AGAINST THE USE OF POST-TEST PREDICTIVE PROBABILITIES IN CLINICAL EPIDEMIOLOGY

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Introduction: In the last years, in order to evaluate the diagnostic performance, many Authors use the so-called Post-Test Predictive Probability (Positive and Negative) besides to the usual indices, such as Sensitivity, Specificity, Positive Predictive Value and Negative Predictive Value, Positive Likelihood Ratio and Negative Likelihood Ratio.

Objectives: The principal objective of the present study is to provide a mathematical proof of the equivalence between Post-test Predictive Probabilities and Predictive Values.

Materials and methods:
Positive Post-Test Predictive Probability is formulated as a function of Pre-test Predictive Probability and Positive Likelihood Ratio, while Negative Post-Test Predictive Probability is formulated as a function of Pre-test Predictive Probability and Negative Likelihood Ratio.
In fact, Positive Post-test Predicted Probability is defined as

$$PPPP = \frac{P \times LR+}{1 - P + P \times LR+}$$

where P was defined as the Pre-test Predicted Probability (i.e. the Prevalence), and $LR+$ is the Positive Likelihood Ratio, corresponding to $LR+ = \frac{Se}{1-Sp}$.
In this way, *PPPP* indicate the probability of a subject to be affected by disease (D+), provided that he/she results positive to the diagnostic test (T+), i.e. $p(D+|T+)$. But, and this the point to underline, this is just the definition of Positive Predictive Value *PPV*.
In fact, it is easy to demonstrate that *PPPP=PPV*:

$$PPPP = \frac{P\times LR+}{1-P+P\times LR} = \frac{P\times\frac{Se}{1-Sp}}{1-P+P\times\frac{Se}{1-Sp}} = \frac{P\times Se}{P\times Se+(1-P)\times(1-Sp)} = PPV.$$

On the other hand, we define the Negative Post-test Predicted Probability as
$NPPP = \frac{P\times LR-}{1-P+P\times LR-}$;
similarly to what was done for *PPPP*, it is easy to demonstrate that *NPPP=1-NPV*, where *NPV* is the Negative Predictive Value.

Results: From the above considerations, we have proved the equivalence between *PPPP* and *PPV* and between *NPPP* and *1-NPV*.

Discussions and Conclusions: In conclusion, we think that it is unnecessary, if not detrimental and confusing, to introduce other parameters in addition to *Se*, *Sp*, *LR+*, *LR-*, *PPV* and *NPV* in order to evaluate a diagnostic test performance, especially if they don't get any additional information.

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