A Cluster-Robust Excess Significance Test for Selective Outcome Reporting

Publication bias and other forms of selective outcome reporting are important threats to the validity of findings from research syntheses—even undermining their special status for informing evidence-based practice and policy guidance. An array of methods have been proposed for detecting selective outcome reporting, ranging from graphical diagnostics based on funnel plots to regression test for correlation between effect size and study precision to tests based on explicit models for the selection process. Nearly all of the available statistical tests are premised on the assumption that each study contributes a single effect size, which is statistically independent of the other effect sizes in the analysis. In practice, however, it is very common for meta-analyses to include studies that contribute multiple, statistically dependent effect sizes (e.g., effect sizes for multiple, related outcome measures, effect sizes at different follow-up times, or effect sizes from multiple replications based on a common protocol).

In this work, I propose a test for selective outcome reporting that accounts for dependencies among effect sizes estimated based on a common sample or under a common protocol. The test extends and generalizes the Test of Excess Significance (TES; Ioannidis & Trikalinos, 2007), which diagnoses publication bias by comparing the observed number of statistically significant effect sizes to the number expected based on the power of included studies to detect the estimated average effect. I show that TES is closely related to the score test under a simple version of the Vevea and Hedges (1995) selection model (also known as the weight function model), and propose cluster-robust sandwich estimation methods to handle dependence of effect sizes nested within studies. After describing the cluster-robust excess significant test, I report simulations evaluating its calibration and power compared to a cluster-robust version of Egger's regression.