

SAS Output from Model 1

Model Information

Description	Value
Data Set	WORK.A
Distribution	BINOMIAL
Link Function	LOGIT
Dependent Variable	RATING
Observations Used	215
Number Of Events	73
Number Of Trials	215
Missing Values	4

GEE Model Information

Description	Value
Correlation Structure	Unstructured
Subject Effect	SUBJECT (73 levels)
Number of Clusters	73
Clusters With Missing Values	4
Correlation Matrix Dimension	3
Maximum Cluster Size	3
Minimum Cluster Size	2

Working Correlation Matrix

	COL1	COL2	COL3
ROW1	1.0000	0.6175	0.3902
ROW2	0.6175	1.0000	0.4280
ROW3	0.3902	0.4280	1.0000

Analysis Of GEE Parameter Estimates
Empirical Standard Error Estimates

Parameter	Estimate	Empirical		95% Confidence Limits		Z	Pr> Z
		Std Err		Lower	Upper		
INTERCEPT	0.5036	1.1598		-1.7696	2.7769	0.4342	0.6641
AGE	-0.0391	0.0255		-0.0890	0.0109	-1.533	0.1253
AGE4	0.0174	0.0325		-0.0463	0.0812	0.5359	0.5920
AGE8	0.0035	0.0325		-0.0603	0.0672	0.1062	0.9154
MALE	-0.7927	0.5288		-1.8292	0.2438	-1.499	0.1339
MALE4	0.0924	0.5179		-0.9227	1.1074	0.1783	0.8585
MALE8	0.1890	0.5539		-0.8966	1.2745	0.3412	0.7329
DOSE2	0.8933	0.8287		-0.7310	2.5175	1.0779	0.2811
DOSE3	1.3253	0.8453		-0.3315	2.9821	1.5678	0.1169
DOSE4	1.4086	0.9115		-0.3779	3.1952	1.5453	0.1223
DOSE24	0.4983	0.7007		-0.8751	1.8717	0.7111	0.4770
DOSE28	-0.4086	0.8541		-2.0826	1.2655	-.4784	0.6324
DOSE34	1.0309	0.6915		-0.3245	2.3862	1.4907	0.1360
DOSE38	0.6924	0.7419		-0.7617	2.1465	0.9333	0.3507
DOSE44	0.8234	0.7365		-0.6201	2.2669	1.1181	0.2635
DOSE48	0.5150	0.9631		-1.3726	2.4027	0.5348	0.5928
WEEK4	-1.3207	1.5473		-4.3533	1.7119	-.8536	0.3934
WEEK8	-0.4118	1.6370		-3.6202	2.7967	-.2515	0.8014
Scale	1.0501	.	.	.	.	.	.

NOTE: The scale parameter for GEE estimation was computed as the square root of the normalized Pearson's chi-square.

SAS Output from Model 1 (continued)

Age X Week Interaction

X

0.0174358

0.0034514

VAR

0.0010587 0.0006238

0.0006238 0.0010565

RESULT	Chi-square	df	p-value
	0.355	2.000	0.837

Sex X Week Interaction

X

0.0923516

0.1889898

VAR

0.268228 0.1214222

0.1214222 0.3067659

RESULT	Chi-square	df	p-value
	0.118	2.000	0.943

Dose X Week Interaction

X

0.4983019

-0.408591

1.0308516

0.692408

0.82343

0.5150259

VAR

0.4910461	0.2946633	0.2358191	0.1694682	0.2739538	0.2116678
0.2946633	0.7295267	0.1627168	0.4165302	0.2072939	0.4074017
0.2358191	0.1627168	0.478196	0.2246463	0.2407342	0.1906232
0.1694682	0.4165302	0.2246463	0.5503949	0.1843903	0.4244211
0.2739538	0.2072939	0.2407342	0.1843903	0.5424087	0.3873636
0.2116678	0.4074017	0.1906232	0.4244211	0.3873636	0.9275523

RESULT	Chi-square	df	p-value
	5.003	6.000	0.543

SAS Output from Model 2 (Indicator Effects for Dosage)

Analysis Of Initial Parameter Estimates

Parameter	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	-0.3723	0.7903	0.2219	0.6376
AGE	1	-0.0286	0.0141	4.0915	0.0431
MALE	1	-0.7268	0.3178	5.2304	0.0222
DOSE2	1	0.9877	0.5088	3.7682	0.0522
DOSE3	1	1.9343	0.5045	14.6980	0.0001
DOSE4	1	1.9672	0.5100	14.8766	0.0001
WEEK4	1	0.2383	0.3858	0.3816	0.5368
WEEK8	1	0.0596	0.3886	0.0235	0.8780
SCALE	0	1.0000	0.0000	.	.

NOTE: The scale parameter was held fixed.

GEE Model Information

Description	Value
Correlation Structure	Unstructured
Subject Effect	SUBJECT (73 levels)
Number of Clusters	73
Clusters With Missing Values	4
Correlation Matrix Dimension	3
Maximum Cluster Size	3
Minimum Cluster Size	2

Working Correlation Matrix

	COL1	COL2	COL3
ROW1	1.0000	0.6080	0.3989
ROW2	0.6080	1.0000	0.4082
ROW3	0.3989	0.4082	1.0000

Analysis Of GEE Parameter Estimates

Empirical Standard Error Estimates

Parameter	Estimate	Empirical Std Err	95% Confidence Limits		Z	Pr>|Z|
			Lower	Upper		
INTERCEPT	-0.3571	0.7657	-1.8579	1.1436	-.4664	0.6409
AGE	-0.0287	0.0154	-0.0589	0.0016	-1.858	0.0632
MALE	-0.6447	0.4240	-1.4756	0.1862	-1.521	0.1283
DOSE2	0.9334	0.7328	-0.5029	2.3697	1.2738	0.2027
DOSE3	1.9282	0.7503	0.4575	3.3988	2.5698	0.0102
DOSE4	1.9368	0.7392	0.4880	3.3856	2.6201	0.0088
WEEK4	0.1890	0.2597	-0.3199	0.6980	0.7280	0.4666
WEEK8	0.0604	0.2923	-0.5124	0.6333	0.2067	0.8362
Scale	1.0411	.	.	.	.	.

NOTE: The scale parameter for GEE estimation was computed as the square root of the normalized Pearson's chi-square.

SAS Output from Model 2 (Linear, Quadratic, and Cubic Effects for Dosage)

Analysis Of Initial Parameter Estimates

Parameter	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	-0.3723	0.7903	0.2219	0.6376
AGE	1	-0.0286	0.0141	4.0915	0.0431
MALE	1	-0.7268	0.3178	5.2304	0.0222
DOSE	1	0.8635	1.1194	0.5950	0.4405
DOSESQ	1	0.1966	0.7962	0.0610	0.8050
DOSECU	1	-0.0724	0.1359	0.2835	0.5944
WEEK4	1	0.2383	0.3858	0.3816	0.5368
WEEK8	1	0.0596	0.3886	0.0235	0.8780
SCALE	0	1.0000	0.0000	.	.

NOTE: The scale parameter was held fixed.

GEE Model Information

Description	Value
Correlation Structure	Unstructured
Subject Effect	SUBJECT (73 levels)
Number of Clusters	73
Clusters With Missing Values	4
Correlation Matrix Dimension	3
Maximum Cluster Size	3
Minimum Cluster Size	2

Working Correlation Matrix

	COL1	COL2	COL3
ROW1	1.0000	0.6080	0.3989
ROW2	0.6080	1.0000	0.4082
ROW3	0.3989	0.4082	1.0000

Analysis Of GEE Parameter Estimates

Empirical Standard Error Estimates

Parameter	Estimate	Empirical Std Err	95% Confidence Limits		Z	Pr>|Z|
			Lower	Upper		
INTERCEPT	-0.3571	0.7657	-1.8579	1.1436	-.4664	0.6409
AGE	-0.0287	0.0154	-0.0589	0.0016	-1.858	0.0632
MALE	-0.6447	0.4240	-1.4756	0.1862	-1.521	0.1283
DOSE	0.7224	1.5725	-2.3597	3.8045	0.4594	0.6460
DOSESQ	0.3012	1.1020	-1.8587	2.4612	0.2733	0.7846
DOSECU	-0.0902	0.1882	-0.4590	0.2786	-.4793	0.6317
WEEK4	0.1890	0.2597	-0.3199	0.6980	0.7280	0.4666
WEEK8	0.0604	0.2923	-0.5124	0.6333	0.2067	0.8362
Scale	1.0411	.	.	.	.	.

NOTE: The scale parameter for GEE estimation was computed as the square root of the normalized Pearson's chi-square.

SAS Output from Model 3 (Indicator Effects for Dosage)

Analysis Of Initial Parameter Estimates

Parameter	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	-0.2746	0.7585	0.1311	0.7173
AGE	1	-0.0285	0.0141	4.0755	0.0435
MALE	1	-0.7221	0.3173	5.1790	0.0229
DOSE2	1	0.9850	0.5083	3.7558	0.0526
DOSE3	1	1.9294	0.5039	14.6636	0.0001
DOSE4	1	1.9614	0.5093	14.8311	0.0001
SCALE	0	1.0000	0.0000	.	.

NOTE: The scale parameter was held fixed.

GEE Model Information

Description	Value
Correlation Structure	Unstructured
Subject Effect	SUBJECT (73 levels)
Number of Clusters	73
Clusters With Missing Values	4
Correlation Matrix Dimension	3
Maximum Cluster Size	3
Minimum Cluster Size	2

Working Correlation Matrix

	COL1	COL2	COL3
ROW1	1.0000	0.6065	0.3905
ROW2	0.6065	1.0000	0.4111
ROW3	0.3905	0.4111	1.0000

Analysis Of GEE Parameter Estimates

Empirical Standard Error Estimates

Parameter	Estimate	Empirical Std Err	95% Confidence Limits		Z	Pr>|Z|
			Lower	Upper		
INTERCEPT	-0.2350	0.7495	-1.7040	1.2339	-.3136	0.7538
AGE	-0.0285	0.0154	-0.0588	0.0017	-1.849	0.0645
MALE	-0.6627	0.4239	-1.4936	0.1681	-1.563	0.1180
DOSE2	0.8819	0.7254	-0.5399	2.3037	1.2158	0.2241
DOSE3	1.8757	0.7440	0.4176	3.3339	2.5213	0.0117
DOSE4	1.9122	0.7334	0.4747	3.3497	2.6072	0.0091
Scale	1.0382	.	.	.	.	.

NOTE: The scale parameter for GEE estimation was computed as the square root of the normalized Pearson's chi-square.

SAS Output from Model 3 (Linear, Quadratic, and Cubic Effects for Dosage)

Analysis Of Initial Parameter Estimates

Parameter	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	-0.2746	0.7585	0.1311	0.7173
AGE	1	-0.0285	0.0141	4.0755	0.0435
MALE	1	-0.7221	0.3173	5.1790	0.0229
DOSE	1	0.8608	1.1183	0.5925	0.4414
DOSESQ	1	0.1965	0.7952	0.0611	0.8048
DOSECU	1	-0.0723	0.1358	0.2835	0.5944
SCALE	0	1.0000	0.0000	.	.

NOTE: The scale parameter was held fixed.

GEE Model Information

Description	Value
Correlation Structure	Unstructured
Subject Effect	SUBJECT (73 levels)
Number of Clusters	73
Clusters With Missing Values	4
Correlation Matrix Dimension	3
Maximum Cluster Size	3
Minimum Cluster Size	2

Working Correlation Matrix

	COL1	COL2	COL3
ROW1	1.0000	0.6065	0.3905
ROW2	0.6065	1.0000	0.4111
ROW3	0.3905	0.4111	1.0000

Analysis Of GEE Parameter Estimates

Empirical Standard Error Estimates

Parameter	Estimate	Empirical Std Err	95% Confidence Limits		Z	Pr>|Z|
			Lower	Upper		
INTERCEPT	-0.2350	0.7495	-1.7040	1.2339	-.3136	0.7538
AGE	-0.0285	0.0154	-0.0588	0.0017	-1.849	0.0645
MALE	-0.6627	0.4239	-1.4936	0.1681	-1.563	0.1180
DOSE	0.6354	1.5619	-2.4258	3.6967	0.4068	0.6841
DOSESQ	0.3418	1.0985	-1.8112	2.4948	0.3111	0.7557
DOSECU	-0.0953	0.1878	-0.4633	0.2728	-.5074	0.6119
Scale	1.0383	.	.	.	.	.

NOTE: The scale parameter for GEE estimation was computed as the square root of the normalized Pearson's chi-square.

SAS Output from Model 4

Analysis Of Initial Parameter Estimates

Parameter	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	0.4523	0.6566	0.4746	0.4909
AGE	1	-0.0335	0.0140	5.7381	0.0166
MALE	1	-0.7588	0.3124	5.9019	0.0151
DOSE	1	0.4434	0.1086	16.6771	0.0001
SCALE	0	1.0000	0.0000	.	.

NOTE: The scale parameter was held fixed.

GEE Model Information

Description	Value
Correlation Structure	Unstructured
Subject Effect	SUBJECT (73 levels)
Number of Clusters	73
Clusters With Missing Values	4
Correlation Matrix Dimension	3
Maximum Cluster Size	3
Minimum Cluster Size	2

Working Correlation Matrix

	COL1	COL2	COL3
ROW1	1.0000	0.5747	0.3995
ROW2	0.5747	1.0000	0.4203
ROW3	0.3995	0.4203	1.0000

Analysis Of GEE Parameter Estimates
Empirical Standard Error Estimates

Parameter	Estimate	Empirical Std Err	95% Confidence Limits		Z	Pr>|Z|
			Lower	Upper		
INTERCEPT	0.4270	0.7833	-1.1082	1.9622	0.5451	0.5857
AGE	-0.0332	0.0170	-0.0665	0.0000	-1.958	0.0502
MALE	-0.7028	0.4339	-1.5532	0.1476	-1.620	0.1053
DOSE	0.4409	0.1446	0.1576	0.7242	3.0500	0.0023
Scale	1.0144	.	.	.	.	.

NOTE: The scale parameter for GEE estimation was computed as the square root of the normalized Pearson's chi-square.

Anesthesia Clinical Trial

Dosage (mg/kg)	Patient	Age (months)	Surgery Duration (minutes)	Recovery Room Scores			
				Admission	Minute 5	Minute 15	Minute 30
15	1	36	128	3	5	6	6
	2	35	70	3	4	6	6
	3	54	138	1	1	1	4
	4	47	67	1	3	3	5
	5	42	55	5	6	6	6
	6	35	94	3	3	6	6
	7	30	44	6	6	6	6
	8	57	54	1	1	1	6
	9	30	74	1	1	4	6
	10	41	65	2	2	2	2
	11	34	50	1	3	3	5
	12	62	35	3	3	5	6
	13	24	55	1	1	1	4
	14	39	165	1	3	5	5
	15	66	158	0	2	2	3
20	1	22	75	1	1	1	6
	2	49	42	1	1	1	6
	3	36	58	2	3	3	6
	4	43	60	1	1	2	3
	5	23	64	5	6	6	6
	6	30	46	1	1	2	4
	7	9	114	6	6	6	6
	8	14	50	4	4	6	6
	9	20	95	1	4	5	5
	10	50	125	1	2	2	5
	11	26	127	6	6	6	6
	12	40	173	0	0	0	4
	13	12	110	3	6	6	6
	14	42	47	1	1	5	6
	15	18	97	2	2	3	5
25	1	26	103	1	1	0	3
	2	28	89	3	6	6	6
	3	41	51	2	3	4	4
	4	46	93	1	1	5	6
	5	37	45	2	3	6	6
	6	28	68	6	6	6	6
	7	37	35	3	5	6	6
	8	60	54	2	3	3	6
	9	60	55	1	1	1	3
	10	38	78	0	2	6	6
	11	47	118	0	0	0	0
	12	38	98	1	1	1	4
	13	23	58	1	2	6	6
	14	56	190	1	1	1	1
	15	31	125	0	3	5	6
30	1	46	72	4	6	6	6
	2	38	85	2	4	6	6
	3	59	54	4	5	5	6
	4	16	100	1	1	1	1
	5	65	113	2	3	3	5
	6	53	72	3	4	4	6
	7	50	70	0	5	5	5
	8	13	85	0	0	0	4
	9	17	25	0	0	0	0
	10	70	53	1	1	1	4
	11	13	45	0	0	4	6
	12	60	41	1	1	4	6
	13	12	61	1	1	4	6
	14	27	61	3	5	5	6
	15	56	106	0	1	1	3

SAS Output

Model with Effects of Dosage, Age, and Surgery Duration

Model Information

Data Set	WORK.B
Distribution	Multinomial
Link Function	Cumulative Logit
Dependent Variable	score
Observations Used	240

Class Level Information

Class	Levels	Values
dosage	4	15 20 25 30
id	15	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Response Profile

Ordered Level	Ordered Value	Count
1	0	22
2	1	56
3	2	20
4	3	31
5	4	22
6	5	24
7	6	65

GEE Model Information

Correlation Structure	Independent
Subject Effect	id(dosage) (60 levels)
Number of Clusters	60
Correlation Matrix Dimension	4
Maximum Cluster Size	4
Minimum Cluster Size	4

Analysis Of GEE Parameter Estimates

Empirical Standard Error Estimates

Parameter	Estimate	Standard Error	95% Confidence Limits		Z	Pr > |Z|
Intercept1	-4.3112	0.9266	-6.1274	-2.4950	-4.65	<.0001
Intercept2	-2.7093	0.8806	-4.4352	-0.9833	-3.08	0.0021
Intercept3	-2.3384	0.8864	-4.0757	-0.6012	-2.64	0.0083
Intercept4	-1.8021	0.8717	-3.5106	-0.0937	-2.07	0.0387
Intercept5	-1.4134	0.8790	-3.1361	0.3093	-1.61	0.1078
Intercept6	-0.9361	0.8879	-2.6763	0.8041	-1.05	0.2917
dose	0.0380	0.0297	-0.0203	0.0962	1.28	0.2014
age	0.0139	0.0109	-0.0074	0.0352	1.28	0.2008
durat	0.0071	0.0046	-0.0019	0.0160	1.55	0.1219

SAS Output

Model with Effects of Dosage, Age, Surgery Duration, and Time

Model Information

Data Set	WORK.B
Distribution	Multinomial
Link Function	Cumulative Logit
Dependent Variable	score
Observations Used	240

Class Level Information

Class	Levels	Values
dosage	4	15 20 25 30
id	15	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Response Profile

Ordered Level	Ordered Value	Count
1	0	22
2	1	56
3	2	20
4	3	31
5	4	22
6	5	24
7	6	65

GEE Model Information

Correlation Structure	Independent
Subject Effect	id(dosage) (60 levels)
Number of Clusters	60
Correlation Matrix Dimension	4
Maximum Cluster Size	4
Minimum Cluster Size	4

Analysis Of GEE Parameter Estimates

Empirical Standard Error Estimates

Parameter	Estimate	Standard Error	95% Confidence Limits		Z	Pr > |Z|
Intercept1	-3.9718	1.1295	-6.1856	-1.7579	-3.52	0.0004
Intercept2	-2.1906	1.0759	-4.2993	-0.0819	-2.04	0.0417
Intercept3	-1.7338	1.0841	-3.8587	0.3911	-1.60	0.1098
Intercept4	-1.0291	1.0712	-3.1287	1.0704	-0.96	0.3367
Intercept5	-0.5152	1.0879	-2.6475	1.6171	-0.47	0.6358
Intercept6	0.0914	1.1101	-2.0845	2.2672	0.08	0.9344
dose	0.0428	0.0364	-0.0284	0.1141	1.18	0.2390
age	0.0163	0.0132	-0.0094	0.0421	1.24	0.2141
durat	0.0096	0.0054	-0.0010	0.0203	1.77	0.0771
time	-0.0946	0.0109	-0.1159	-0.0732	-8.66	<.0001