Cox Proportional Hazards Model
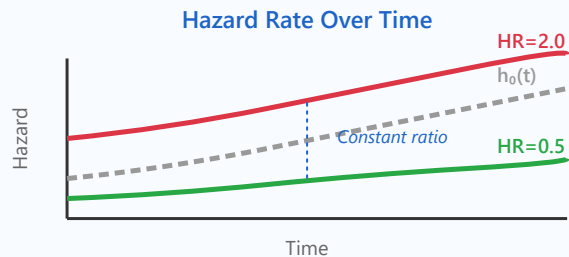
Gold standard for survival analysis in clinical research

Model Formula

$$h(t|X) = h_0(t) \cdot \exp(\beta_1 X_1 + \ldots + \beta_p X_p)$$

Hazard ratio = exp(β)

Hazard Rate Over Time

HR=2.0
$h_0(t)$
Constant ratio
HR=0.5

Hazard · Time

Key Assumptions

- **Proportional hazards:** HR constant over time
- **Linear relationship:** with log-hazard
- **Independent censoring:** uninformative

Testing PH Assumption

Flat trend = PH holds ✓

Time-varying Covariates
Handle changing predictors

Stratification
When PH assumption violated

Penalized Cox
High-dimensional data