EXAM C QUESTIONS OF THE WEEK

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Week of October 1/07

A Cox proportional hazard model is applied to model the effectiveness of a treatment for a particular medical condition. The model has two covariates:

$Z_1 = \begin{cases} 0 & \text{did not receive treatment} \\ 1 & \text{did receive treatment} \end{cases}$ and $Z_2 = \begin{cases} 0 & \text{male} \\ 1 & \text{female} \end{cases}$

The associated regression coefficients in the Cox model are β_1 and β_2.

You are given the 95 percent confidence interval for the relative risk of a female who received treatment to a male who did not receive treatment is $(.315, .955)$,
and the 95 percent confidence interval for the relative risk of a female who received treatment to a male who received treatment is $(.553, 1.212)$.

You are also given that the estimated 5-year survival probability of a male who has the medical condition but does not receive treatment is .6 . Find the estimated 5-year survival probability of a male who has the medical condition but receives treatment.

The solution can be found below.

Week of October 1/07 - Solution

A male who does not receive treatment is the baseline group.
The estimated 5 year survival probability for the baseline group is $S_0(5) = .6$.

The estimated 5 year survival probability for someone with covariate values Z_1 and Z_2 is $[S_0(5)] \cdot exp(Z_1\widehat{\beta}_1 + Z_2\widehat{\beta}_2)$.

For a male who does not receive treatment, we have $Z_1 = 1$, $Z_2 = 0$, so the estimated 5 year survival probability will be $(.6)^{e^{\widehat{\beta}_1}}$.

The 95 percent confidence interval for the relative risk of a female who received treatment to a male who did not receive treatment is (e^{ℓ_1}, e^{u_1}) , where
$\ell_1 = \widehat{\beta}_1 + \widehat{\beta}_2 - 1.96\sqrt{Var(\widehat{\beta}_1 + \widehat{\beta}_2)}$ and $u_1 = \widehat{\beta}_1 + \widehat{\beta}_2 + 1.96\sqrt{Var(\widehat{\beta}_1 + \widehat{\beta}_2)}$.
Therefore, $\widehat{\beta}_1 + \widehat{\beta}_2 = \frac{\ell_1 + u_1}{2} = \frac{ln(.315) + ln(.955)}{2} = -.601$

The 95 percent confidence interval for the relative risk of a female who received treatment to a male who received treatment is (e^{ℓ_2}, e^{u_2}) , where
$\ell_2 = \widehat{\beta}_2 - 1.96\sqrt{Var(\widehat{\beta}_2)}$ and $u_1 = \widehat{\beta}_2 + 1.96\sqrt{Var(\widehat{\beta}_2)}$.
Therefore, $\widehat{\beta}_2 = \frac{\ell_2 + u_2}{2} = \frac{ln(.553) + ln(1.212)}{2} = -.200$.

Then, $\widehat{\beta}_1 = -.601 - (-.2) = -.401$, and for a male who does not receive treatment, we have $Z_1 = 1$, $Z_2 = 0$, so the estimated 5 year survival probability will be $(.6)^{e^{-.4}} = .71$.