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Remarks on “A simple decision analytic solution to the comparison of two binary diagnostic tests” by Vickers *et al.*

Stuart G. Baker*

Biometry Research Group, National Cancer Institute, Bethesda, MD 20892 USA.

Vickers *et al* make a valuable contribution to the comparison of two binary diagnostic tests by taking a decision-analytic approach [1]. They introduce relative diagnostic value which yields a threshold probability for selecting the preferred test. Two additional points are worth noting.

First, although the context differs, the equation relating relative diagnostic value to the odds of prevalence and threshold odds of disease is mathematically identical to an equation for finding the optimal slope of a concave Receiver Operating Characteristic (ROC) curve when the two tests correspond to adjacent points on the ROC curve [2, 3]. The relative diagnostic value is derived by setting equal the net benefits of the two tests. The optimal slope of the concave ROC curve is found by setting equal the net benefits of tests corresponding to adjacent points on the ROC curve, which corresponds to maximizing a function by finding where its slope is zero.

Second the asymptotic confidence interval for the threshold probability corresponding to the relative diagnostic value can be computed with a simple formula derived from the Multinomial-Poisson (MP) transformation [4]. The relative diagnostic value is $R = n_0 (c_1 - b_1) / \{n_1 (c_0 - b_0)\}$. For persons without disease, n_0 is the total number in the sample, c_0 is the number positive on the first test and negative on the second test, and b_0 is the number positive on the second test and negative on the first test. For persons with disease, n_1 , c_1 , and b_1 are defined analogously. Using the MP transformation applied to the logarithm of R (which may have a more symmetric distribution than R) yields, after algebraic simplification, a standard error of $\log(R)$ of

$$se\log R = \left\{ -1/n_0 - 1/n_1 + (c_0 + b_0) / (c_0 - b_0)^2 + (c_1 + b_1) / (c_1 - b_1)^2 \right\}^{\frac{1}{2}}.$$

Let $R_L = \exp\{\log(R) - 1.96 se\log R\}$ and $R_U = \exp\{\log(R) + 1.96 se\log R\}$. Let π denote the prevalence of disease. The formula for the threshold probability is $p = R \pi / (1 + R \pi - \pi)$, which is denoted here by $f(R, \pi)$, so the asymptotic 95% CI for p is $\{f(R_L, \pi), f(R_U, \pi)\}$.

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*sb16i@nih.gov.

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