The cancer data

April 6, 2011

The data:

```
early radical no no 10
early radical no yes 41
early radical yes no 17
early radical yes yes 64
early limited no no 1
early limited no yes 13
early limited yes no 3
early limited yes yes 9
advanced radical no no 38
advanced radical no yes 6
advanced radical yes no 64
advanced radical yes yes 11
advanced limited no no 3
advanced limited no yes 1
advanced limited yes no 13
advanced limited yes yes 5
```

The SAS code and output:

```
        data cancer;
          infile "cancer.dat";
          input stage $ operation $ xray $ survival $ count;

proc catmod;
  weight count;
  model stage*operation*xray*survival=_response_;
  loglin stage|operation|xray|survival;

proc catmod;
  weight count;
  model stage*operation*xray*survival=_response_;
  loglin stage|operation|xray|survival @ 2;

proc catmod;
```

```
  weight count;
  model stage*operation*xray*survival=_response_;
  loglin stage operation xray survival stage*survival;

run;
```

The CATMOD Procedure

Data Summary

Response	stage*operat*xray*surviv	Response Levels	16
Weight Variable	count	Populations	1
Data Set	CANCER	Total Frequency	299
Frequency Missing	0	Observations	16

Population Profiles

Sample	Sample Size
1	299

Response Profiles

Response	stage	operation	xray	survival
1	advanced	limited	no	no
2	advanced	limited	no	yes
3	advanced	limited	yes	no
4	advanced	limited	yes	yes
5	advanced	radical	no	no
6	advanced	radical	no	yes
7	advanced	radical	yes	no
8	advanced	radical	yes	yes
9	early	limited	no	no
10	early	limited	no	yes
11	early	limited	yes	no
12	early	limited	yes	yes
13	early	radical	no	no
14	early	radical	no	yes
15	early	radical	yes	no
16	early	radical	yes	yes

Maximum Likelihood Analysis

Maximum likelihood computations converged.

Maximum Likelihood Analysis of Variance

Source	DF	Chi-Square	Pr > ChiSq
stage	1	0.71	0.3980
operation	1	52.95	<.0001

stage*operation	1	0.05	0.8196
xray	1	9.63	0.0019
stage*xray	1	1.72	0.1900
operation*xray	1	0.80	0.3712
stage*operation*xray	1	1.33	0.2495
survival	1	0.15	0.6979
stage*survival	1	40.09	<.0001
operation*survival	1	1.69	0.1930
stage*operation*survival	1	0.11	0.7425
xray*survival	1	0.48	0.4871

The CATMOD Procedure

Maximum Likelihood Analysis of Variance

Source	DF	Chi-Square	Pr > ChiSq
stage*xray*survival	1	0.87	0.3502
operation*xray*survival	1	0.48	0.4874
stage*operat*xray*surviv	1	0.57	0.4499
Likelihood Ratio	0	.	.

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	Chi-Square	Pr > C
stage	advanced	-0.1006	0.1190	0.71	0.
operation	limited	-0.8663	0.1190	52.95	<.
stage*operation	advanced limited	0.0271	0.1190	0.05	0.
xray	no	-0.3694	0.1190	9.63	0.
stage*xray	advanced no	-0.1560	0.1190	1.72	0.
operation*xray	limited no	-0.1065	0.1190	0.80	0.
stage*operation*xray	advanced limited no	-0.1371	0.1190	1.33	0.
survival	no	-0.0462	0.1190	0.15	0.
stage*survival	advanced no	0.7538	0.1190	40.09	<.
operation*survival	limited no	-0.1550	0.1190	1.69	0.
stage*operation*survival	advanced limited no	-0.0391	0.1190	0.11	0.
xray*survival	no no	-0.0827	0.1190	0.48	0.
stage*xray*survival	advanced no no	0.1112	0.1190	0.87	0.
operation*xray*survival	limited no no	-0.0827	0.1190	0.48	0.
stage*operat*xray*surviv	advanced limited no no	0.0900	0.1190	0.57	0.

The CATMOD Procedure

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6	advanced	radical	no	yes
7	advanced	radical	yes	no
8	advanced	radical	yes	yes
9	early	limited	no	no
10	early	limited	no	yes
11	early	limited	yes	no
12	early	limited	yes	yes
13	early	radical	no	no
14	early	radical	no	yes
15	early	radical	yes	no
16	early	radical	yes	yes

Maximum Likelihood Analysis

Maximum likelihood computations converged.

Maximum Likelihood Analysis of Variance

Source	DF	Chi-Square	Pr > ChiSq
stage	1	0.27	0.6033
operation	1	102.15	<.0001
stage*operation	1	0.59	0.4415
xray	1	10.01	0.0016
stage*xray	1	0.62	0.4324
operation*xray	1	0.01	0.9326
survival	1	0.23	0.6294
stage*survival	1	99.45	<.0001
operation*survival	1	2.06	0.1511
xray*survival	1	0.09	0.7696
Likelihood Ratio	5	7.17	0.2084

The CATMOD Procedure

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	Chi-Square	Pr > ChiSq
stage	advanced	-0.0544	0.1047	0.27	0.6033
operation	limited	-0.8339	0.0825	102.15	<.0001
stage*operation	advanced limited	0.0800	0.1039	0.59	0.4415
xray	no	-0.2589	0.0818	10.01	0.0016
stage*xray	advanced no	-0.0612	0.0780	0.62	0.4324
operation*xray	limited no	-0.00692	0.0818	0.01	0.9326
survival	no	-0.0509	0.1055	0.23	0.6294
stage*survival	advanced no	0.7665	0.0769	99.45	<.0001
operation*survival	limited no	-0.1500	0.1045	2.06	0.1511
xray*survival	no no	-0.0228	0.0779	0.09	0.7696

The CATMOD Procedure

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12	early	limited	yes	yes
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14	early	radical	no	yes
15	early	radical	yes	no
16	early	radical	yes	yes

Maximum Likelihood Analysis
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Maximum Likelihood Analysis of Variance

Source	DF	Chi-Square	Pr > ChiSq
stage	1	1.50	0.2202
operation	1	110.28	<.0001
xray	1	17.46	<.0001
survival	1	0.55	0.4584
stage*survival	1	100.74	<.0001
Likelihood Ratio	10	10.99	0.3583

The CATMOD Procedure

Analysis of Maximum Likelihood Estimates

Parameter		Estimate	Standard Error	Chi-Square	Pr > ChiSq
stage	advanced	-0.0930	0.0759	1.50	0.2202
operation	limited	-0.8271	0.0788	110.28	<.0001
xray	no	-0.2492	0.0596	17.46	<.0001
survival	no	0.0562	0.0759	0.55	0.4584
stage*survival	advanced no	0.7613	0.0759	100.74	<.0001