The use of generalized p-values and generalized confidence intervals in meta-analysis

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The concept of generalized p-values has been introduced by Tsui and Weerahandi (1989) to perform exact statistical analysis in the presence of nuisance parameters. The term "exact" means that the rejection region in the underlying test problem is exactly described. Moreover, Weerahandi (1993) proposes the concept of generalized confidence intervals on the parameter of interest in the presence of nuisance parameters.

In the models of meta-analysis, either fixed-effects or random-effects model, all the involved variance parameters are nuisance parameters for the inference on the overall treatment effect. The use of generalized p-values and generalized confidence intervals will be discussed in both meta-analysis models. Beside the inference on the overall treatment effect, a generalized confidence interval on the heterogeneity parameter will be presented in the random-effects model.

The methods will be illustrated in examples with normal and binary outcomes in controlled trials. For normally distributed outcomes, the methods can be directly applied. For binary outcomes, first, the distributions of the within-trials variances have to be well-approximated and then the methods can be applied.

References

1. Tsui, K., Weerahandi, S. Generalized p-values in significance testing of hypotheses in the presence of nuisance parameters. JASA 1989; 84: 602-7.
2. Weerahandi, S. Generalized confidence intervals. JASA 1993; 88: 899-905.