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Simulation from a known Cox MSM using standard parametric models for the g-formula

Inverse probability (IP) weighted estimation of Cox Marginal Structural Models (MSMs) is now a popular approach for estimating the effects of time-varying antiretroviral therapy regimes on survival in HIV-infected patients. Unlike standard estimates, IP weighted estimates of the parameters of a correctly specified Cox MSM may remain unbiased for the causal effect of following one regime over another in the presence of a time-varying confounder affected by prior treatment (e.g. CD4 cell count). A standard estimate might be a likelihood-based estimate of the parameters on treatment in a time-dependent Cox model for the observed failure hazard at each time conditional on past measured treatment and confounders. Previously proposed methods for simulating data according to a known Cox MSM are useful for studying the performance of an IPW estimator as they involve explicit knowledge of quantities required for unbiased IPW estimation. These approaches are limited, however, for studying bias in a standard estimate due only to the presence of time-varying confounders affected by prior treatment as they lack explicit knowledge of the observed conditional failure hazard. Here an alternative approach to Cox MSM data generation is considered that addresses this problem by generating data from a standard parametrization of the observed data distribution. In this case, the true Cox MSM parameters may be derived by the relation between a Cox MSM and the g-formula. This talk will review this relationship in general and work through an example. This approach has limitations including those implied by the g-null paradox theorem.