

What Makes a Good Diagnostic Test for Bacterial Infection from a Clinician's Point of View?

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Abstract

It is commonplace for emergency department (ED) staff to encounter undifferentiated patients with potential infection. Clinicians are then tasked with determining which patients have a serious bacterial infection and require antibiotic therapy vs. those with viral or benign infection. While this clinical decision making is far from an exact practice, Bayesian reasoning allows clinicians to estimate the posttest probability of disease given the pretest likelihood of disease and the likelihood ratio of the given diagnostic test.

The concept of diagnostic testing in clinical decision making gives a framework from which to examine what makes a good biomarker or test for bacterial infection. In this framework, a researcher recruits a cohort of patients with suspected disease, measures the value of the diagnostic test (predictor variable), and compares this value to a gold standard outcome (outcome variable). The researcher can then calculate the sensitivity, specificity, likelihood ratio positive (LR+), and likelihood ratio negative (LR-). Importantly, diagnostic tests (e.g., biomarkers) are often measured on scales as continuous variables, which requires additional statistical manipulation (ROC curves, interval likelihood ratios, etc.).

An ideal biomarker for patients with suspected infection would be able to quickly and accurately differentiate patients with and without serious bacterial infection or at least improve the estimation of the posttest probability of disease enough to influence clinical decision making (e.g., administering antibiotics). Many biomarkers have been studied in this context. For example, one study from Self et al. found "Procalcitonin discriminated bacterial pathogens, including typical and atypical bacteria, from viral pathogens with an area under the receiver operating characteristic (ROC) curve of 0.73 (95% confidence interval [CI], .69-.77)." While no one biomarker has been shown to be excellent at predicting whether there exists a bacterial infection, clinicians often incorporate all clinical data (including any biomarkers available) to guide their therapeutic plan.