

Visualizing the results of a diagnostic accuracy study using comparison regions

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Background

The results of a diagnostic accuracy are often two parameters which we have to interpret together: Sensitivity and specificity, false positive and true negative rate, positive and negative predictive value, test positive rate and sensitivity, change in false positive and true negative rate, change in sensitivity and specificity, etc. For the interpretation, we often assign weights or utilities to each rate, and consider a weighted average. However, different stakeholders may use different weights, and the weights may also vary with the intended application of the test. This raises the question how we should present the results of a diagnostic accuracy study – and in particular their uncertainty – such that we can evaluate different weights in a post hoc situation.

Methods

Post hoc analyses of weighted averages require testing null hypotheses of the type that a weighted average is below a certain threshold. This can be approached by comparing the corresponding half space in the two-dimensional parameter space with a 95% confidence region. However, this is a very conservative approach. We present as an alternative approach so-called comparison regions, such that no overlap between the half space and the comparison region is equivalent to rejecting the null hypothesis at the 5% level. This way we can test any hypothesis about any weighted average, and in addition any hypothesis, which corresponds to the complement of a convex sets. Figure 1 illustrates the point.

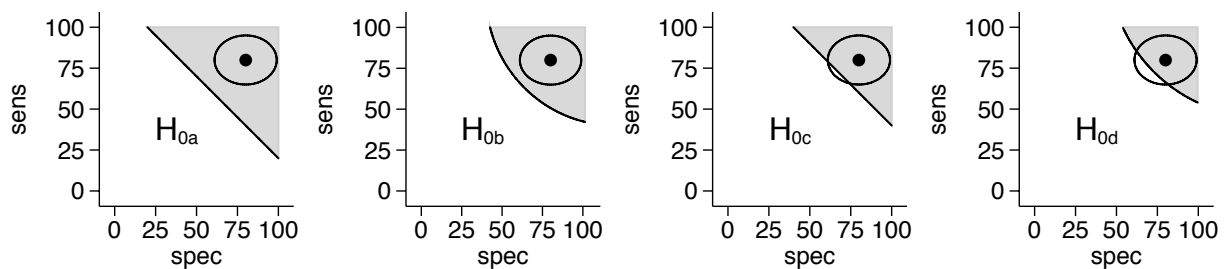


Figure 1: The results of a single arm diagnostic accuracy study visualized by the point estimate and a comparison region. Four different hypotheses are tested post hoc. H0a and H0b can be rejected. H0c and H0d cannot be rejected.

Conclusion:

The results of a diagnostic accuracy study can be presented in a way, which allows post hoc testing of (linear) hypotheses of weighted averages about two diagnostic accuracy parameters.

Keywords

Diagnostic accuracy studies, uncertainty, visualization, sensitivity and specificity, false positive and true negative rate.

References

M. Eckert, W. Vach, On the use of comparison regions in visualizing stochastic uncertainty in some two-parameter estimation problems. *Biometrical Journal*. 2019 (to appear). <https://doi.org/10.1002/bimj.201800232>