## Piecewise Constant baseline Hazard Model

In a piecewise constant hazard model, the time axis is divided into several intervals, and the hazard rate is assumed to be constant within each interval but can vary between them. The model is flexible and often used when the hazard rate is not constant over time.

### Notation and Setup

Suppose:

* is the observed survival time for the -th individual.
* is the event indicator (1 if the event occurred, 0 if censored).
* The total observation period is divided into intervals with boundaries
* The hazard rate is constant within each interval and is denoted as for

The survival time of an individual will fall into one of the intervals. Let be the index of the interval in which the event occurs for individual such that .

#### Likelihood for the Piecewise Constant Hazard Model

The likelihood function for the piecewise constant hazard model is constructed based on the hazard rates for each interval. The contribution to the likelihood depends on whether the observation is an event or is censored:

For an individual , if falls into interval , the contribution to the likelihood involves the constant hazard rates up to the interval and accounts for the time spent in each interval:

where

* The product represents that survival probability up to the start of the interval
* The term is the probability of surviving until time within the interval
* The factor accounts for the probability of an event occurring at if it is not censored

#### Complete Likelihood

Assuming individuals, the total likelihood function is:

The log-likelihood is given by:

## Piecewise constant hazard with fixed covariates