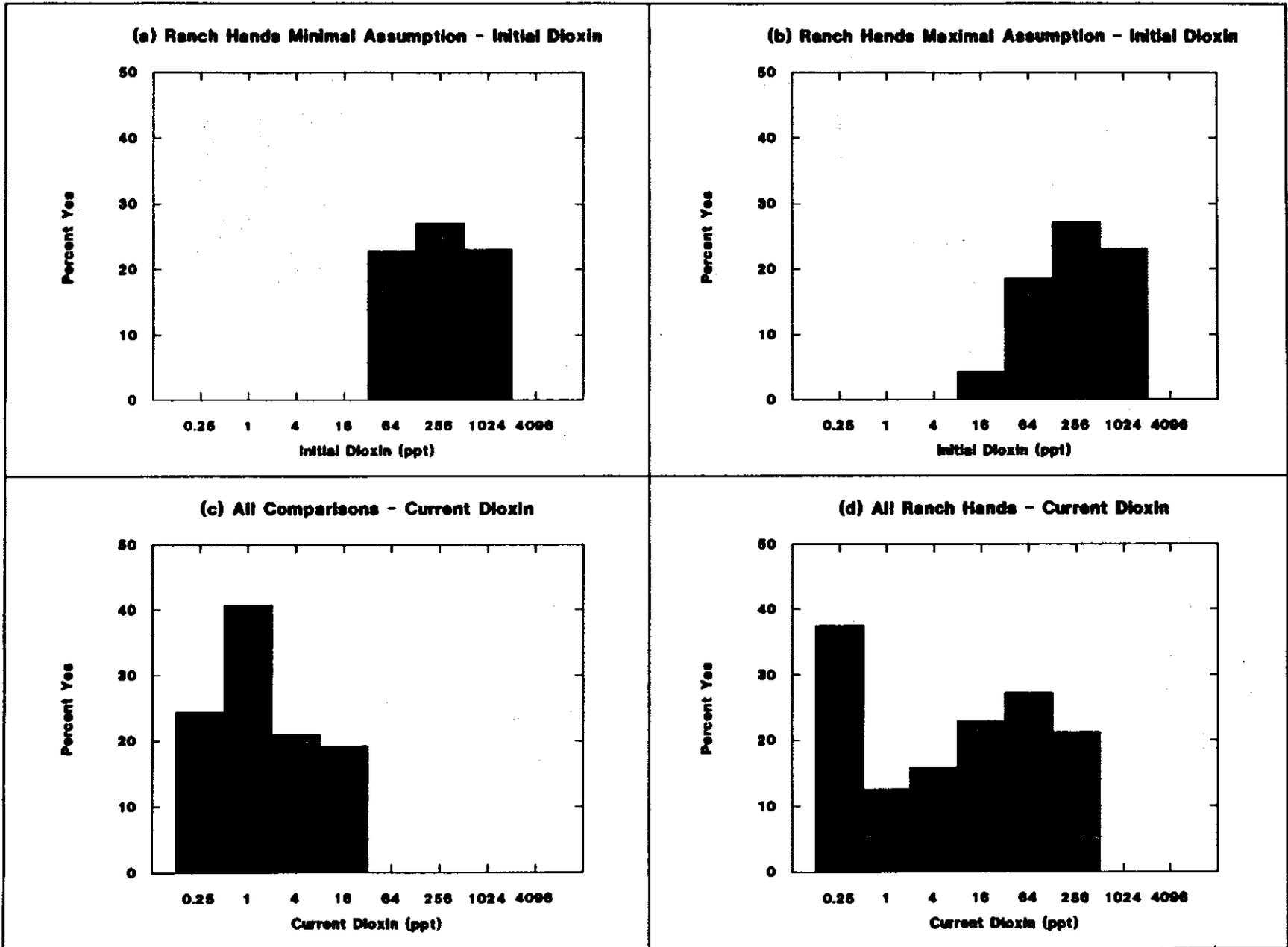
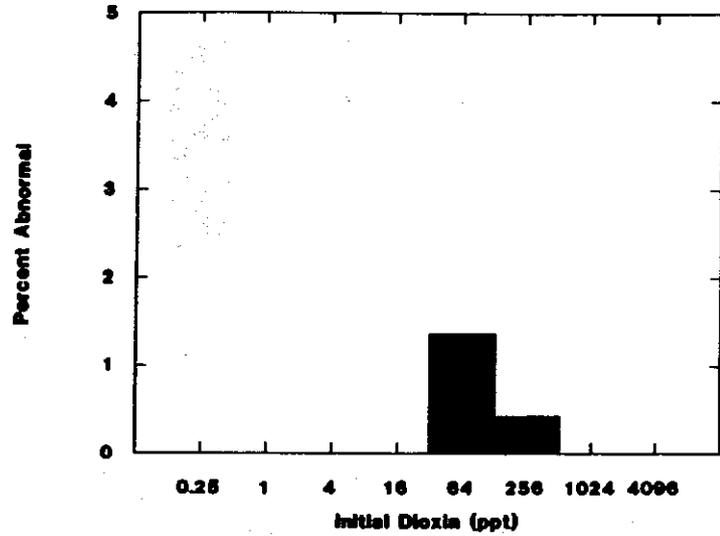
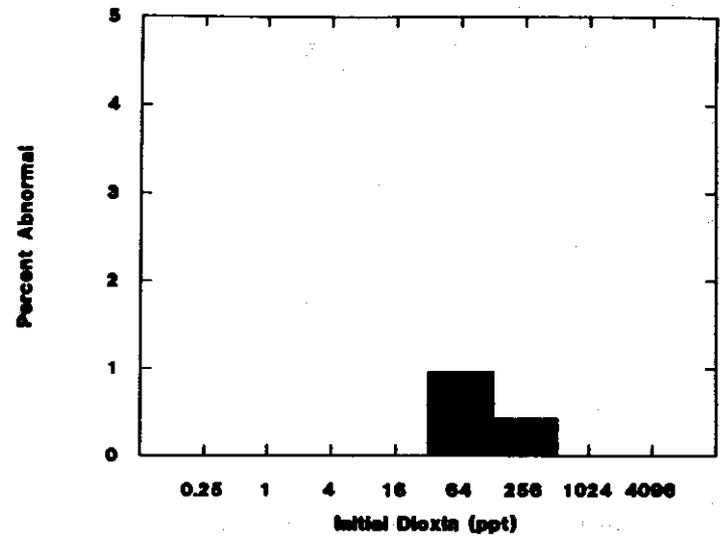


FIGURE G-1-8. Other Neurological Disorders versus Dioxin

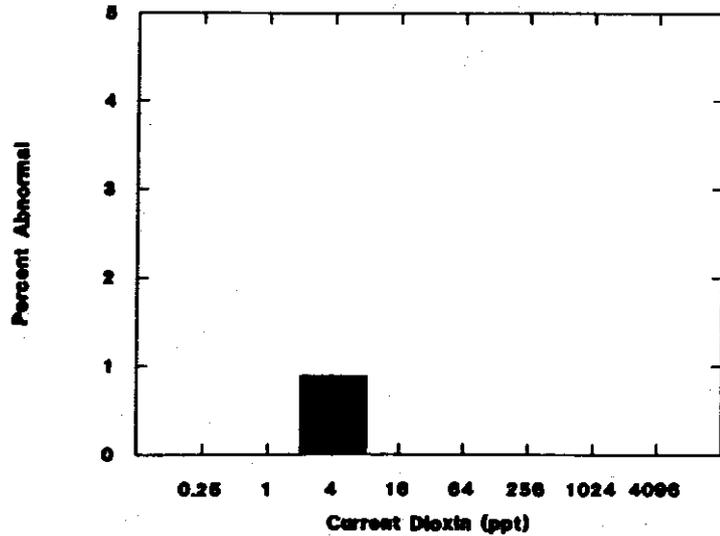
(a) Ranch Hands Minimal Assumption - Initial Dioxin



(b) Ranch Hands Maximal Assumption - Initial Dioxin



(c) All Comparisons - Current Dioxin



(d) All Ranch Hands - Current Dioxin

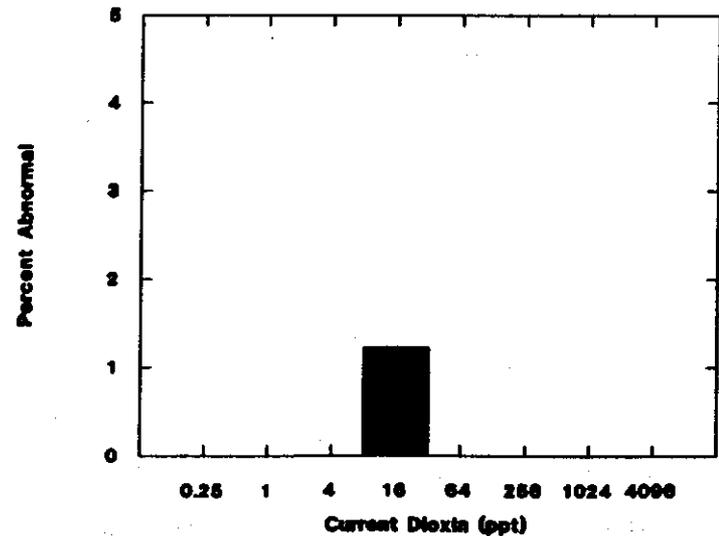


FIGURE G-1-9. Smell versus Dioxin

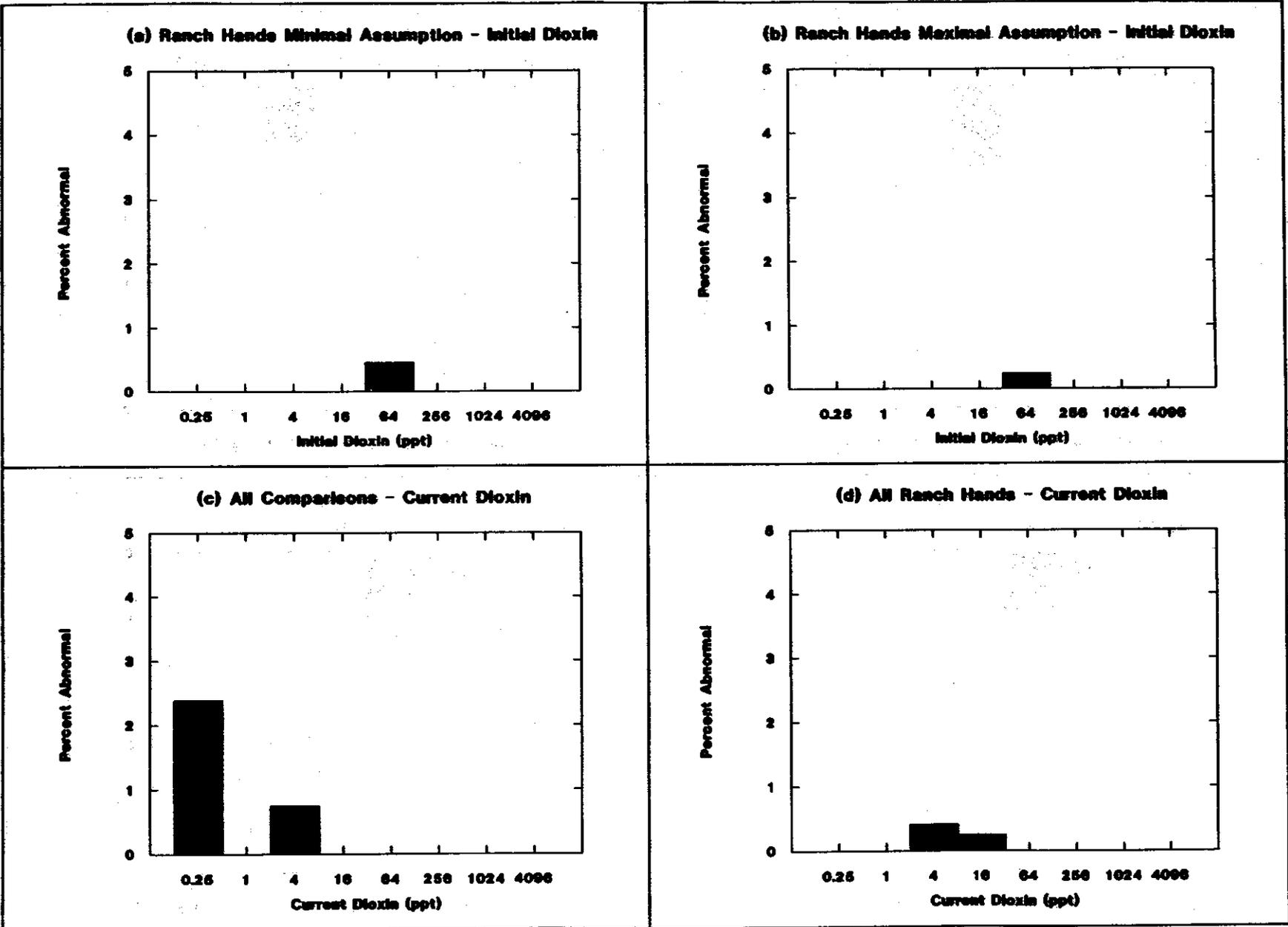


FIGURE G-1-10. Visual Fields versus Dioxin

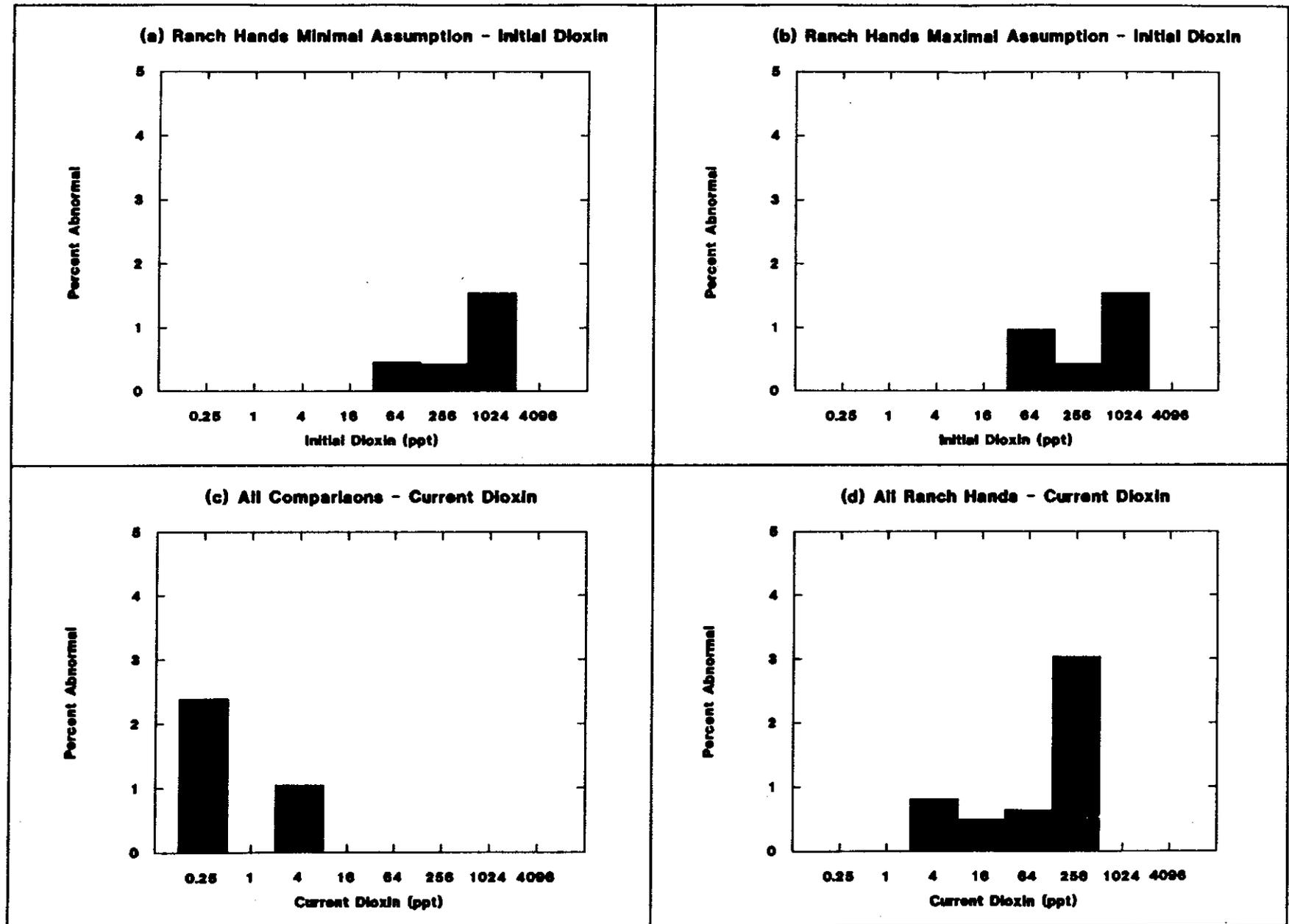


FIGURE G-1-11. Light Reaction versus Dioxin

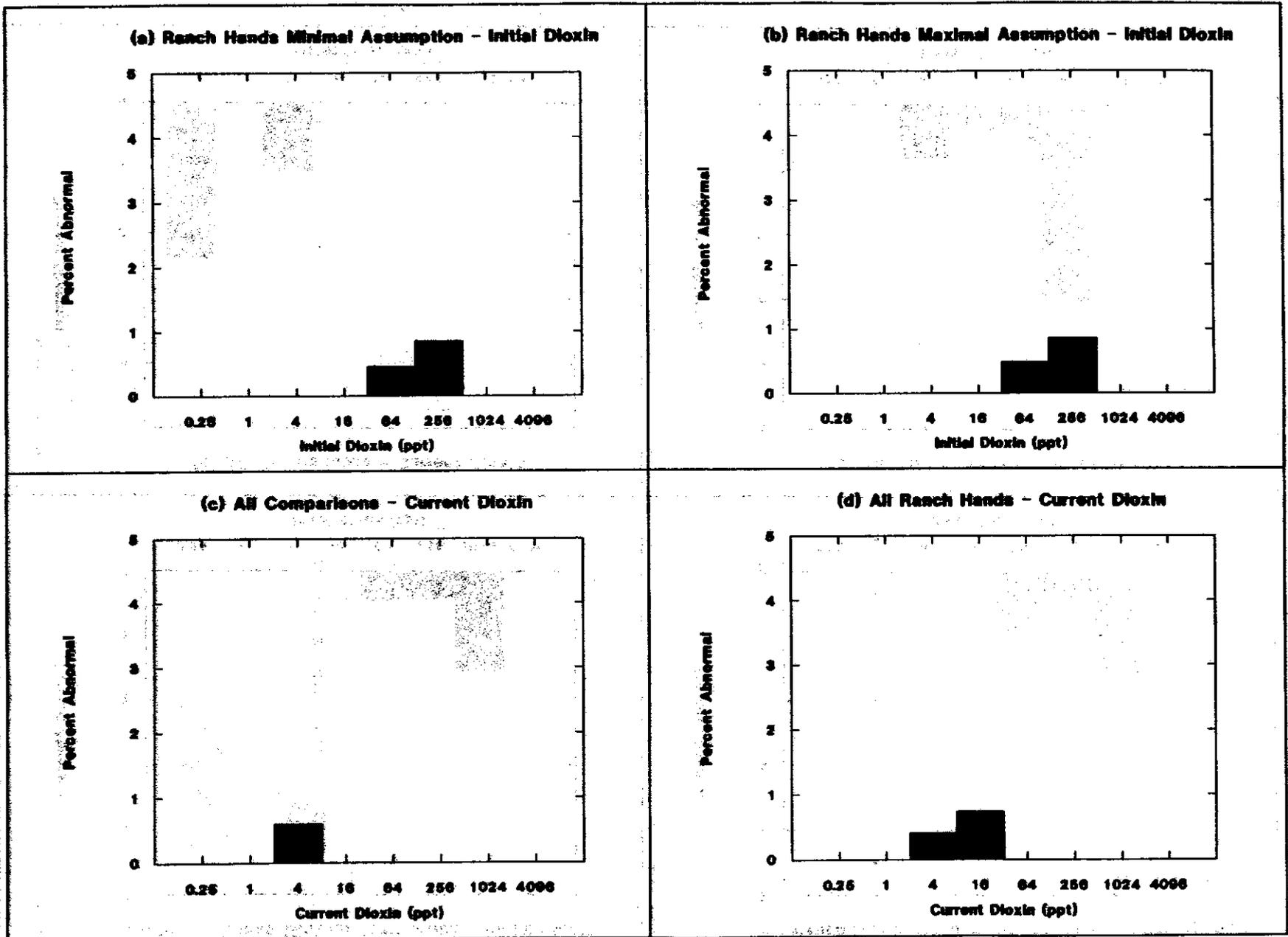


FIGURE G-1-12. Ocular Movement versus Dioxin

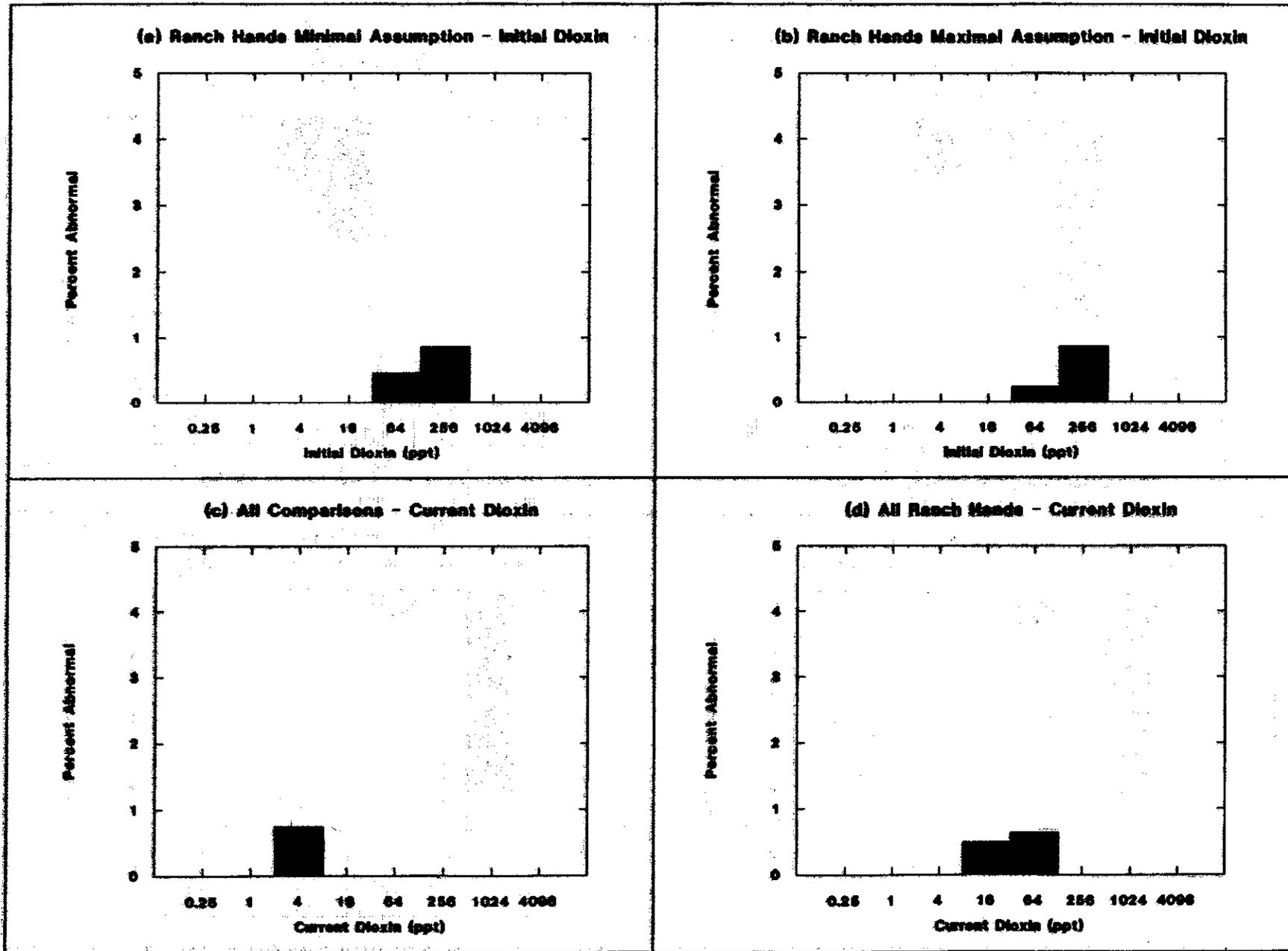


FIGURE G-1-13. Facial Sensation versus Dioxin

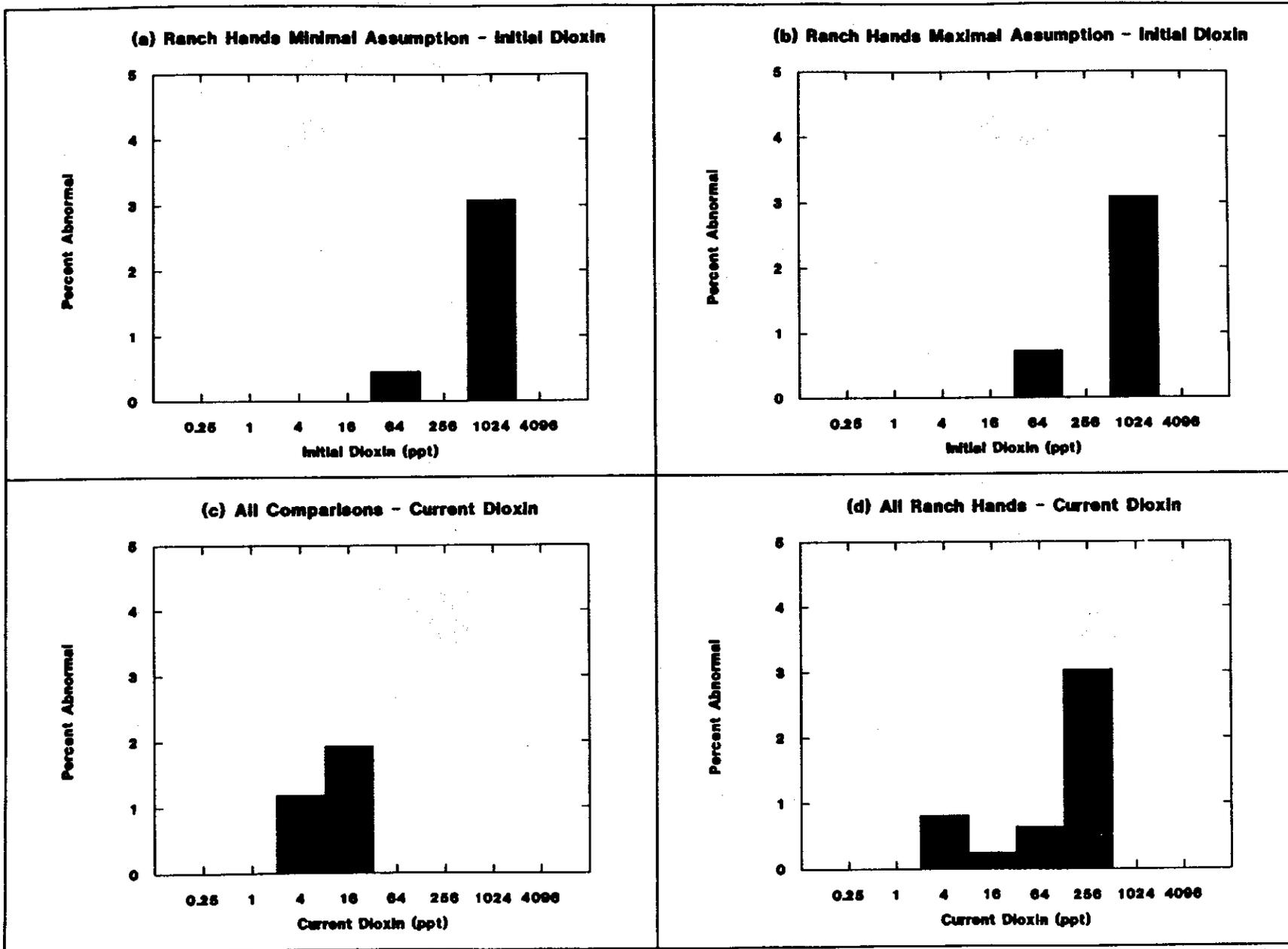


FIGURE G-1-14. Smile versus Dioxin

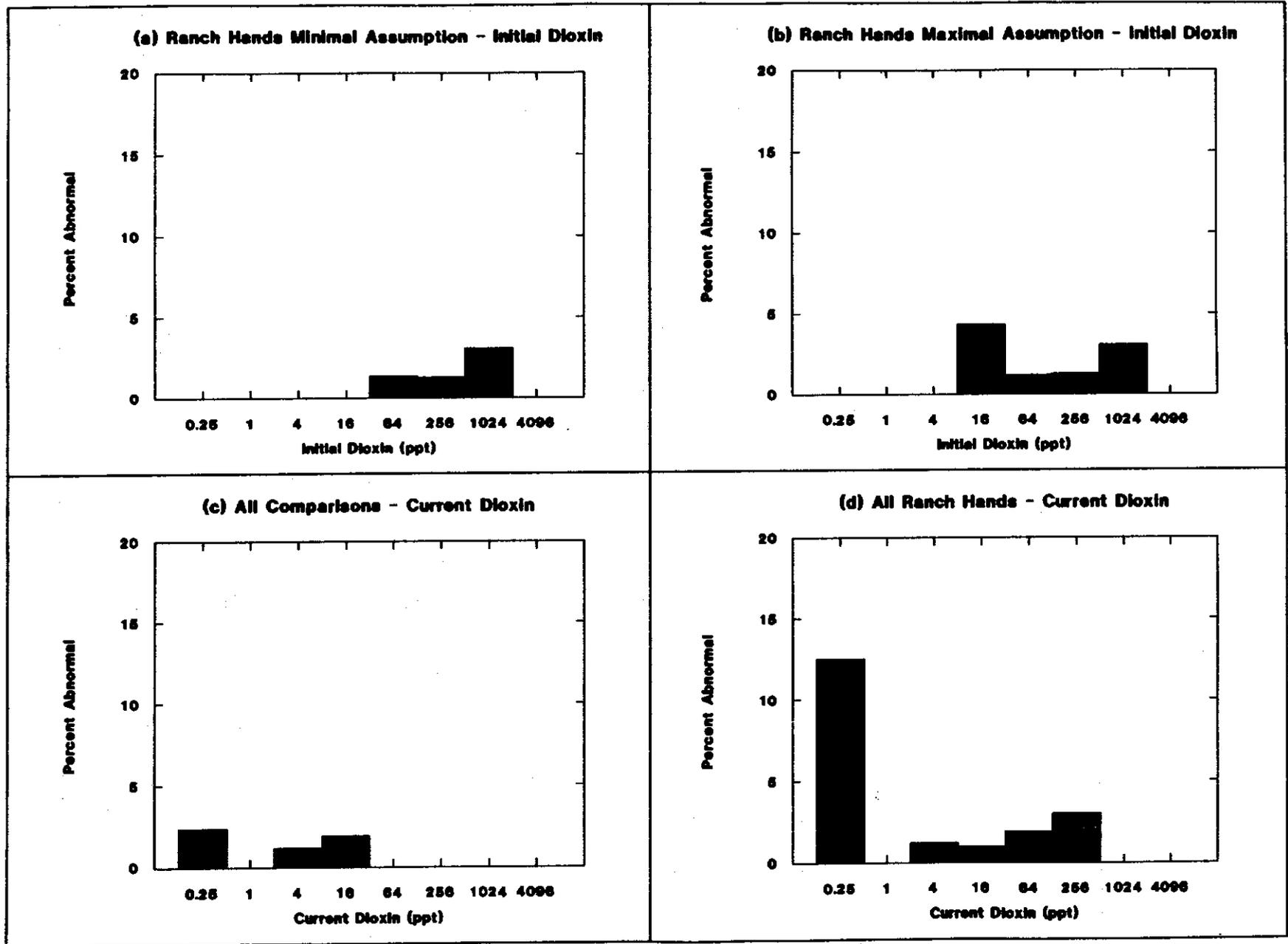


FIGURE G-1-15. Palpebral Fissure versus Dioxin

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G-1-18

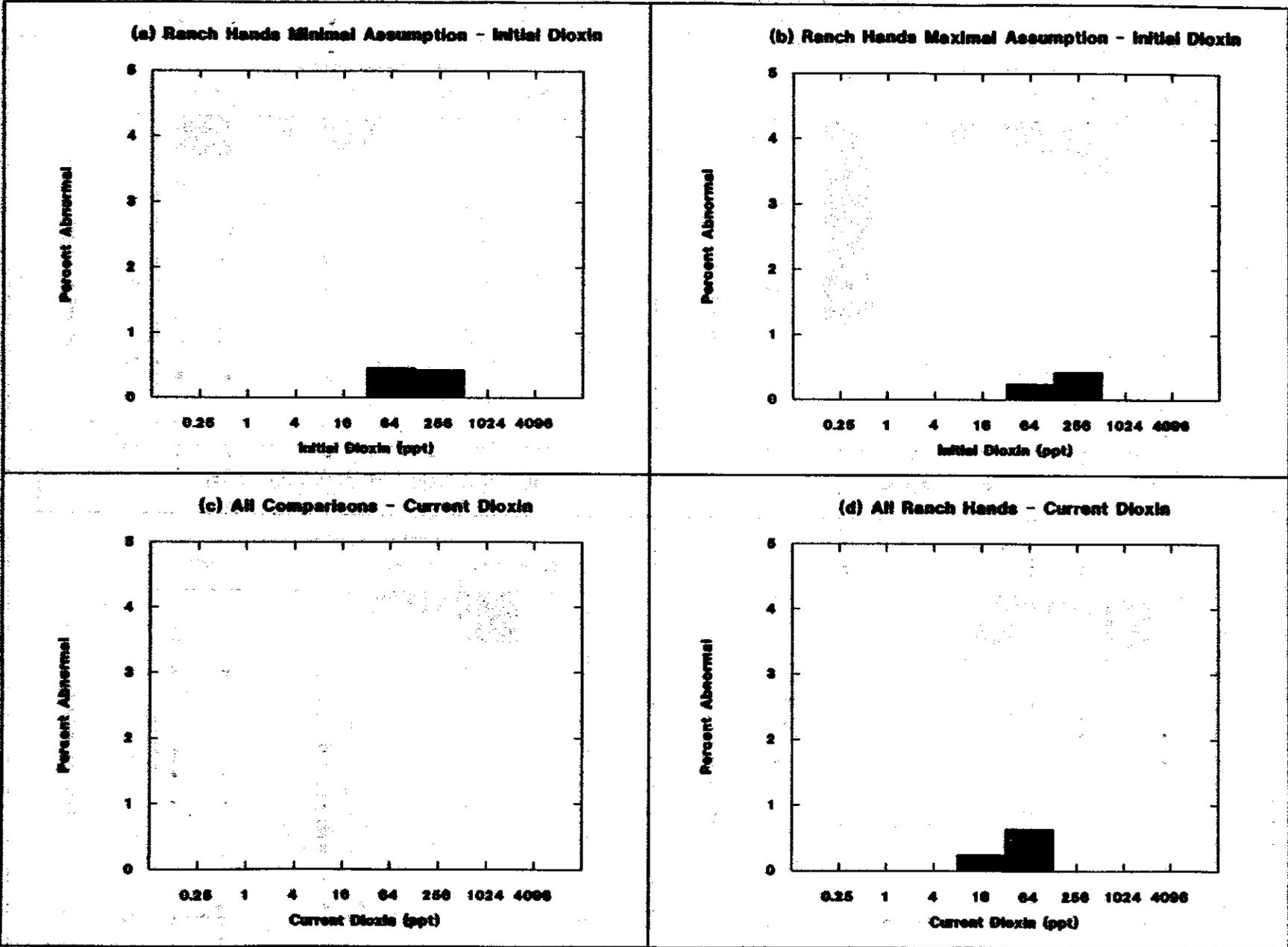


FIGURE G-1-16. Balance versus Dioxin

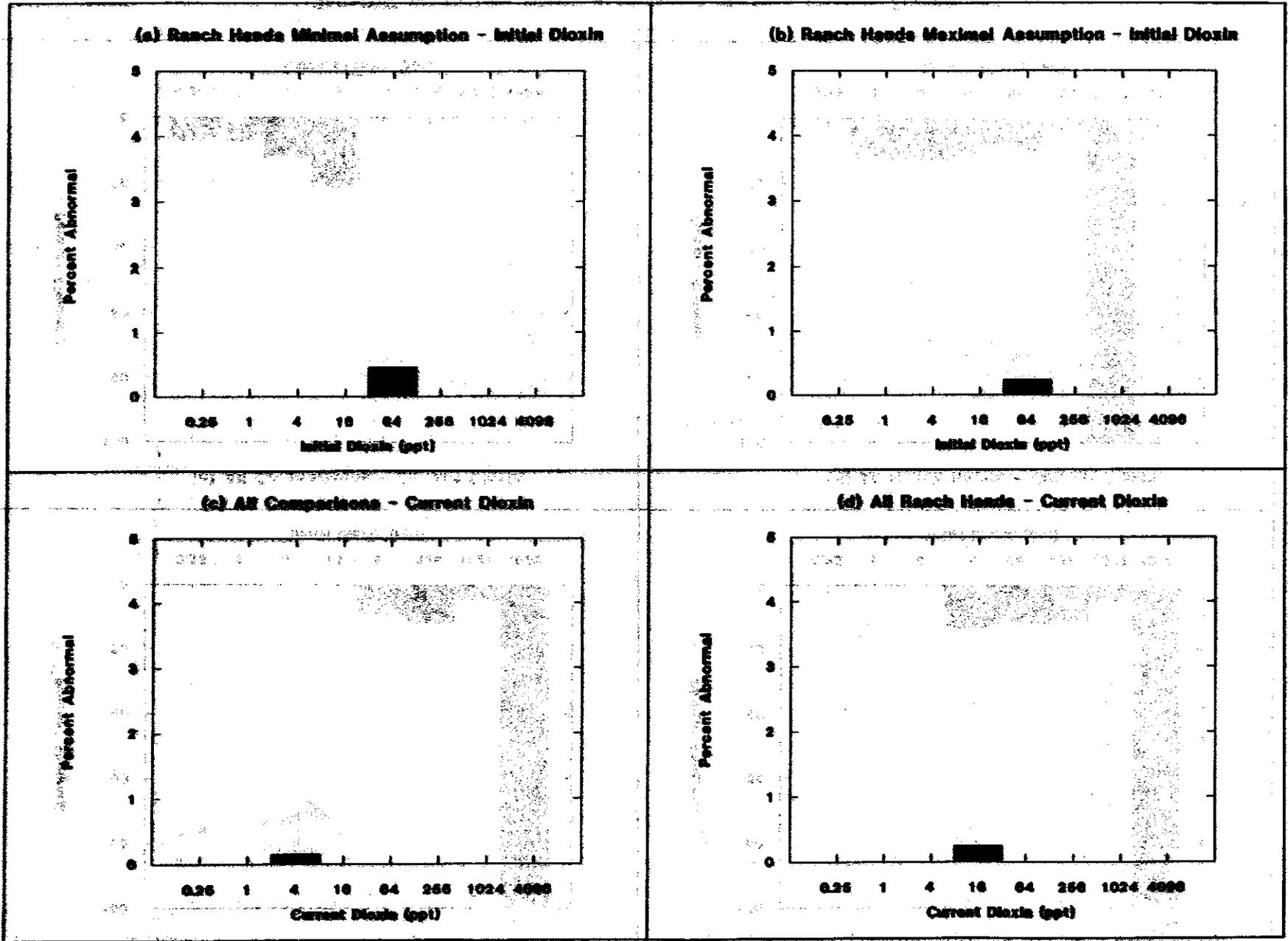


FIGURE G-1-17. Speech versus Dioxin

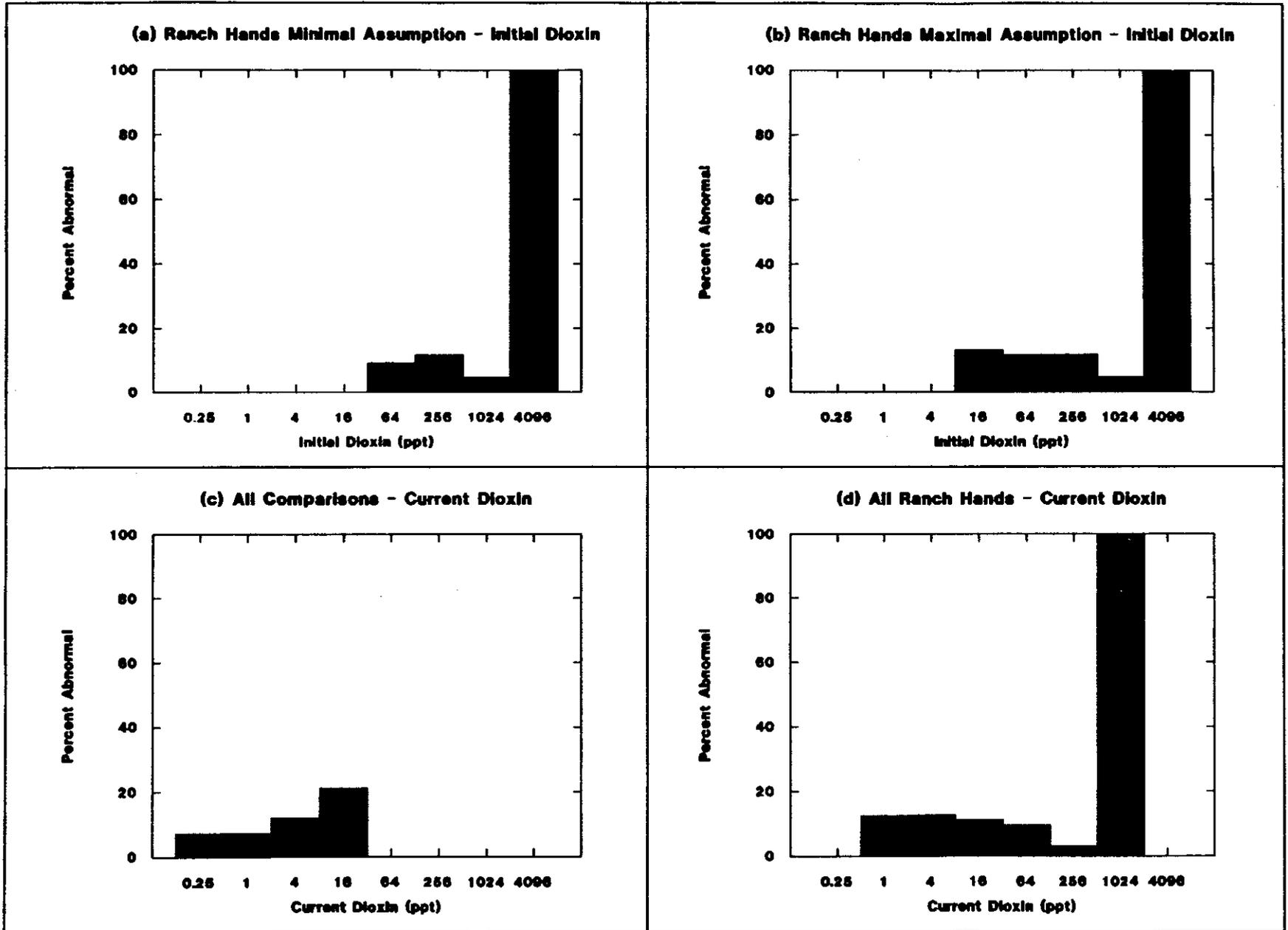


FIGURE G-1-18. Neck Range of Motion versus Dioxin

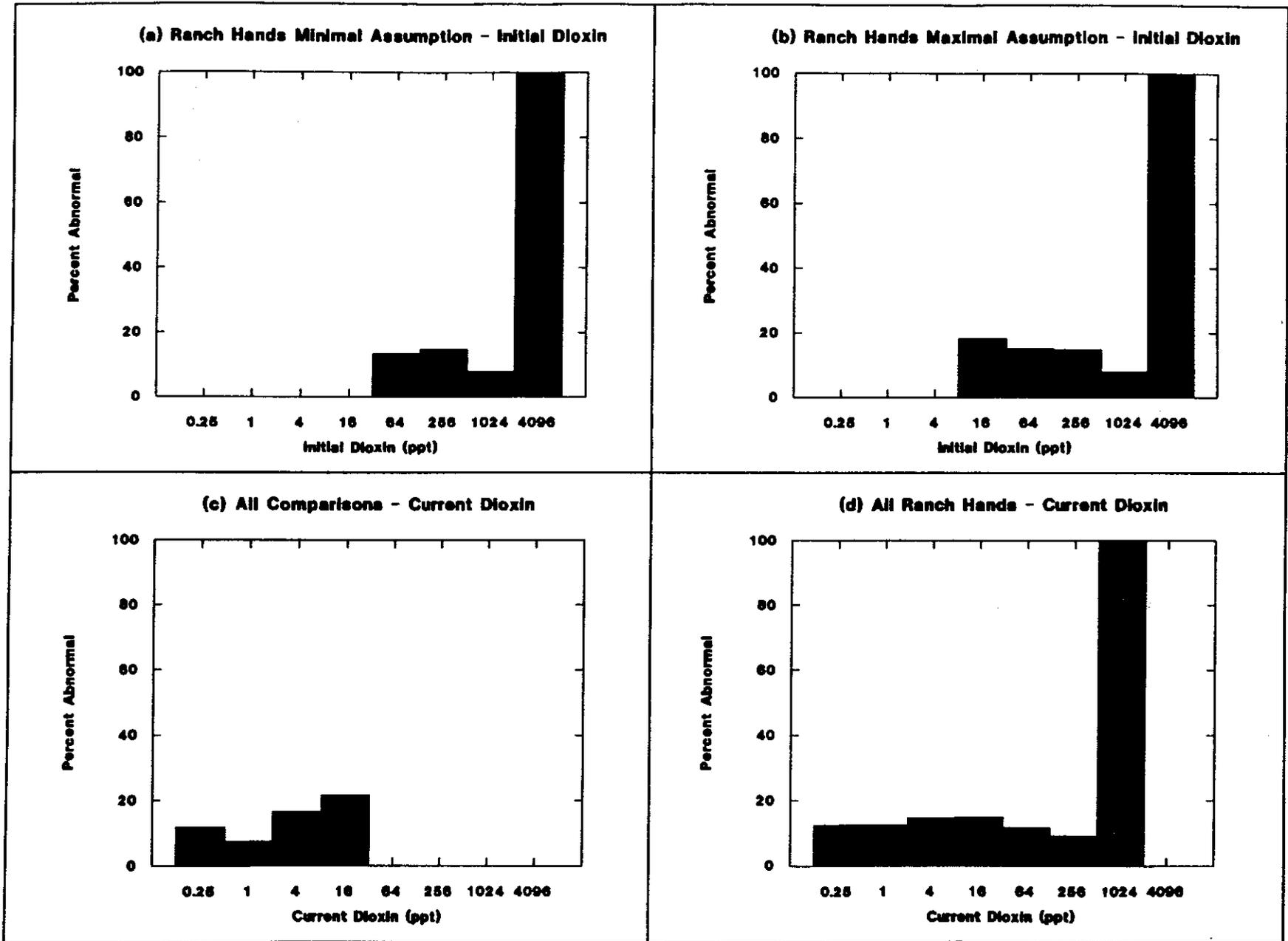


FIGURE G-1-19. Cranial Nerve Index versus Dioxin

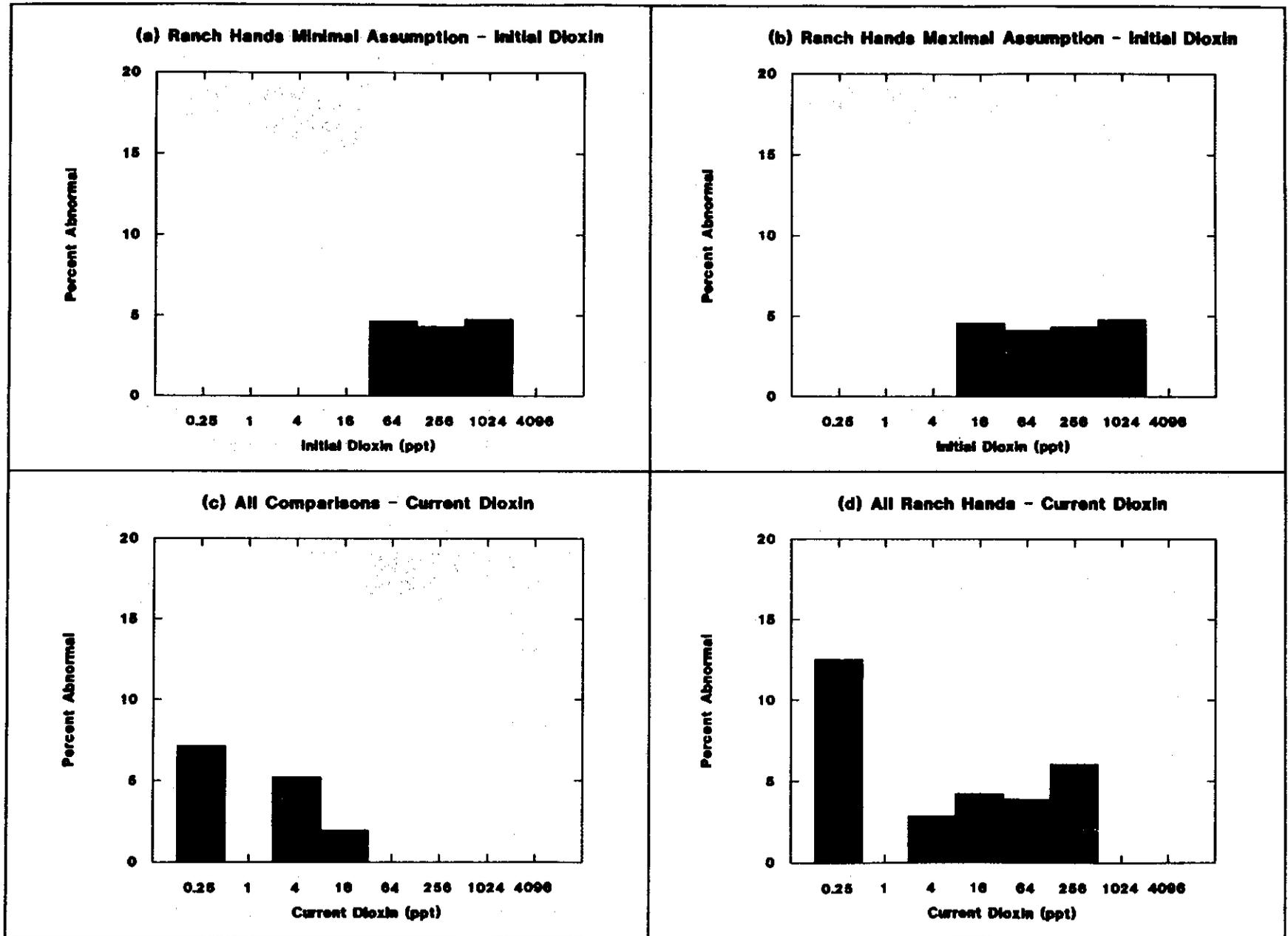


FIGURE G-1-20. Cranial Nerve Index Without Range of Motion versus Dioxin

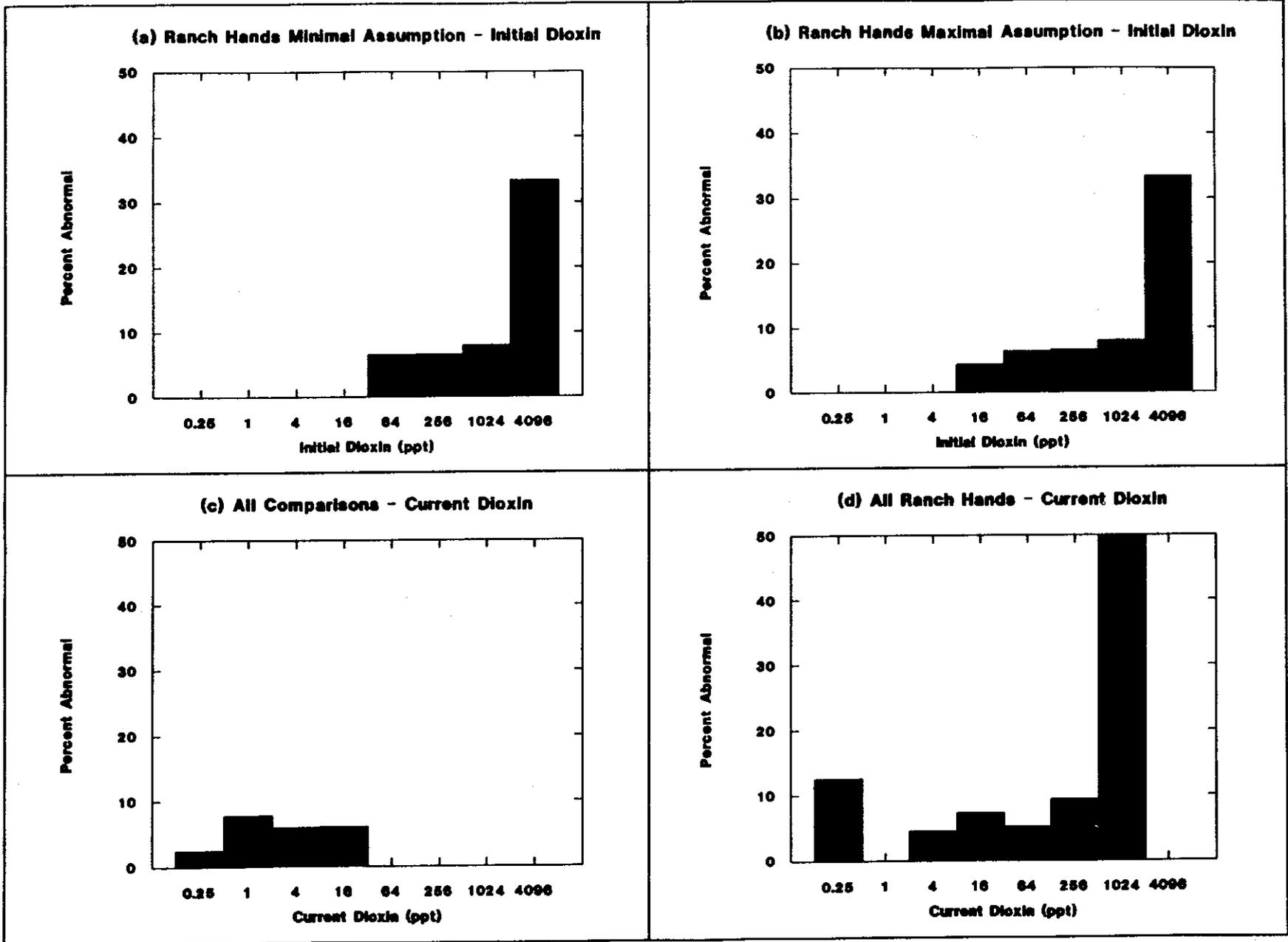


FIGURE G-1-21. Pin Prick versus Dioxin

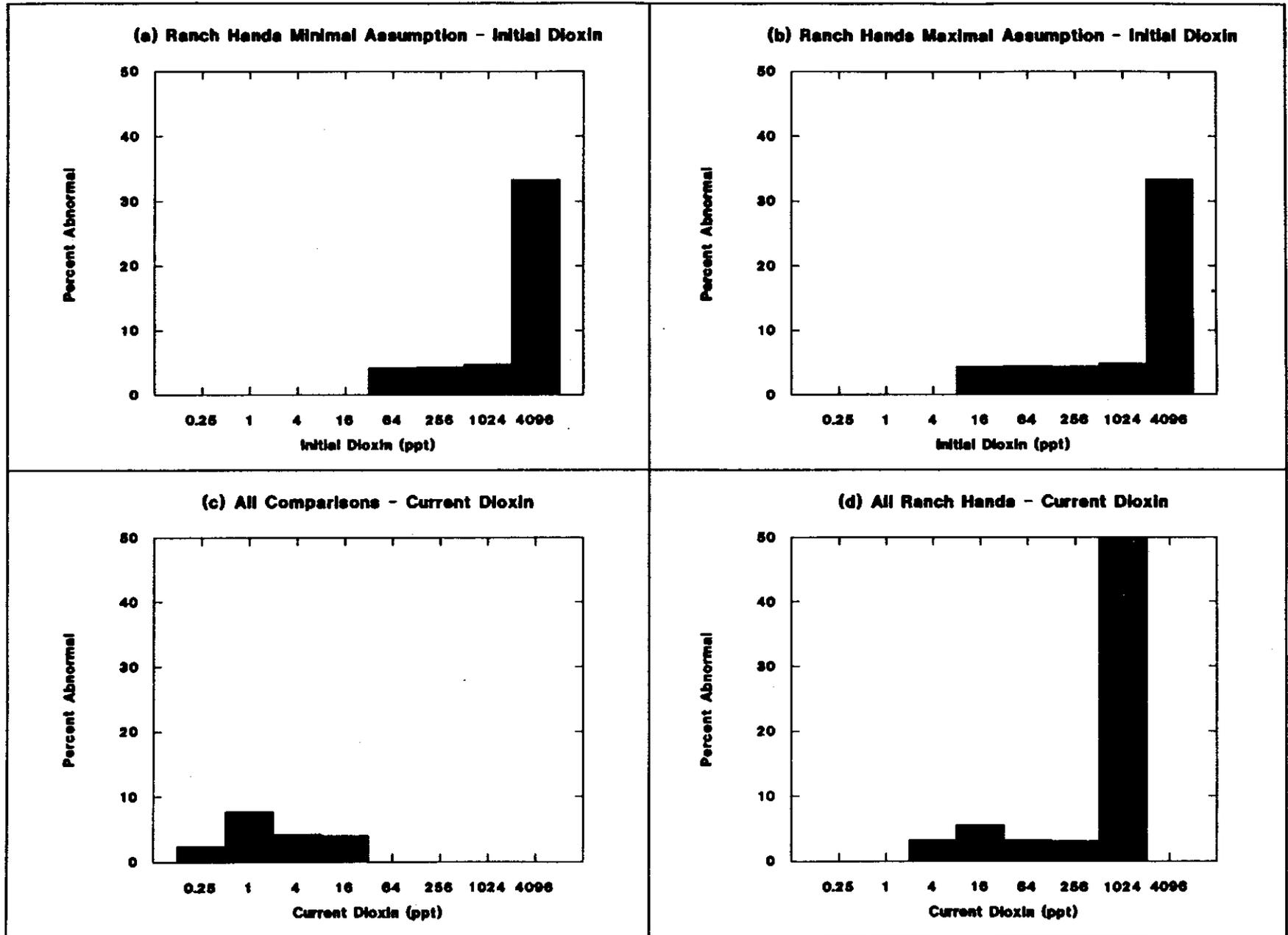


FIGURE G-1-22. Light Touch versus Dioxin

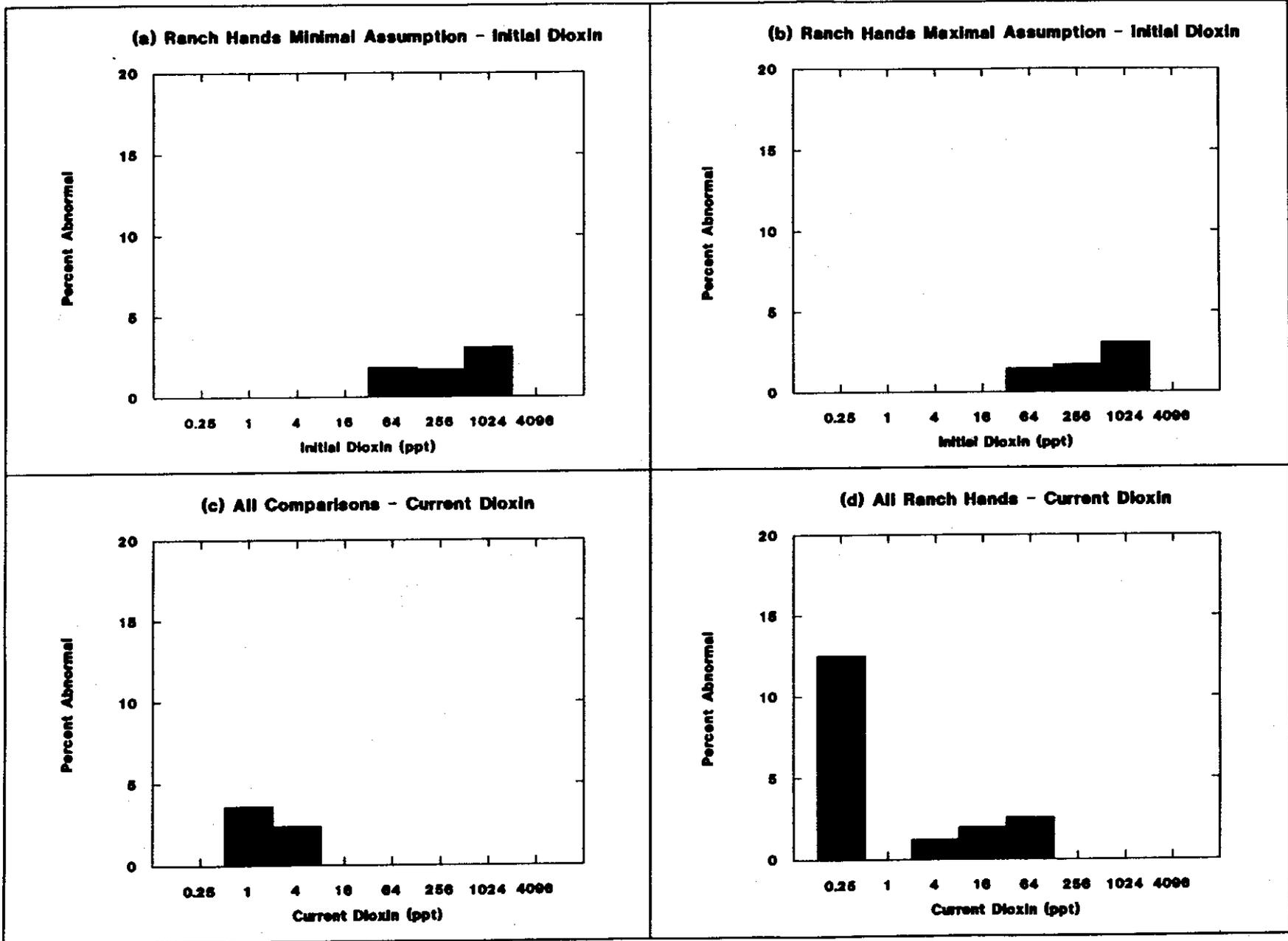


FIGURE G-1-23. Muscle Status versus Dioxin

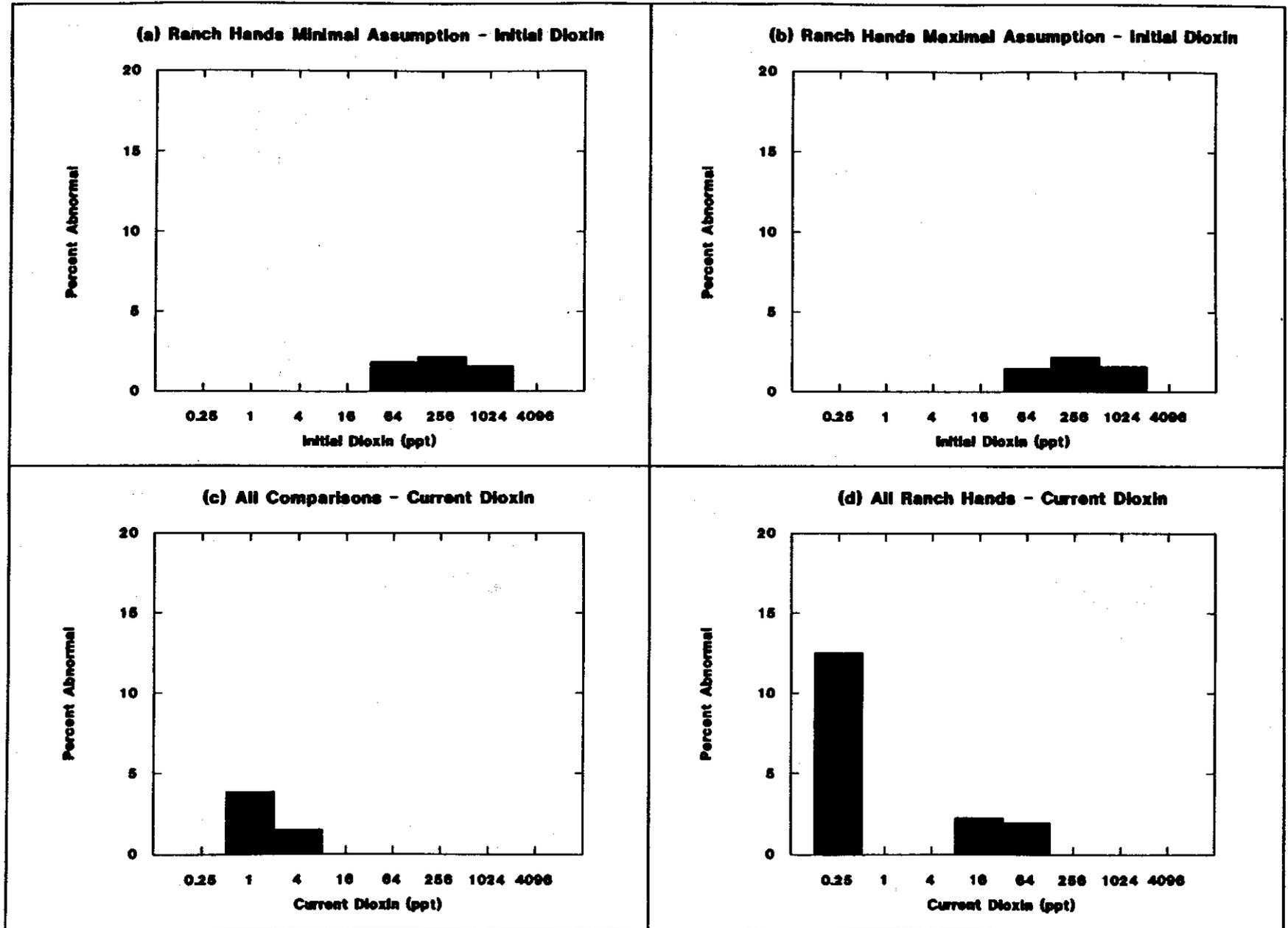


FIGURE G-1-24. Vibration versus Dioxin

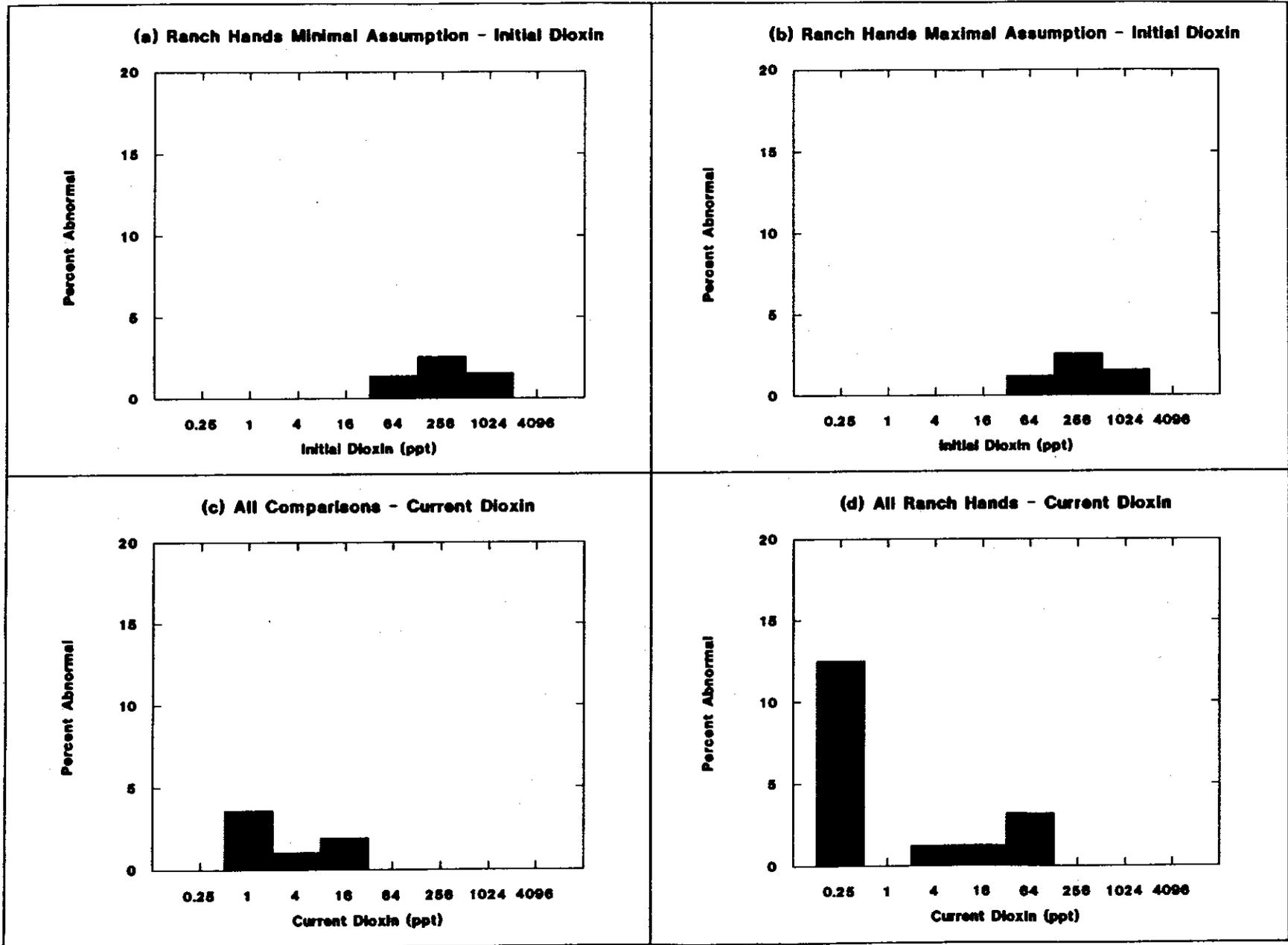


FIGURE G-1-25. Patellar Reflex versus Dioxin