

data on Down's syndrome

DATA a;

```

INFILE 'downs.dat' ;
INPUT  AgeL  AgeU  BirthOrd  Cases Births      ;

MidAge = (AgeL + AgeU)/2 ;

Rate = 1000*Cases/Births;
LogRate = Log( (Cases+0.5)/Births );

LogDenom = Log(Births);

age_c      = MidAge - 30;
age_c_sq   = age_c * age_c;
age_c_cu   = age_c * age_c * age_c ;
    
```

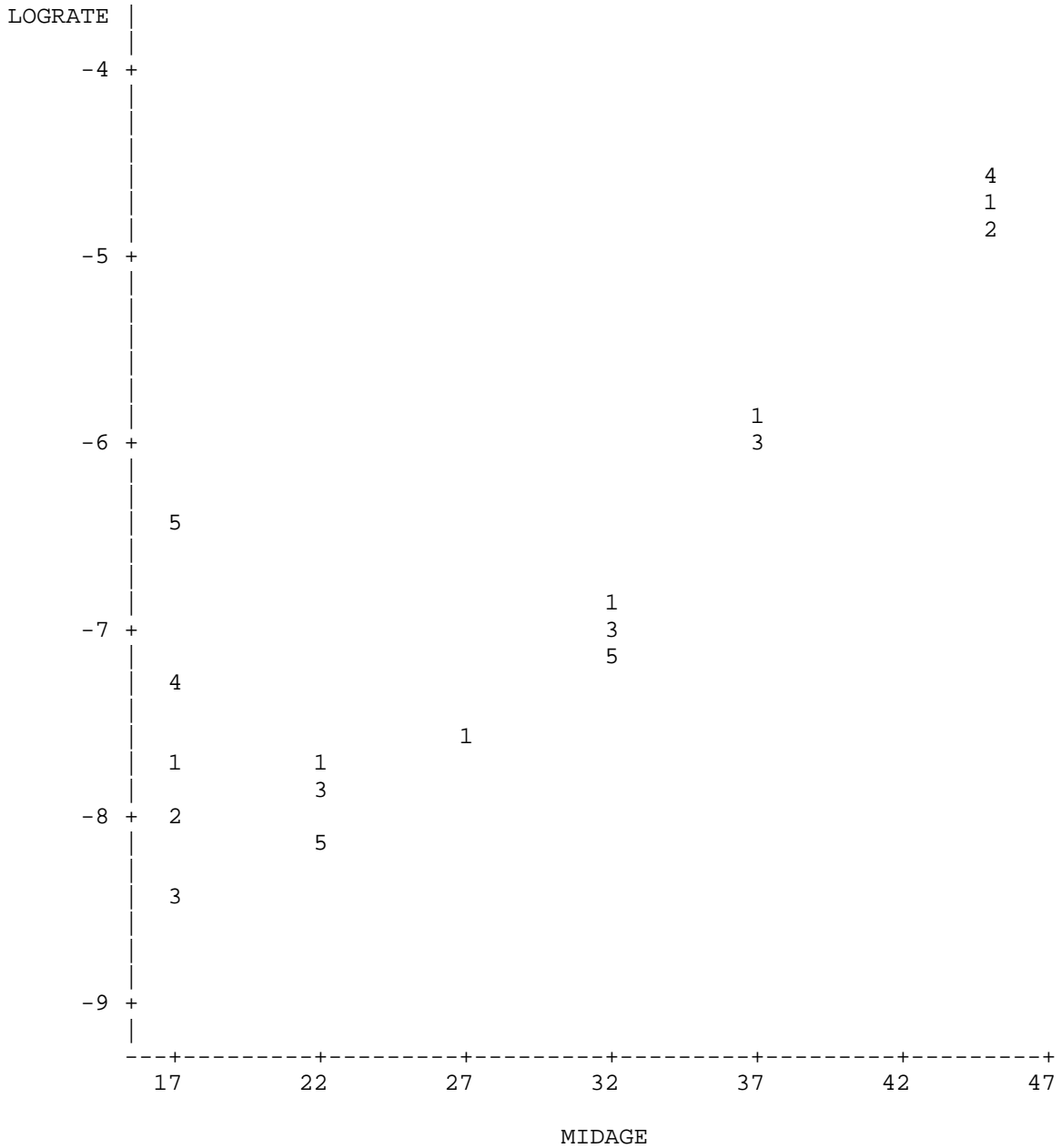
PROC PRINT;

	B	I	R	T	C	B	M	I	I	R	D	R	L	O	G	A	A
	A	A	H	A	R	D	R	A	A	T	A	A	E	D	E	G	G
O	G	G	O	S	T	A	A	A	A	R	E	R	A	N	E	—	—
B	E	E	R	E	H	G	T	T	O	—	S	C	—	O	—	S	C
S	L	U	D	S	S	E	E	E	M	C	Q	U	—	M	C	Q	U
1	15	19	1	107	230061	17	0.46509	-7.66861	12.3461	-13	169	-2197					
2	15	19	2	25	72202	17	0.34625	-7.94854	11.1872	-13	169	-2197					
3	15	19	3	3	15050	17	0.19934	-8.36637	9.6191	-13	169	-2197					
4	15	19	4	1	2293	17	0.43611	-7.33215	7.7376	-13	169	-2197					
5	15	19	5	0	327	17	0.00000	-6.48311	5.7900	-13	169	-2197					
6	20	24	1	141	329449	22	0.42799	-7.75288	12.7052	-8	64	-512					
7	20	24	2	150	326701	22	0.45914	-7.68284	12.6968	-8	64	-512					
8	20	24	3	71	175702	22	0.40409	-7.80685	12.0765	-8	64	-512					
9	20	24	4	26	68800	22	0.37791	-7.86181	11.1390	-8	64	-512					
10	20	24	5	8	30666	22	0.26088	-8.19084	10.3309	-8	64	-512					
11	25	29	1	60	114920	27	0.52210	-7.54935	11.6520	-3	9	-27					
12	25	29	2	110	208667	27	0.52716	-7.54348	12.2485	-3	9	-27					
13	25	29	3	114	207081	27	0.55051	-7.50029	12.2409	-3	9	-27					
14	25	29	4	64	132424	27	0.48330	-7.62710	11.7938	-3	9	-27					
15	25	29	5	63	123419	27	0.51046	-7.57230	11.7233	-3	9	-27					
16	30	34	1	40	39487	32	1.01299	-6.88242	10.5837	2	4	8					
17	30	34	2	84	83228	32	1.00928	-6.89259	11.3293	2	4	8					
18	30	34	3	103	117300	32	0.87809	-7.03292	11.6725	2	4	8					
19	30	34	4	89	98301	32	0.90538	-7.00155	11.4958	2	4	8					
20	30	34	5	112	149919	32	0.74707	-7.19490	11.9179	2	4	8					
21	35	39	1	39	14208	37	2.74493	-5.88526	9.5616	7	49	343					
22	35	39	2	82	28466	37	2.88063	-5.84367	10.2565	7	49	343					
23	35	39	3	108	45026	37	2.39861	-6.02825	10.7150	7	49	343					
24	35	39	4	137	46075	37	2.97341	-5.81440	10.7380	7	49	343					
25	35	39	5	262	104088	37	2.51710	-5.98274	11.5530	7	49	343					
26	40	50	1	25	3052	45	8.19135	-4.78487	8.0236	15	225	3375					
27	40	50	2	39	5375	45	7.25581	-4.91321	8.5895	15	225	3375					
28	40	50	3	75	8660	45	8.66051	-4.74234	9.0665	15	225	3375					
29	40	50	4	96	9834	45	9.76205	-4.62406	9.1936	15	225	3375					
30	40	50	5	295	34392	45	8.57758	-4.75691	10.4456	15	225	3375					

data on Down's syndrome

```
PROC PLOT;  
  PLOT LogRATE*MidAge = BirthOrd;
```

Plot of LOGRATE*MIDAGE. Symbol is value of BIRTHORD.



NOTE: 13 obs hidden.

data on Down's syndrome

PROC GLM;
MODEL LogRate = BirthOrd;

General Linear Models Procedure

Number of observations in data set = 30

Dependent Variable: LOGRATE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.02597671	0.02597671	0.02	0.8917
Error	28	38.53113672	1.37611203		

R-Square	C.V.	Root MSE	LOGRATE Mean
0.000674	-17.31339	1.17308	-6.77555

Source	DF	Type I SS	Mean Square	F Value	Pr > F
BIRTHORD	1	0.02597671	0.02597671	0.02	0.8917

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
INTERCEPT	-6.837975555	-13.61	0.0001	0.50228200
BIRTHORD	0.020807334	0.14	0.8917	0.15144372

PROC GLM;
MODEL LogRate = MidAge;

Dependent Variable: LOGRATE

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	31.2214512	31.2214512	119.17	0.0001
Error	28	7.3356623	0.2619879		

R-Square	C.V.	Root MSE	LOGRATE Mean
0.809746	-7.554328	0.51185	-6.77555

Source	DF	Type I SS	Mean Square	F Value	Pr > F
MIDAGE	1	31.2214512	31.2214512	119.17	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
INTERCEPT	-10.06301844	-31.91	0.0001	0.31531106
MIDAGE	0.10958216	10.92	0.0001	0.01003816

data on Down's syndrome

PROC GLM;
MODEL LogRate = MidAge BirthOrd;

General Linear Models Procedure

Number of observations in data set = 30

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	31.2474279	15.6237139	57.71	0.0001
Error	27	7.3096855	0.2707291		
Corrected Total	29	38.5571134			

R-Square	C.V.	Root MSE	LOGRATE Mean
0.810419	-7.679319	0.52032	-6.77555

Source	DF	Type I SS	Mean Square	F Value	Pr > F
MIDAGE	1	31.2214512	31.2214512	115.32	0.0001
BIRTHORD	1	0.0259767	0.0259767	0.10	0.7591

Source	DF	Type III SS	Mean Square	F Value	Pr > F
MIDAGE	1	31.2214512	31.2214512	115.32	0.0001
BIRTHORD	1	0.0259767	0.0259767	0.10	0.7591

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
INTERCEPT	-10.12544045	-26.74	0.0001	0.37861271
MIDAGE	0.10958216	10.74	0.0001	0.01020424
BIRTHORD	0.02080733	0.31	0.7591	0.06717255

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PROC Logistic; MODEL Cases/Births = MidAge BirthOrd ;

Data Set: WORK.A
 Response Variable (Events): CASES
 Response Variable (Trials): BIRTHS
 Number of Observations: 30
 Link Function: Logit

Response Profile

Ordered Value	Binary Outcome	Count
1	EVENT	2529
2	NO EVENT	2822644

Model Fitting Information and Testing Global Null Hypothesis BETA=0

Criterion	Intercept and Covariates		Chi-Square for Covariates
	Intercept Only	Covariates	
AIC	40557.313	38244.491	.
SC	40570.167	38283.053	.
-2 LOG L	40555.313	38238.491	2316.822 with 2 DF (p=0.0001)
Score	.	.	2811.079 with 2 DF (p=0.0001)

Variable	DF	Parameter Estimate	Standard Error	Wald Chi-Square	Pr > Chi-Square	Standardized Estimate	Odds Ratio
INTERCPT	1	-10.8697	0.0885	15079.6740	0.0001	.	.
MIDAGE	1	0.1378	0.00295	2185.6745	0.0001	0.473818	1.148
BIRTHORD	1	-0.0644	0.0157	16.8743	0.0001	-0.049376	0.938

Association of Predicted Probabilities and Observed Responses

Concordant = 42.8%	Somers' D = 0.364
Discordant = 6.3%	Gamma = 0.743
Tied = 50.9%	Tau-a = 0.001
(7138466676 pairs)	c = 0.682

PROC GenMod; MODEL Cases/Births = MidAge BirthOrd /
Link = logit dist = binomial;

The GENMOD Procedure

Data Set	WORK.A
Distribution	BINOMIAL
Link Function	LOGIT
Dependent Variable	CASES
Dependent Variable	BIRTHS
Observations Used	30
Number Of Events	2529
Number Of Trials	2825173

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	27	218.9919	8.1108
Scaled Deviance	27	218.9919	8.1108
Pearson Chi-Square	27	246.2110	9.1189
Scaled Pearson X2	27	246.2110	9.1189
Log Likelihood	.	-19119.2455	.

Analysis Of Parameter Estimates

Parameter	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	-10.8696	0.0885	15079.6716	0.0001
MIDAGE	1	0.1378	0.0029	2185.6690	0.0001
BIRTHORD	1	-0.0644	0.0157	16.8745	0.0001
SCALE	0	1.0000	0.0000	.	.

NOTE: The scale parameter was held fixed.

data on Down's syndrome

PROC GenMod;

MODEL Cases = MidAge BirthOrd /
Link = log
dist = Poisson
offset = logDenom;

The GENMOD Procedure

Model Information

Description	Value
Data Set	WORK.A
Distribution	POISSON
Link Function	LOG
Dependent Variable	CASES
Offset Variable	LOGDENOM
Observations Used	30

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	27	217.7491	8.0648
Scaled Deviance	27	217.7491	8.0648
Pearson Chi-Square	27	244.7355	9.0643
Scaled Pearson X2	27	244.7355	9.0643
Log Likelihood	.	9360.0014	.

Analysis Of Parameter Estimates

Parameter	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	-10.8628	0.0884	15113.6837	0.0001
MIDAGE	1	0.1375	0.0029	2186.5125	0.0001
BIRTHORD	1	-0.0641	0.0157	16.7658	0.0001
SCALE	0	1.0000	0.0000	.	.

NOTE: The scale parameter was held fixed.

data on Down's syndrome

```
PROC GenMod ORDER = DATA;  
  
Class MidAge BirthOrd;  
  
MODEL Cases/Births = MidAge BirthOrd /  
  
Link = logit  
dist = binomial;
```

The GENMOD Procedure

Model Information

Description	Value
Data Set	WORK.A
Distribution	BINOMIAL
Link Function	LOGIT
Dependent Variable	CASES
Dependent Variable	BIRTHS
Observations Used	30
Number Of Events	2529
Number Of Trials	2825173

Class Level Information

Class	Levels	Values
MIDAGE	6	17 22 27 32 37 45
BIRTHORD	5	1 2 3 4 5

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	20	15.5543	0.7777
Scaled Deviance	20	15.5543	0.7777
Pearson Chi-Square	20	14.6816	0.7341
Scaled Pearson X2	20	14.6816	0.7341
Log Likelihood	.	-19017.5267	.

Analysis Of Parameter Estimates

Parameter	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	-4.7847	0.0490	9543.6836	0.0001
MIDAGE 17	1	-3.1016	0.1076	831.2655	0.0001
MIDAGE 22	1	-3.0821	0.0742	1726.7208	0.0001
MIDAGE 27	1	-2.8532	0.0690	1708.9816	0.0001
MIDAGE 32	1	-2.3190	0.0663	1224.2087	0.0001
MIDAGE 37	1	-1.2031	0.0595	409.4061	0.0001
MIDAGE 45	0	0.0000	0.0000	.	.
BIRTHORD 1	1	0.1315	0.0726	3.2776	0.0702
BIRTHORD 2	1	0.1148	0.0637	3.2431	0.0717
BIRTHORD 3	1	0.0443	0.0612	0.5239	0.4692
BIRTHORD 4	1	0.1142	0.0624	3.3499	0.0672
BIRTHORD 5	0	0.0000	0.0000	.	.
SCALE	0	1.0000	0.0000	.	.

NOTE: The scale parameter was held fixed.

data on Down's syndrome

```
PROC GenMod;      MODEL Cases/Births = MidAge /  
  
                  Link    = logit  
                  dist    = binomial;
```

The GENMOD Procedure

Model Information

Description	Value
Data Set	WORK.A
Distribution	BINOMIAL
Link Function	LOGIT
Dependent Variable	CASES
Dependent Variable	BIRTHS
Observations Used	30
Number Of Events	2529
Number Of Trials	2825173

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	28	235.7686	8.4203
Scaled Deviance	28	235.7686	8.4203
Pearson Chi-Square	28	267.1089	9.5396
Scaled Pearson X2	28	267.1089	9.5396
Log Likelihood	.	-19127.6338	.

Analysis Of Parameter Estimates

Parameter	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	-10.8988	0.0889	15019.8353	0.0001
MIDAGE	1	0.1323	0.0026	2501.0727	0.0001
SCALE	0	1.0000	0.0000	.	.

NOTE: The scale parameter was held fixed.

data on Down's syndrome

PROC GenMod; MODEL Cases/Births = age_c age_c_sq /

Link = logit
dist = binomial;

Distribution BINOMIAL
Link Function LOGIT
Dependent Variable CASES
Dependent Variable BIRTHS
Observations Used 30
Number Of Events 2529
Number Of Trials 2825173

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	27	80.9473	2.9980
Scaled Deviance	27	80.9473	2.9980
Pearson Chi-Square	27	83.6744	3.0991
Scaled Pearson X2	27	83.6744	3.0991
Log Likelihood	.	-19050.2232	.

Analysis Of Parameter Estimates

Parameter	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	-7.1317	0.0278	65951.7993	0.0001
AGE_C	1	0.1099	0.0029	1466.5276	0.0001
AGE_C_SQ	1	0.0037	0.0003	165.6187	0.0001
SCALE	0	1.0000	0.0000	.	.

NOTE: The scale parameter was held fixed.

PROC GenMod; MODEL Cases/Births = age_c age_c_sq age_c_cu /

Link = logit
dist = binomial;

Distribution BINOMIAL
Link Function LOGIT
Dependent Variable CASES
Dependent Variable BIRTHS
Observations Used 30
Number Of Events 2529
Number Of Trials 2825173

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	26	44.0686	1.6949
Scaled Deviance	26	44.0686	1.6949
Pearson Chi-Square	26	42.4516	1.6328
Scaled Pearson X2	26	42.4516	1.6328
Log Likelihood	.	-19031.7839	.

Analysis Of Parameter Estimates

Parameter	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	-7.1852	0.0293	60160.2224	0.0001
AGE_C	1	0.1410	0.0058	584.5830	0.0001
AGE_C_SQ	1	0.0051	0.0003	209.4542	0.0001
AGE_C_CU	1	-0.0002	0.0000	38.0598	0.0001
SCALE	0	1.0000	0.0000	.	.

NOTE: The scale parameter was held fixed.

data on Down's syndrome

PROC GenMod; MODEL Cases/Births = age_c age_c_sq /

Link = Identity
dist = binomial;

```
Distribution          BINOMIAL
Link Function         IDENTITY
Dependent Variable   CASES
Dependent Variable   BIRTHS
Observations Used    30
Number Of Events     2529
Number Of Trials     2825173
```

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	27	224.0613	8.2986
Scaled Deviance	27	224.0613	8.2986
Pearson Chi-Square	27	222.6608	8.2467
Scaled Pearson X2	27	222.6608	8.2467
Log Likelihood	.	-19121.7802	.

Analysis Of Parameter Estimates

Parameter	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	0.0009	0.0000	1223.4647	0.0001
AGE_C	1	0.0002	0.0000	1107.6418	0.0001
AGE_C_SQ	1	0.0000	0.0000	537.1787	0.0001
SCALE	0	1.0000	0.0000	.	.

PROC GenMod; MODEL Cases/Births = age_c age_c_sq age_c_cu /

Link = Identity
dist = binomial;

The GENMOD Procedure

```
Distribution          BINOMIAL
Link Function         IDENTITY
Dependent Variable   CASES
Dependent Variable   BIRTHS
Observations Used    30
Number Of Events     2529
Number Of Trials     2825173
```

Criteria For Assessing Goodness Of Fit

Criterion	DF	Value	Value/DF
Deviance	26	35.2238	1.3548
Scaled Deviance	26	35.2238	1.3548
Pearson Chi-Square	26	33.8765	1.3029
Scaled Pearson X2	26	33.8765	1.3029
Log Likelihood	.	-19027.3615	.

Analysis Of Parameter Estimates

Parameter	DF	Estimate	Std Err	ChiSquare	Pr>Chi
INTERCEPT	1	0.0007	0.0000	667.7660	0.0001
AGE_C	1	0.0001	0.0000	397.5153	0.0001
AGE_C_SQ	1	0.0000	0.0000	577.0956	0.0001
AGE_C_CU	1	0.0000	0.0000	177.2283	0.0001
SCALE	0	1.0000	0.0000	.	.