

Laboratory Assignment 3

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Questions

1. Using the Kaplan-Meier plots, graphically assess the relationship between baseline smoking status and time to death. **Briefly interpret what you see.** In 1-2 sentences describe the limitations of this approach. [include the graph, labeled Figure 1] **(10 points)**
2. **Referring to the code from lecture**, are you able to calculate the overall median survival time in this case? If so, provide an estimate of this quantity, if not, describe why and provide an estimate of a percentile of survival time (of your choice). Interpret the quantity that you estimated. **(20 points)**
3. Answer the following questions about the log-rank test: **(10 points total)**
 - (a) Describe the specific null and alternative hypotheses that the log-rank test is considering here.
 - (b) What do you conclude from this test (use 5% significance criteria)? List a limitation of the inference that you obtain from the log-rank test.
4. Answer the following questions about the Cox models estimated above: **(20 points total)**
 - (a) Why do we use specialized methods for survival analysis (instead of linear or logistic regression, for example)? (Hint: See readings from Vittinghoff et al. 2012 text.)
 - (b) What are the advantages of the Cox model over other survival analysis methods? What is a potential disadvantage of the Cox model?
 - (c) What assumptions, if any, does the standard **Cox** proportional hazards model make?
 - (d) Compare the test of the smoking-mortality association between the log-rank test and the likelihood ratio test from the unadjusted Cox proportional hazards model. What do you observe? Between these two analytic approaches, which one would you prefer, and why?
5. Write the equation for the log-hazard function for the *adjusted* model you estimated. **Clearly define all functions, terms (covariates), and parameters in the model. (20 points)**
6. Complete the following table. How would you interpret the parameter estimate that compares smokers to non-smokers in the **adjusted model**? What measure of association common in epidemiologic research does this correspond to? **(10 points)**

Table 1: Crude and adjusted hazard ratio (HR) estimates of the association between baseline smoking status and mortality. Framingham Cohort Study. 1948-1972, Framingham, MA.

Smoker	Events	Follow-Up Time (years)	Crude HR (95% CI)	Adjusted HR (95% CI)
No				
Yes				

7. Based on the model that included covariate-by-time interactions, is there evidence for a violation of the proportional hazards assumption in any of the variables? Indicate how you arrived at your conclusion. In 1-2 sentences describe in general how you would account for any violations in the proportional hazards assumption (ignoring whether or not there were significant differences here). **(10 points)**

Question 1

Question 2

Question 3

Question 4

Question 5

Question 6

Question 7