

Controlling for time-dependent confounding using marginal structural models

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Abstract. Longitudinal studies in which exposures, confounders, and outcomes are measured repeatedly over time have the potential to allow causal inferences about the effects of exposure on outcome. There is particular interest in estimating the causal effects of medical treatments (or other interventions) in circumstances in which a randomized controlled trial is difficult or impossible. However, standard methods for estimating exposure effects in longitudinal studies are biased in the presence of time-dependent confounders affected by prior treatment.

This article describes the use of marginal structural models (described by Robins, Hernán, and Brumback [2000]) to estimate exposure or treatment effects in the presence of time-dependent confounders affected by prior treatment. The method is based on deriving *inverse-probability-of-treatment* weights, which are then used in a pooled logistic regression model to estimate the causal effect of treatment on outcome. We demonstrate the use of marginal structural models to estimate the effect of methotrexate on mortality in persons suffering from rheumatoid arthritis.

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