

## Exponential and Weibull Models

We consider the data of times to infection of kidney dialysis patients. In a study Wyse et al. (2011), (given in the book by ?) designed to assess the time to first exit-site infection (in months) in patients with renal insufficiency, 43 patients utilized a surgically placed catheter (Group 1), and 76 patients utilized a percutaneous placement of their catheter (Group 2), a total of 119 patients.

The variables represented in the data set are time to infection in months/10 denoted by  $t$ , infection indicator or event (0=no, 1=yes) denoted by  $\delta$  and catheter placement (1=surgically, 2=percutaneously) denoted by  $trt$ . We analyse the data set using exponential model and Weibull model.

The **exponential model** for this example can be specified as:

$$t_i \sim E(\lambda_i)$$

Where each survival time follows an exponential distribution with parameter  $\lambda_i$  and  $i$  is from 1 to 119. For this example we have only one covariate, catheter placement ( $trt$ ) and therefore  $\beta = (\beta_0, \beta_1)'$ , where  $\beta_0$  denotes the intercept term and  $\beta_1$  denotes the coefficient for the placement covariate ( $trt$ ). Here, the latent field is

$$\lambda_i = \exp(\eta_i)$$

with

$$\eta_i = \beta_0 + trt_i \beta_1$$

where both  $\beta_0$  and  $\beta_1$  are assigned the following priors distributions

$$\beta_0 \sim N(0, 0.001)$$

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There is no hyperparameter used in this model.

The **Weibull model** for this example can be specified as:

$$t_i \sim \text{Weibull}(\alpha, \lambda_i)$$

Here also, the latent field is

$$\lambda_i = \exp(\eta_i)$$

with

$$\eta_i = \beta_0 + trt_i\beta_1$$

where  $\beta_0$  and  $\beta_1$  are assign the following priors distributions

$$\beta_0 \sim N(0, 0.001)$$

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The model has one hyperparameter,  $\alpha$  , we assign the following prior distribution

$$\alpha \sim \text{Gamma}(1, 0.001)$$

## References

Wyse, J., Friel, N., and Rue, H. (2011). Approximate simulation-free bayesian inference for multiple changepoint models with dependence within segments (with discussion). *Bayesian Analysis*, 6(4):501–546.