Yale

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Causal inference, competing events and mechanism

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ABSTRACT

In failure-time settings, a competing risk event is any event that makes it impossible for the event of interest to occur. For example, cardiovascular disease death is a competing event for prostate cancer death because an individual cannot die of prostate cancer once he has died of cardiovascular disease. Various statistical estimands have been posed in the classical competing risks literature. These include the cause-specific hazard, subdistribution hazard, marginal hazard, cause-specific cumulative incidence and marginal cumulative incidence. Here we will place these estimands within a counterfactual framework for causal inference in order to define, interpret and identify counterfactual contrasts in each of these estimands under different treatment interventions in a given study. We discuss limitations in the interpretation of these existing estimands when a causal treatment effect on the event of interest is the goal and the treatment affects the competing event. Finally, we introduce the new separable effects for causal inference which overcome these interpretational limitations, coincide with effects often cited to justify the clinical relevance of an analysis of path-specific effects and that rely only on assumptions that are testable in a future experiment.