Lab 7: Proportional hazards regression

Data: squamous.csv (see the squamous.pdf file for data dictionary/useful information).

Practical objective: To gain familiarity with implementation/interpretation of survival analysis methods.

Scientific objective: To identify predictors of time to all-cause death among patients with confirmed squamous-cell carcinoma of the urinary bladder.

Noteworthy commands: Below is a list of Stata commands and options that will be helpful for this lab.

- `stset`
- `sts graph`

- `stci`
- `stcox`

Exercises: Below is a set of exercises that we will go through individually, in small groups, and/or together as appropriate and as time permits.

Exercise 1: Load the data set squamous.csv into Stata and tell Stata which variables will define your time-to-event outcome. Generate an overall Kaplan-Meier curve.

Exercise 2: Based on a visual inspection of the Kaplan-Meier curve, state an approximate probability of surviving at least ten years post-diagnosis.

Exercise 3: Estimate the restricted mean survival time. To what time is the restriction?

Exercise 4: Estimate the 25th percentile of the survival distribution.

Exercise 5: Stratify the Kaplan-Meier curve by tumor stage. Based on a visual inspection of the curve, which group has the lowest restricted mean survival time? Confirm your answer by estimating the restricted means in each group.

Exercise 6: Without running a Cox model, do you expect the unadjusted hazard ratio comparing the hazard of all-cause death between Stage 4 (numerator) and Stage 1 (denominator) to be >> 1, << 1, or $\cong$ 1? Is there compelling evidence of a departure from the proportional hazards assumption?

Exercise 7: Fit a Cox model in which you include age, radical cystectomy, tumor size, cancer stage, tumor grade, number of lymph nodes removed, number of positive lymph nodes among those removed, lymphovascular invasion, perineural invasion. Characterize the strength of evidence of an association between cancer stage and hazard of all-cause death.

Exercise 8: Repeat Exercise 7, including the perioperative chemotherapy and radiation. What role do you believe these two variables play? Explain why – based on the data – it may not be a worthwhile endeavor to include an interaction term between perioperative chemotherapy and radiation.