Evaluating the Impact of Baseline Hazard Function Misspecification on Treatment Effect Estimation

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Objectives

The goal of this study is to evaluate how misspecifying the baseline hazard function can influence the estimation of treatment effects in survival. This work focuses on conducting simulations to compare the exponential, Weibull and lognormal proportional hazards models to the semi-parameteric Cox proportional hazards model. We also investigate the impact of utilizing an overly complicated model (e.g., Cox) when a less complex model (e.g., exponential) is sufficient.

Statistical Methods

The purpose of proportional hazards modeling is to assess the effectiveness of a particular treatment (X) over survival time T, where the hazard ratio for patient i at time t is defined as $h_i(t) = h_0(t)e^{x_i\theta}$. Here, $h_0(t)$ denotes the pre-specified baseline hazard function, x_i indicates treatment allocation (0=control, 1=treatment), and θ represents the log hazard ratio, or the hazard reduction among treated individuals compared to the control group. Thus, the proportional hazard can be expressed as $\frac{h(t|x_0)}{h(t|x_1)} = e^{\beta(x_0-x_1)}$, which is independent of survival time t.

Each of the models we consider implement different baseline hazard functions, except for the Cox model, which estimates θ without this specification. Baseline hazard functions for the exponential, Weibull, and lognormal models are shown in the table below.

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Simulation Design

Data Generation

Measuring Performance

To assess model performance, we used mean-squared error (MSE) and _____.

Results

Conclusions