

Exam 2010 - Problem 3

(a) The Kaplan-Meier curves are (non-parametric) estimates of the survival function, $S(t)$, which in this case represents the probability of being alive t days after the start of the study. From the plot, we see that patients with ascites have a lower probability of survival.

(b) Cox regression is an appropriate method for censored survival data, relating the hazard of an individual to its covariates. In this case, the model takes the form:

$$h(t|x_1, x_2) = h_0(t) e^{\beta_1 x_1 + \beta_2 x_2},$$

where $h_0(t)$ is the baseline hazard.

(c) The hazard ratio between a patient with ascites and a patient without, and both patients being of the same gender, is given by:

$$HR = \frac{h_0(t) e^{\beta_1 + \beta_2 x_1}}{h_0(t) e^{\beta_2 x_1}} = e^{\beta_1}$$

Using the output, we get the estimated hazard ratio:

$$\hat{HR} = e^{\hat{\beta}_1} = e^{0.894} \approx 2.44$$

Thus, the hazard for a patient with ascites is more than twice as high than for a patient without ascites.

A 95% CI for the HR is given by

$$e^{\hat{\beta}_1 \pm 1.96 \text{se}(\hat{\beta}_1)} = (e^{0.635}, e^{1.153}) = (1.89, 3.17)$$

Thus, we are 95% confident that the HR is covered by $(1.89, 3.17)$.