

# Dimension reduction in multivariate baseline proportional hazards models

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**Abstract:** In many applications, it is important to summarize the hazard ratio of certain primary exposure variables, while controlling for many other covariates flexibly.

In the literature, a continuously-stratified proportional hazards model has been proposed to extend Cox model and allow fully nonparametric modeling on controlled covariates. However, when the number of covariates is large, the curse of dimensionality leads to unstable estimation of the primary exposure effect. To address this issue, we will study partial sufficient dimension reduction for survival data by introducing a nested family of multivariate baseline proportional hazards models. The model maintains the practically desirable hazard-ratio interpretation of target parameters, while allowing data-adaptive dimension reduction of multi-dimensional covariates to reduce the effect of curse of dimensionality. Under the proposed model, we characterize the semiparametric efficiency bound and propose an efficient estimator. The efficiency gain compared to the continuously stratified proportional hazards model is also proved.