Part IIIA: Relative risk regression models

Graphical check of proportional hazards

To check proportionality for one covariate assuming that poportionality is ok for the remaining covariates. If proportionality is ok for z_1, we have:

$$\lambda(t; z_1, z_2) = \lambda_0(t) \exp\{\beta_1 z_1\} \exp\{\beta_2 z_2\},$$

where z_2 is the collection of covariates other than z_1.
To check the assumption, create K strata based on the values of z_1

$$\lambda(t; \textit{stratum } k, z_2) = \lambda_{0k}(t) \exp\{\beta_2 z_2\},$$

If the proportionality holds then

$$\lambda_{0k}(t) = \lambda_0(t) \exp\{\beta_{1k} z_1(\textit{stratum } k)\}.$$

Graphical check of proportional hazards

Thus if proportionality is holds, then the log(cumulative hazards) is

$$\log(\Lambda_{0k}(t)) = \log(\Lambda_0(t)) + \beta_{1k} z_1(stratum\ k).$$

To check the proportionality, fit the stratified Cox model and plot $\log(\Lambda_{0k}(t))$ versus time t for each stratum k. The plots should be parallel if the proportionality holds.

Test of proportional hazards

A formal test for proportional hazard is performed by fitting a model of the form

$$\lambda(t; z_1, z_2) = \lambda_0(t) \exp\{\beta_{11} z_1 + \beta_{12} z_1 g(t) + \cdots + \beta_{p1} z_p + \beta_{p2} z_p g(t)\}$$

for a known function $g()$, a common choice is $g(t) = log(t)$. Then test the hypothesis that one or all of β_{j2} are 0. This can be done using likelihood ratio test.