

*BIOS 522: Survival Analysis Methods*

**Activity 5:**

**Introduction to the Cox model**

*This week**, we reviewed linear and logistic regression. We introduced Cox proportional hazards regression for modeling time-to-event data. We defined the partial likelihood and how to handle tied survival times. We predicted survival under the Cox proportional hazards model.*

Problem 1. Discussion board post

Have each small group participant take 1-2 minutes to describe the Cox model example they posted in this week’s discussion board. As a group, identify one example to share with the class and summarize the example using the structure below. Select one group member to present this to the class. (Ideally this will not be the person who originally identified the plot, though that person can offer comments if there is subsequent discussion.)

1. *Provide a reference/link to the study*
2. Goal: [In one or two sentences, describe the primary scientific goal that the study investigators sought to address.]
3. Population: [In one or two sentences, describe the population included in the study. Examples you might include (if relevant to the study): sample size, age, location, time window, and eligibility criteria.]
4. Outcome variable: [In one or two sentences, describe the time-to-event variable being studied. This should include the time origin and the definition of the event. Optional - describe any censoring.]
5. Predictor variables: [Describe the covariates includes in the Cox model, including whether the variables are continuous, categorical, or binary.]
6. Results: [Select some of the key results, reporting important hazard ratios and any other notable model findings. Briefly describe the overall conclusions of the study.]
7. What do you not understand? Flag anything we haven’t covered in class yet. *We will return to these examples in a few weeks!*

Problem 2. Predicted survival under the proportional hazards model

1. Show that for a proportional hazards model .

Answer:

We could also show it via the cumulative hazard function:

1. Write out the density function for an individual with hazard function . Your final expression should be written only in terms of and .

Problem 3. Cox’s partial likelihood (*if time permits*)

Describe how a censored observation contributes to Cox’s partial likelihood.

The partial likelihood is the product of these contributions over all failure times :

Censored observations do not contribute to the numerator, but they do contribute to the denominators via the risk sets. The individual who fails at is compared to all other individuals at-risk at time , including individuals who are censored later in the study.