Validity of Regression Meta-Analyses versus Pooled Analyses of Mixed Effect Linear Models

Eric V. Slud and Mathewos DeMissie

Statistics Program, Mathematics Department
University of Maryland College Park
College Park, MD 20742 USA
E-mail: evs@math.umd.edu / mathew94@yahoo.com

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Meta-analysis techniques (Hartung, Knapp and Sinha 2008) combine results from many small studies to estimate a common parameter of interest, e.g., a parameter quantifying treatment effectiveness. Often, the statistician has from each study only an estimator of the parameter of interest, together with an estimator of standard error, and the separate estimates are treated as data and fitted within a so-called *meta-regression* model, with the parameter of interest regarded as a common mean, with study as a categorical predictor, and with error term consisting of a constant-variance error plus an independent study effect with standard deviation fixed equal to the separate estimated study standard error. Occasionally, patient-level data including covariates are available from each separate study, in which case pooled patient-level data can be analyzed including fixed covariate effects, with study effects as random intercepts and possibly with random treatment-by-study interactions. Comparisons are sometimes published in biomedical settings between the meta-regression results and the results of pooled mixed (generalized) linear model analyses. This paper reports theoretical and simulation results on the biases of meta-regression estimators versus pooled model estimators, when the latter are properly specified.