

Estimating and Adjusting for Publication Bias Using Data Augmentation in Bayesian Meta-Analysis

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Abstract

We introduce a Bayesian approach which estimates and adjusts for selection bias in a set of studies used in a meta-analysis. We use a hierarchical model for study outcome, and propose an additional model component to account for publication bias, which is the possibility that studies of interest are not equally likely to be published and hence observed studies are not a random sample. Estimation is based on the data augmentation principle and the number and outcomes of unobserved studies are simulated using Gibbs sampling methods.

After examining simulation performance, we apply our techniques to a meta-analysis of 35 studies of the relationship between lung cancer and spousal exposure to environmental tobacco smoke. We find that the 95% posterior probability interval for relative risk is shifted downward after allowing for this. These results are consistent with earlier, ad hoc, approaches to this problem.

Keywords and phrases: Meta-analysis, publication bias, missing studies, Markov chain Monte Carlo, MCMC, Gibbs sampling, environmental tobacco smoke, ETS, passive smoking, lung cancer, file drawer problem.

1 Introduction

Meta-analysis seeks to combine the analyses from individual studies into a single statistical analysis with an overall estimate and confidence interval for effect size (Cooper and Hedges, 1994; Hedges and Olkin, 1985). Ideally, greater statistical power can be achieved through meta-analysis than through any one individual study, since data from a greater number of subjects are used, and in recent years there has been an enormous increase in the use of meta-analysis in many medical areas in order to obtain overall evaluations of association in areas where individual studies are equivocal (Olkin, 1992).

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