



## Identification and Estimation of Causal Mediation Effects with Treatment Noncompliance

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Treatment noncompliance, a common problem in program evaluation, poses a serious challenge to the identification of causal mechanisms via causal mediation analysis. This is because the mediated portion of an intention-to-treat (ITT) effect cannot be nonparametrically identified even when there is no unobserved confounding. In particular, the commonly-used naïve approach of ignoring the actual treatment status and applying the “mediation formula” to the assigned treatment, mediator and outcome leads to a biased estimate of the mediated ITT effect. This paper proposes an alternative approach. It is shown that the mediated ITT effects and the local average causal mediation effects (LACME) for compliers can be identified under a local sequential ignorability assumption as well as the standard instrumental variable assumptions. Bias in the naïve estimator is formally characterized. The proposed estimator is illustrated via a Monte Carlo simulation study and applied to data from a large-scale job training experiment. The proposed method, implemented in an open-source R package, enables researchers to investigate causal mechanisms by which the treatment affects the outcome of interest even when treatment noncompliance exists.

**Keywords:** Causal inference; Program evaluation; Instrumental variables; Encouragement design.