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Identifying and accommodating outlying studies in diagnostic test meta-analyses: a mixture modelling approach

Outlying studies are prevalent in meta-analyses of diagnostic test accuracy studies. Statistical methods for detecting and downweighting the effect of such studies have recently gained the attention of many researchers. These methods dichotomize each study in the meta-analysis as outlying or non-outlying and focus on examining the effect of outlying studies on the summary sensitivity and specificity only. In this work, we develop a random-effects bivariate mixture model for meta-analyzing diagnostic test accuracy studies by accounting for both the within- and across-study heterogeneity in diagnostic test results. Instead of dichotomizing the studies in the meta-analysis, the proposed model generates the probability that each study is outlying and allows assessing the impact of outlying studies on the pooled sensitivity, specificity, and between-study heterogeneity. We illustrate the performance of the developed method on real-life and simulated meta-analytic data.