mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study

The FREQ Procedure

Frequency

Table of baseage by age

baseage(Baseline age (years))	age							
	6	8	10	12	14	16	18	Total
6	353	670	749	0	0	0	0	1772
8	0	708	738	750	0	0	0	2196
10	0	0	758	765	676	0	0	2199
12	0	0	0	753	588	560	0	1901
14	0	0	0	0	769	655	364	1788
Total	353	1378	2245	2268	2033	1215	364	9856

Frequency

Table of occasion by age

occasion(Occasion (1=1977, 2=1979, 3=1981))	age							
	6	8	10	12	14	16	18	Total
1	353	708	758	753	769	0	0	3341
2	0	670	738	765	588	655	0	3416
3	0	0	749	750	676	560	364	3099
Total	353	1378	2245	2268	2033	1215	364	9856

Frequency

Table of baseage by occasion

baseage(Baseline age (years))	occasion(Occasion (1=1977, 2=1979, 3=1981))			
	1	2	3	Total
6	353	670	749	1772
8	708	738	750	2196
10	758	765	676	2199
12	753	588	560	1901
14	769	655	364	1788
Total	3341	3416	3099	9856

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study

Obs	baseage	age	occasion
1	6	6	1
2	6	8	2
3	6	10	3
4	8	8	1
5	8	10	2
6	8	12	3
7	10	10	1
8	10	12	2
9	10	14	3
10	12	12	1
11	12	14	2
12	12	16	3
13	14	14	1
14	14	16	2
15	14	18	3

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study Table 13.1

		Occasion (1=1977, 2=1979, 3=1981)		
		1	2	3
		Obesity (0=no, 1=yes)	Obesity (0=no, 1=yes)	Obesity (0=no, 1=yes)
		Mean	Mean	Mean
Gender (0=Male, 1=Female)	Baseline age (years)			
0	6	0.08	0.15	0.21
	8	0.19	0.21	0.24
	10	0.21	0.23	0.22
	12	0.24	0.22	0.19
	14	0.19	0.21	0.18
1	6	0.14	0.17	0.25
	8	0.16	0.24	0.25
	10	0.25	0.26	0.22
	12	0.24	0.22	0.20
	14	0.23	0.26	0.21

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study Table 13.1

		Occasion (1=1977, 2=1979, 3=1981)		
		1	2	3
		Obesity (0=no, 1=yes)	Obesity (0=no, 1=yes)	Obesity (0=no, 1=yes)
		N	N	N
Gender (0=Male, 1=Female)	Baseline age (years)			
0	6	189	350	391
	8	356	375	380
	10	396	387	347
	12	371	298	278
	14	380	318	187
1	6	164	320	358
	8	352	363	370
	10	362	378	329
	12	382	290	282
	14	389	337	177

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study Count # obs per subject

The FREQ Procedure

Frequency Count				
COUNT	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	1626	33.48	1626	33.48
2	1460	30.07	3086	63.55
3	1770	36.45	4856	100.00

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study Count # obs per subject

The FREQ Procedure

Frequency
Percent
Row Pct
Col Pct

Table of gender by baseage

gender(Gender (0=Male, 1=Female))	baseage(Baseline age (years))					
	6	**8**	**10**	**12**	**14**	**Total**
0	493 10.15 19.83 52.73	522 10.75 21.00 51.48	533 10.98 21.44 52.00	476 9.80 19.15 50.80	462 9.51 18.58 48.89	2486 51.19
1	442 9.10 18.65 47.27	492 10.13 20.76 48.52	492 10.13 20.76 48.00	461 9.49 19.45 49.20	483 9.95 20.38 51.11	2370 48.81
Total	935 19.25	1014 20.88	1025 21.11	937 19.30	945 19.46	4856 100.00

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study
Response patterns

Obs	y1	y2	y3	COUNT
1	0	0	0	1209
2	0	.	.	583
3	.	0	0	463
4	0	0	.	426
5	.	.	0	381
6	.	0	.	293
7	1	.	.	173
8	1	1	1	169
9	0	.	0	125
10	.	.	1	119
11	1	1	.	118
12	0	0	1	91
13	.	1	1	82
14	0	1	1	78
15	.	1	.	77
16	0	1	0	66
17	1	0	0	64
18	.	0	1	63
19	1	1	0	62
20	0	1	.	54
21	.	1	0	37
22	1	0	.	33
23	1	0	1	31
24	0	.	1	27
25	1	.	1	27
26	1	.	0	5
				4856

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study With order=freq and the list option

The FREQ Procedure

y1	y2	y3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
.	.	0	381	7.85	381	7.85
.	.	1	119	2.45	500	10.30
.	0	.	293	6.03	793	16.33
.	0	0	463	9.53	1256	25.86
.	0	1	63	1.30	1319	27.16
.	1	.	77	1.59	1396	28.75
.	1	0	37	0.76	1433	29.51
.	1	1	82	1.69	1515	31.20
0	.	.	583	12.01	2098	43.20
0	.	0	125	2.57	2223	45.78
0	.	1	27	0.56	2250	46.33
0	0	.	426	8.77	2676	55.11
0	0	0	1209	24.90	3885	80.00
0	0	1	91	1.87	3976	81.88
0	1	.	54	1.11	4030	82.99
0	1	0	66	1.36	4096	84.35
0	1	1	78	1.61	4174	85.96
1	.	.	173	3.56	4347	89.52
1	.	0	5	0.10	4352	89.62
1	.	1	27	0.56	4379	90.18
1	0	.	33	0.68	4412	90.86
1	0	0	64	1.32	4476	92.17
1	0	1	31	0.64	4507	92.81
1	1	.	118	2.43	4625	95.24
1	1	0	62	1.28	4687	96.52
1	1	1	169	3.48	4856	100.00

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study 1. Table 13.2

The GENMOD Procedure

Model Information		
Data Set	WORK.A	
Distribution	Binomial	
Link Function	Logit	
Dependent Variable	obesity	Obesity (0=no, 1=yes)

Number of Observations Read	9856
Number of Observations Used	9856
Number of Events	2112
Number of Trials	9856

Class Level Information		
Class	**Levels**	**Values**
id	4856	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 ...
occasion	3	1 2 3

Response Profile		
Ordered Value	**obesity**	**Total Frequency**
1	1	2112
2	0	7744

PROC GENMOD is modeling the probability that obesity='1'.

Parameter Information	
Parameter	**Effect**
Prm1	Intercept
Prm2	gender
Prm3	cage
Prm4	cage2
Prm5	gender*cage
Prm6	gender*cage2

Algorithm converged.

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study 1. Table 13.2

The GENMOD Procedure

GEE Model Information	
Log Odds Ratio Structure	Fully Parameterized Clusters
Within-Subject Effect	occasion (3 levels)
Subject Effect	id (4856 levels)
Number of Clusters	4856
Correlation Matrix Dimension	3
Maximum Cluster Size	3
Minimum Cluster Size	1

Log Odds Ratio Parameter Information	
Parameter	**Group**
Alpha1	(1, 2)
Alpha2	(1, 3)
Alpha3	(2, 3)

Algorithm converged.

GEE Fit Criteria	
QIC	10202.4645
QICu	10200.7266

Analysis Of GEE Parameter Estimates						
Empirical Standard Error Estimates						
Parameter	**Estimate**	**Standard Error**	**95% Confidence Limits**		**Z**	**Pr > |Z|**
Intercept	-1.2135	0.0506	-1.3126	-1.1144	-24.00	<.0001
gender	0.1159	0.0711	-0.0235	0.2553	1.63	0.1033
cage	0.0378	0.0133	0.0118	0.0638	2.85	0.0043
cage2	-0.0175	0.0034	-0.0241	-0.0109	-5.19	<.0001
gender*cage	0.0075	0.0182	-0.0282	0.0433	0.41	0.6795
gender*cage2	0.0039	0.0046	-0.0051	0.0130	0.85	0.3949
Alpha1	3.1528	0.1280	2.9019	3.4037	24.63	<.0001
Alpha2	2.5975	0.1353	2.3323	2.8627	19.20	<.0001
Alpha3	2.9868	0.1236	2.7446	3.2291	24.17	<.0001

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study 1. Table 13.2

The GENMOD Procedure

Contrast Results for GEE Analysis				
Contrast	**DF**	**Chi-Square**	**Pr > ChiSq**	**Type**
Age X Gender Interaction	2	0.91	0.6356	Wald

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study 2. Table 13.3

The GENMOD Procedure

Model Information		
Data Set	WORK.A	
Distribution	Binomial	
Link Function	Logit	
Dependent Variable	obesity	Obesity (0=no, 1=yes)

Number of Observations Read	9856
Number of Observations Used	9856
Number of Events	2112
Number of Trials	9856

Class Level Information		
Class	**Levels**	**Values**
id	4856	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 ...
occasion	3	1 2 3

Response Profile		
Ordered Value	**obesity**	**Total Frequency**
1	1	2112
2	0	7744

PROC GENMOD is modeling the probability that obesity='1'.

Parameter Information	
Parameter	**Effect**
Prm1	Intercept
Prm2	gender
Prm3	cage
Prm4	cage2

Algorithm converged.

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study 2. Table 13.3

The GENMOD Procedure

Estimated Covariance Matrix				
	Prm1	**Prm2**	**Prm3**	**Prm4**
Prm1	0.001679	-0.001240	0.0000104	-0.000057
Prm2	-0.001240	0.002425	-5.59E-6	2.2461E-7
Prm3	0.0000104	-5.59E-6	0.0000791	-1.438E-6
Prm4	-0.000057	2.2461E-7	-1.438E-6	7.4486E-6

GEE Model Information	
Log Odds Ratio Structure	Fully Parameterized Clusters
Within-Subject Effect	occasion (3 levels)
Subject Effect	id (4856 levels)
Number of Clusters	4856
Correlation Matrix Dimension	3
Maximum Cluster Size	3
Minimum Cluster Size	1

Log Odds Ratio Parameter Information	
Parameter	**Group**
Alpha1	(1, 2)
Alpha2	(1, 3)
Alpha3	(2, 3)

Algorithm converged.

GEE Fit Criteria	
QIC	10198.8772
QICu	10196.7481

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study 2. Table 13.3

The GENMOD Procedure

Analysis Of GEE Parameter Estimates						
Empirical Standard Error Estimates						
Parameter	Estimate	Standard Error	95% Confidence Limits		Z	Pr > |Z|
Intercept	-1.2283	0.0477	-1.3218	-1.1348	-25.75	<.0001
gender	0.1449	0.0627	0.0221	0.2678	2.31	0.0208
cage	0.0418	0.0091	0.0240	0.0596	4.60	<.0001
cage2	-0.0155	0.0023	-0.0200	-0.0110	-6.73	<.0001
Alpha1	3.1496	0.1280	2.8987	3.4004	24.61	<.0001
Alpha2	2.5931	0.1352	2.3281	2.8582	19.17	<.0001
Alpha3	2.9878	0.1236	2.7456	3.2300	24.18	<.0001

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study 3. Table 13.4

The GENMOD Procedure

Model Information		
Data Set	WORK.A	
Distribution	Binomial	
Link Function	Logit	
Dependent Variable	obesity	Obesity (0=no, 1=yes)

Number of Observations Read	9856
Number of Observations Used	9856
Number of Events	2112
Number of Trials	9856

Class Level Information		
Class	**Levels**	**Values**
id	4856	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 ...
occasion	3	1 2 3

Response Profile		
Ordered Value	**obesity**	**Total Frequency**
1	1	2112
2	0	7744

PROC GENMOD is modeling the probability that obesity='1'.

Parameter Information	
Parameter	**Effect**
Prm1	Intercept
Prm2	gender
Prm3	cage
Prm4	cage2

Algorithm converged.

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study 3. Table 13.4

The GENMOD Procedure

GEE Model Information	
Log Odds Ratio Structure	Replicated Z-Matrix
Within-Subject Effect	occasion (3 levels)
Subject Effect	id (4856 levels)
Number of Clusters	4856
Correlation Matrix Dimension	3
Maximum Cluster Size	3
Minimum Cluster Size	1

Log Odds Ratio Parameter Information		
Cluster Pair	**Alpha1**	**Alpha2**
(1, 2)	1	0
(1, 3)	0	1
(2, 3)	1	0

Algorithm converged.

GEE Fit Criteria	
QIC	10198.8094
QICu	10196.6784

Analysis Of GEE Parameter Estimates						
Empirical Standard Error Estimates						
Parameter	**Estimate**	**Standard Error**	**95% Confidence Limits**		**Z**	**Pr > |Z|**
Intercept	-1.2270	0.0477	-1.3205	-1.1335	-25.72	<.0001
gender	0.1445	0.0627	0.0216	0.2674	2.31	0.0212
cage	0.0416	0.0091	0.0238	0.0594	4.58	<.0001
cage2	-0.0156	0.0023	-0.0201	-0.0111	-6.77	<.0001
Alpha1	3.0684	0.0957	2.8809	3.2559	32.07	<.0001
Alpha2	2.5929	0.1353	2.3278	2.8581	19.17	<.0001

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study 4. Table 13.5

The GENMOD Procedure

Model Information		
Data Set	WORK.A	
Distribution	Binomial	
Link Function	Logit	
Dependent Variable	obesity	Obesity (0=no, 1=yes)

Number of Observations Read	9856
Number of Observations Used	9856
Number of Events	2112
Number of Trials	9856

Class Level Information		
Class	**Levels**	**Values**
id	4856	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 ...
occasion	3	1 2 3

Response Profile		
Ordered Value	**obesity**	**Total Frequency**
1	1	2112
2	0	7744

PROC GENMOD is modeling the probability that obesity='1'.

Parameter Information	
Parameter	**Effect**
Prm1	Intercept
Prm2	gender
Prm3	cage
Prm4	cage2
Prm5	cage3

Algorithm converged.

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study 4. Table 13.5

The GENMOD Procedure

GEE Model Information	
Log Odds Ratio Structure	Fully Parameterized Clusters
Within-Subject Effect	occasion (3 levels)
Subject Effect	id (4856 levels)
Number of Clusters	4856
Correlation Matrix Dimension	3
Maximum Cluster Size	3
Minimum Cluster Size	1

Log Odds Ratio Parameter Information	
Parameter	**Group**
Alpha1	(1, 2)
Alpha2	(1, 3)
Alpha3	(2, 3)

Correlation Matrix (Model-Based)					
	Prm1	**Prm2**	**Prm3**	**Prm4**	**Prm5**
Prm1	1.0000	-0.6670	-0.0127	-0.3504	0.0427
Prm2	-0.6670	1.0000	-0.0096	-0.0013	0.0040
Prm3	-0.0127	-0.0096	1.0000	0.0876	-0.7786
Prm4	-0.3504	-0.0013	0.0876	1.0000	-0.2179
Prm5	0.0427	0.0040	-0.7786	-0.2179	1.0000

Correlation Matrix (Empirical)								
	Prm1	**Prm2**	**Prm3**	**Prm4**	**Prm5**	**Alpha1**	**Alpha2**	**Alpha3**
Prm1	1.0000	-0.6673	-0.0258	-0.3538	0.0462	-0.0116	-0.0204	-0.0315
Prm2	-0.6673	1.0000	0.0066	0.0096	-0.0152	0.0084	0.0053	0.0184
Prm3	-0.0258	0.0066	1.0000	0.0905	-0.7707	-0.0257	0.0202	0.0037
Prm4	-0.3538	0.0096	0.0905	1.0000	-0.2144	0.0069	0.0329	0.0427
Prm5	0.0462	-0.0152	-0.7707	-0.2144	1.0000	-0.0017	-0.0590	-0.0029
Alpha1	-0.0116	0.0084	-0.0257	0.0069	-0.0017	1.0000	0.3054	0.1641
Alpha2	-0.0204	0.0053	0.0202	0.0329	-0.0590	0.3054	1.0000	0.3404
Alpha3	-0.0315	0.0184	0.0037	0.0427	-0.0029	0.1641	0.3404	1.0000

Algorithm converged.

mus001.sas: Marginal Logistic Regression Model for Obesity Muscatine Coronary Risk Factor Study 4. Table 13.5

The GENMOD Procedure

GEE Fit Criteria	
QIC	10192.7695
QICu	10191.4072

Analysis Of GEE Parameter Estimates						
Empirical Standard Error Estimates						
Parameter	Estimate	Standard Error	95% Confidence Limits		Z	Pr > |Z|
Intercept	-1.2228	0.0477	-1.3163	-1.1294	-25.65	<.0001
gender	0.1457	0.0627	0.0229	0.2685	2.33	0.0200
cage	0.0078	0.0144	-0.0205	0.0361	0.54	0.5898
cage2	-0.0166	0.0024	-0.0213	-0.0120	-6.99	<.0001
cage3	0.0018	0.0006	0.0006	0.0030	3.01	0.0026
Alpha1	3.1501	0.1290	2.8973	3.4029	24.42	<.0001
Alpha2	2.6135	0.1353	2.3483	2.8786	19.32	<.0001
Alpha3	2.9933	0.1231	2.7519	3.2346	24.31	<.0001