Analysis Example for Survival Analysis: Cox Model in SAS: PROC SURVEYPHREG (SAS V9.2 TS2M3)

This example demonstrates how to use the SURVEYPHREG procedure for a complex sample corrected Cox survival model. This example illustrates the analysis example presented in Table 10.2 of ASDA, see page 321 for details.

Previous versions of SAS did not offer a survey corrected Cox model capability and this procedure is still experimental in this release of SAS.

Note that the syntax requires the usual weight, strata, and cluster statements to declare the survey design variables plus a dependent variable specification in the form of age of onset of event*variable indicating event or censor with the censor value in parentheses: model ageonsetmde*mde(0). The remainder of the model and class syntax is similar to other SAS modeling procedures. Additional features of this command are a test statement, ODS output tables options, other variance methods such as repeated replication methods, and an estimate statement, see the SAS documentation for details.

```sas
proc surveyphreg data=ncsr ;
  weight ncsrwts ;
  strata sestrat ;
  cluster seclustr ;
  class ed4cat (ref=first) racecat (ref=first) mar3cat (ref=first) sex (ref=last) / param=ref ;
  model ageonsetmde*mde(0) = ed4cat racecat mar3cat sex age / risklimit;
run ;
```

The SAS System

The SURVEYPHREG Procedure

Model Information

```
Data Set WORK.NCSR
Dependent Variable ageonsetmde
Censoring Variable mde
Censoring Value(s) 0
Weight Variable NCSRWTS NCSR sample part 1 weight
Stratum Variable SESTRAT SAMPLING ERROR STRATUM
Cluster Variable SECLUSTR SAMPLING ERROR CLUSTER
Ties Handling BRESLOW
```

Number of Observations Read 9282
Number of Observations Used 9282
Sum of Weights Read 9282
Sum of Weights Used 9282

Design Summary

```
Number of Strata 42
Number of Clusters 84
```

Class Level Information

```
Class Levels Values
ED4CAT  4   1 2 3 4
racecat 4   1 2 3 4
MAR3CAT 3   1 2 3
```
<table>
<thead>
<tr>
<th>SEX</th>
<th>2 1 2</th>
</tr>
</thead>
</table>

Summary of the Number of Event and Censored Values

<table>
<thead>
<tr>
<th>Total</th>
<th>Event</th>
<th>Censored</th>
<th>Percent Censored</th>
</tr>
</thead>
<tbody>
<tr>
<td>9282</td>
<td>1829</td>
<td>7453</td>
<td>80.30</td>
</tr>
</tbody>
</table>

Summary of the Weighted Number of Event and Censored Values

<table>
<thead>
<tr>
<th>Total</th>
<th>Event</th>
<th>Censored</th>
<th>Percent Censored</th>
</tr>
</thead>
<tbody>
<tr>
<td>9282</td>
<td>1779.464</td>
<td>7502.536</td>
<td>80.83</td>
</tr>
</tbody>
</table>

Variance Estimation

Method: Taylor Series

Model Fit Statistics

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Without Covariates</th>
<th>With Covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2 LOG L</td>
<td>31226.798</td>
<td>30366.511</td>
</tr>
<tr>
<td>AIC</td>
<td>31226.798</td>
<td>30386.511</td>
</tr>
</tbody>
</table>

Testing Global Null Hypothesis: BETA=0

<table>
<thead>
<tr>
<th>Test</th>
<th>Statistic</th>
<th>Num DF</th>
<th>Den DF</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likelihood Ratio</td>
<td>860.2864</td>
<td>10</td>
<td>Infty</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Wald</td>
<td>52.9702</td>
<td>10</td>
<td>42</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

The SAS System

The SURVEYPHREG Procedure

Analysis of Maximum Likelihood Estimates

| Parameter | DF  | Estimate | Standard Error | t Value | Pr > |t| | Hazard Ratio | 95% Hazard Ratio Confidence Limits |
|-----------|-----|----------|----------------|---------|-------|------------|----------------|----------------------------------|
| ED4CAT 2  | 42  | -0.056883| 0.067081       | -0.85   | 0.4013 | 0.945      | 0.825           | 1.082                           |
| ED4CAT 3  | 42  | 0.045664 | 0.058045       | 0.79    | 0.4359 | 1.047      | 0.931           | 1.177                           |
| ED4CAT 4  | 42  | -0.090199| 0.063705       | -1.42   | 0.1642 | 0.914      | 0.804           | 1.039                           |
| racecat 2 | 42  | -0.249951| 0.134437       | -1.86   | 0.0700 | 0.779      | 0.594           | 1.022                           |
| racecat 3 | 42  | -0.479031| 0.149019       | -3.21   | 0.0025 | 0.619      | 0.459           | 0.837                           |
| racecat 4 | 42  | 0.077782 | 0.117511       | 0.66    | 0.5116 | 1.081      | 0.853           | 1.370                           |
| MAR3CAT 2 | 42  | 0.502499 | 0.060059       | 8.37    | <.0001 | 1.653      | 1.464           | 1.866                           |
| MAR3CAT 3 | 42  | 0.080631 | 0.088878       | 0.91    | 0.3695 | 1.084      | 0.906           | 1.297                           |
| SEX 1     | 42  | -0.453581| 0.062338       | -7.28   | <.0001 | 0.635      | 0.560           | 0.721                           |
| AGE       | 42  | -0.049505| 0.002381       | -20.79  | <.0001 | 0.952      | 0.947           | 0.956                           |