CPH 931 — Fall 2008 — Dr. Charnigo

Written Assignment 4

Written Assignment 4 is due on Tuesday 18 November at the end of lecture.

All three exercises pertain to a data set on burn patients that can be acquired from {http://www.biostat.mcw.edu/homepgs/klein/burn.html}. Descriptions of the variables are provided on the website. The response variable is T_3, time to *Straphylocous aureaus* infection. Note that information about right censoring of T_3 is contained in δ_3.

[40] 1. Consider the Weibull model

$$\log T_{3,i} = \beta_0 + \beta_1 z_{1,i} + \beta_{10} z_{10,i} + \sigma W_i,$$

with W_i having the distribution shown on p. 4 of Lecture 9.

[10] a. Which of the following would indicate that body cleansing is a better treatment than routine bathing: $\beta_1 < 0$ or $\beta_1 > 0$? Please give a brief explanation for your answer.

[10] b. Use SAS to fit the Weibull model. Report parameter estimates, standard errors, and p-values.

[10] c. Create a plot of estimated survival functions (or estimated cumulative distribution functions) based on the Weibull model. More specifically, display the estimated survival functions for the following four groups of patients: routine bathing without burn in the respiratory tract, routine bathing with burn in the respiratory tract, body cleansing without burn in the respiratory tract, and body cleansing with burn in the respiratory tract.

[10] d. For patients receiving routine bathing without burn in the respiratory tract, find the estimated median time to *Straphylocous aureaus* infection. Find the same for patients in the other three groups. Can the relationships between these estimated median times be described simply in terms of $\hat{\beta}_1$ and $\hat{\beta}_{10}$?
Hint: You can answer this with pencil and paper. For each group, set the estimated survival function equal to 0.50 and solve for t.

[30] 2. Consider the familiar proportional hazards model from CPH 930,

$$\log h_{z_{1,i},z_{10,i}}(t) = \alpha(t) + \beta_1 z_{1,i} + \beta_{10} z_{10,i},$$

where $h_{z_{1,i},z_{10,i}}(t)$ is the hazard of *Straphylocous aureaus* infection at time t.

[10] a. Respond to part a of exercise 1 using the proportional hazards model.

[10] b. Respond to part b of exercise 1 using the proportional hazards model.

[10] c. Respond to part c of exercise 1 using the proportional hazards model.

[30] 3. Consider the extended proportional hazards model

$$\log h_{z_{1,i},z_{10,i}}(t) = \alpha(t) + \beta_1 z_{1,i} + \beta_{10} z_{10,i} + \beta_{12} z_{12,i}(t),$$

where the time-dependent explanatory variable $Z_{12,i}(t)$ is defined as 1 for $t > T_{1,i}$ (i.e., if excision has occurred by time t) and as 0 for $t < T_{1,i}$ (i.e., if excision has not occurred by time t).

[10] a. Which of the following would indicate that excision is protective against *Straphylocous aureaus* infection: $\beta_{12} < 0$ or $\beta_{12} > 0$? Please give a brief explanation for your answer.

[10] b. Use SAS to fit the extended proportional hazards model. Report parameter estimates, standard errors, and p-values.

[10] c. Estimate the factor by which the hazard of *Straphylocous aureaus* infection is multiplied when a patient undergoes excision. Is this factor significantly different from 1? If yes, state whether excision is protective or detrimental.