A Prior Sensitivity Investigation in a Bayesian Network Meta-Analysis

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Prior sensitivity examination plays an important role in applied Bayesian analyses. This is especially true for Bayesian hierarchical models, where interpretability of the parameters within deeper layers in the hierarchy becomes challenging. In addition, lack of information together with identifiability issues may imply that the prior distributions for such models have an undesired influence on the posterior inference. In this context prior sensitivity analysis are currently used. They require repetitive re-fits of the model with ad-hoc modified base prior parameter values.

The main purpose of the analysis is to assess the relative effect of multiple treatment by fitting a network meta-analysis in a Bayesian framework assessing the robustness of inference via sensitivity analysis setting different prior on heterogeneity parameters.

Randomized clinical trials selected are focused on commonly prescribed pharmacological treatments for knee osteoarthrtitis. Study selection has been conducted through Pubmed, EMBASE Scopus, Web of Science, Cochrane and Google Scholar. The outcome variable to assess the variation in symptoms is the standardized mean difference, obtained computing the Hedges' g effect size, in WOMAC score at six month follow up visit. A Bayesian multiple treatment meta-analysis, with random effect and uninformative prior, has been performed using an arm based approach; the convergence has evaluated by Gelman and Rubin diagnostic and the consistency verified with specific tests, as indicated in literature. To determine how inferences are affected by changes in prior, a sensitivity analysis have been performed considering uniform prior ranging 0-2; 0-5; 0-10 on heterogeneity parameter.

Seventeen studies have been considered in full sample, while seven are randomly sampled without replacement to perform prior sensitivity analysis. It is possible to assess that there is a significant effect size for chondroitin and other pharmacological therapies. The estimates are robust respect to prior variation. In subsample the effect sizes are nor significant with a greater variability increasing as increase upper limit of uniform prior showing less robustness.

For meta-analyses including small or moderate numbers of studies, there will be little information in the likelihood regarding the estimation of τ^2, hence the prior can be influential in the analyses. In small meta-analyses, may be appropriate to define informative prior distribution for the between-study variance.