A New Graphical Method for Reporting Performance Results of a Diagnostic Test

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Introduction: Reporting diagnostic performance results using standard performance measures, such as: sensitivity, specificity, and predictive values, have been a standard practice for decades. Issues with reporting using only numerical values include: only a subset of performance measures are reported and it is difficult to visualize the complex relationships of the reported performance measures. To overcome these shortcomings, a graphical presentation has been developed to further improve the test results reporting.

Method: The efficacy of a diagnostic test is entirely captured by four performance measures: true-positive, false-negative, false-positive, and true-negative. From these measurements, 15 commonly used statistical measures can then be derived. These derivation formulas were reviewed and common product terms, each contains two performance measures, were identified. From these product terms, corresponding areas were created and arranged in a most logical manner to maximize the number of performance measures that can be captured.

Results: With the proposed graphic presentation, it is shown that a total of 19 commonly used performance measures can be presented in this single graph. To demonstrate the value of this new graphic method, several examples are provided: 1) Relationship between prevalence and algorithm performance specified by sensitivity and specificity, 2) Dependency of prevalence and the single-valued overall accuracy performance measure and the well-known "accuracy paradox" problem, 3) Trade-off of sensitivity and specificity in algorithm design for improved predictive values.

Conclusions: A new graphic presentation has been developed for performance reporting with several major advantages: 1) Large number of performance measures can be presented and visualized simultaneously in a single graph. 2) Allow the complex relationships of all performance measures to be understood more easily, 3) A great teaching tool in explaining the relationships of the commonly used performance measures, and 4) The graph reduces the need to memorize some of the complex formulas for performance measures.