Dealing with multiple thresholds in diagnostic test accuracy meta-analysis: application of two modelling strategies

Hanne Ann Boon[1], Thomas Struyf[1], Dominique Bullens[2,3], Ann Van den Bruel[1,4] and Jan Y Verbakel[1,4]

[1]Department of Public Health and Primary Care, KU Leuven, Leuven, Belgium
[2]Department of Microbiology, Immunology and Transplantation, KU Leuven, Leuven, Belgium
[3]Clinical division of pediatrics, UZ Leuven, Leuven, Belgium
[4]Nuffield Department of Primary Care Health Sciences, University of Oxford, UK

Background and aims

Dealing with multiple thresholds in diagnostic accuracy meta-analysis can be challenging. We applied two modelling strategies to summarize the available evidence of the diagnostic accuracy of biomarkers for urinary tract infections in children.

Methods

We performed a systematic review and meta-analysis of diagnostic test accuracy studies. We searched seven databases for relevant articles. Eligible studies were prospective or retrospective observational studies that reported the accuracy of urine or blood biomarkers for urinary tract infections in children. Statistical analyses were performed using R software. The bivariate random effects model by Reitsma et al. (2004) ('mada' package) and the model by Steinhauser et al. (2016, 'diagmeta' package), taking into account multiple thresholds per study, were both performed to calculate summary estimates for six biomarkers. We compared the output of two modelling strategies and reported the following characteristics: Area Under the Curve (AUC) and clinical usability (clinically relevant threshold providing a specificity of 0.90). For now, only results for C-reactive protein (CRP) are shown, with the other biomarkers to be presented at the MEMTAB 2020 symposium.

Results

We screened 9975 eligible studies, of which we included 62 in the review. For CRP, we found eight primary studies that reported on 1 to 6 thresholds, ranging from 5 to 200 mg/l. Using the model by Reitsma et al. (2004) and Steinhauser et al. (2016) the AUC was 0.705 (95%CI 0.581 – 0.812) and 0.748 (95%CI 0.617-0.856), respectively. To reach a specificity of 0.90 (diagnosing UTIs), the clinically relevant threshold was 25.33 mg/l, using the second method.

Conclusions

The 'diagmeta' package, implementing the method by Steinhauser et al (2016), allows specification of clinically relevant thresholds according to the intended test aim. All primary study data, including all reported thresholds, can be implemented in the model, resulting in more reliable summary estimates.