BIOS 662, Fall 2018

Homework 7

Assigned: Tuesday, November 27

Due: Tuesday, December 4

Calculations need not be done "by hand."

1. This question uses the data in Problem 15.5 on pages 654/5 of the textbook (available on Sakai in the dataset "HW8_Q1.txt", with the "Unknown" category of "Physical Status" coded as 0).

   Note that here the "sample" is the number of operations. These occur at a distinct point in time (and the outcome is vital status at 6 weeks after the operation). Although there is a 4-year time interval, in this particular problem that is essentially irrelevant in terms of incidence. The rate of interest is deaths per 100,000 operations rather than per year (or any other time period).

   SAS versions 9.3 and 9.4 have a procedure for direct and indirect standardization (`PROC STDRATE`). It uses somewhat different formulas for variance estimation from the ones covered in class but you are welcome to use it.

   (a) Calculate the crude death rate (that is, the overall rate, ignoring physical status) per 100,000 operations for halothane and cyclopropane. Are these two rates significantly different?

   (b) Using direct standardization (relative to the total study sample, not just those in the two specific treatment groups), calculate the standardized death rates for halothane and cyclopropane and test whether they are equal.

   (c) Using indirect standardization, with the total study sample as the reference population, calculate the standardized incidence ratio for halothane and test whether $\pi_{halothane}/\pi_{overall} = 1$.

   (Comment: The "total" numbers include those for halothane so the two are not independent, but that complication should be ignored.)

2. The dataset "HW8_SURV.txt" on the Sakai site contains data from a study investigating a new treatment for lung cancer. The variables in the dataset are ID (an identified for each participant), TIMEDEATH (time in days from randomization to death or censoring), DEATH (=0 for a censored observation, =1 for a death), AGE (in years) and GROUP (treatment group;

=1 placebo, =2 the new treatment). The new treatment is intended to be given in addition to usual care. Patients in the placebo group will also be receiving usual care, so the use of a placebo is ethical here.

(a) Compute and plot in the same graph the Kaplan-Meier (product limit) curves for the two treatment groups.

(b) Use the log-rank test to test whether the distribution of survival times is the same in the two groups.

(c) Now use the proportional hazards model to test whether the distribution of survival times is the same in the two groups. That is, use the p-value from the SAS or R output to determine whether the β coefficient differs significantly from 0.

(d) Using your model in part (c), estimate the hazard ratio for group 2 relative to group 1 and provide a 95% confidence interval for the true hazard ratio.

(e) Now include age in the proportional hazards model in part (c). Does age have a significant effect on survival? Does adjusting for age make a substantial difference to the estimate of the treatment effect?

(f) For the placebo group, estimate the median survival time, that is, the time at which $S(t) = 0.5$.