

Title: Causal Hazard Ratio Estimation In Randomized And Observational Studies

Abstract:

The Hazard Ratio (HR) is often reported as the main effect when analyzing survival data. Despite its popularity, the HR suffers from an unclear causal interpretation. As already pointed out in the literature, there is a built-in selection bias in the HR, because the HR conditions on survival at time t . Recently, Martinussen et al.¹ presented the Causal-HR (C-HR), a hazard-based contrast with causal interpretation. In this work, we develop sensitivity analysis techniques coupled with a flexible non-parametric estimation based on kernels estimators to estimate the C-HR. First, we discuss the identification under censoring and estimation approaches for the C-HR in randomized controlled trials. Then, we extend our framework to adjust for potential confounders using the inverse probability of treatment weighting, making our method useful in analyzing observational studies. Our approach is illustrated via extensive simulation studies and a data application.

¹ Martinussen, T., Vansteelandt, S., and Andersen, P. K., “Subtleties in the interpretation of hazard contrasts,” *Lifetime Data Analysis*, vol. 26, no. 4, pp. 833-855, 2020.