

PH 250B Week 4, Tab 3 Ungraded quiz - ANSWERS

Topic: Measures of Association

Problem 1. (Fall 2017 250B Practice exam problem set)

The investigator conducts an analysis to ascertain whether age is associated with the hazard of death in this study population. The output from the analysis is below. (Note: The young patients are the comparison/baseline group).

	Hazard Ratio	Std. Error	Z	P> z	95% CI
Age (categorized)	1.34	0.247	1.59	0.112	(0.934, 1.92)

a. Interpret this Hazard Ratio in words. (1 point)

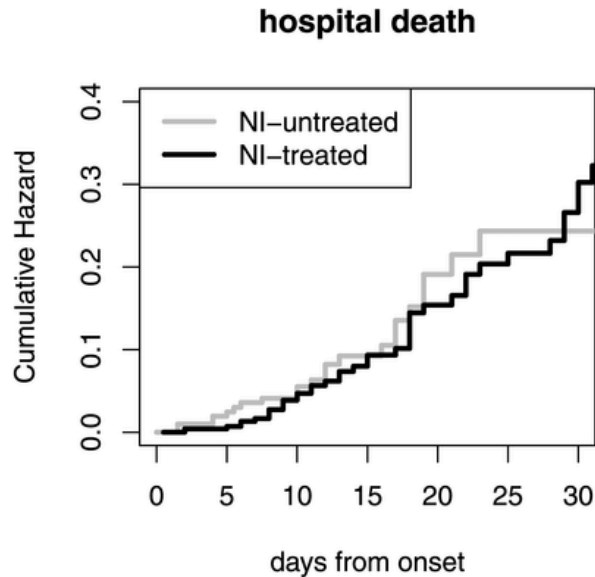
The hazard of death among older lung cancer patients is 1.34 times the hazard of death among younger lung cancer patients.

b. Using all the relevant information presented in the output above, in 1-2 sentences, state what you conclude about the relationship between age and the relative hazard of dying in lung cancer patients. (2 points)

Although the HR is greater than 1.0, the 95% confidence interval includes the null value of 1.0, and its associated p-value is greater than the conventional level of significance ($\alpha=0.05$). This indicates that the relationship between age and hazard of death among lung cancer patients is not statistically significant (we cannot exclude the role of chance).

Problem 2.

An observational study evaluated the impact of treatment on hospital deaths, and the results are shown in the plot below. At the 30 day follow-up, the cumulative hazard was 0.24 among the untreated and 0.31 among the treated.



- a. Estimate and interpret the hazard ratio at the 30 day follow-up.

$$\begin{aligned} \text{HR} &= \text{hazard among the exposed} / \text{hazard among the unexposed} \\ &= 0.31 / 0.24 = 1.29 \end{aligned}$$

The hazard of hospital death among treated patients was 1.29 times the hazard of hospital death among untreated patients.

- b. Would it be sensible to estimate a pooled hazard ratio in this study?

Not necessarily, a pooled HR would obscure potentially meaningful variation in hazard over time. In this study, at the end of the follow-up period the hazard in the treated group is higher than that in the untreated group, but at all other time points it is lower. This pattern might be obscured in a pooled hazard ratio.

- c. Assume that in this study there was no unmeasured confounding and no measurement error, and the appropriate statistical modeling approach was used. Your colleague looks at this graph and concludes that because survival is lower among the treated at 30 days from onset, it is appropriate to infer that treatment caused an increased hazard of hospital death. Explain why this is not a valid inference, focusing your answer on concepts related to hazard ratios.

Hazard ratios are calculated among survivors who did not develop the disease at earlier time points in a study. As a result, they have selection bias built in. Even when 1) there is no unmeasured confounding, 2) there is no measurement error, and 3) the appropriate statistical modeling approach is used, we cannot necessarily conclude that hazard ratios reflect a causal effect.

