What constitutes clinical evidence?

A dynamic approach to clinical diagnosis

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Two commonly accepted parameters describing the diagnostic power of various clinical tests are sensitivity and specificity, and likelihood ratios. Evidence-based authorities have repeatedly highlighted the advantages of likelihood ratios in clinical decision making. A less emphasized attribute of likelihood ratios, however, is their role in a dynamic approach to clinical diagnosis.

Sensitivity and specificity

Sensitivity (the proportion of patients with a disease who have positive test results) and specificity (the proportion of patients without the disease who have negative test results) are familiar to family physicians. If testing is intended to establish or rule out a particular diagnosis, these measures can help physicians greatly. A negative test result for a highly sensitive question will rule out the diagnosis, and obtaining a positive test result from a highly specific test will establish the diagnosis.

Unfortunately, some clinicians seek clinical evidence to replace their uncertainty with complete certainty. Typically, evidence for such physicians is something (a test result) that entirely proves or disproves a particular diagnosis. This approach, however, seems rarely, if ever, applicable in family medicine. Uncertainty is an ineradicable part of clinical decision making. In reality, the total number of clinical tests with 100% sensitivity or specificity is very low, and their application in routine clinical practice poses a variety of problems.

Diagnoses are frequently proved or disproved based on sensitivity or specificity of a single test. With this outlook, using tests with sensitivity or specificity nearing 100% becomes logical. Tests with lower sensitivity and specificity can appear to be less effective. Moreover, getting a positive test result from a sensitive test (or a negative result from a specific one) does not change the pretest position of a clinician; this is why these parameters are considered static. We need a tool that can facilitate a dynamic diagnosis to assemble the information derived from a constellation of clinical tests.

Likelihood ratios

Likelihood ratios (LRs) are measures that express the relative likelihood that a given test result would be expected in a patient with (as opposed to one without) a condition. For instance, in the scenario below, a history of cancer is 14.7 times more likely to be found in a patient with a spinal neoplasm. Likelihood ratios for positive test results are derived from the equation sensitivity/1-specificity; LRs for negative test results are derived from the equation 1-sensitivity/specificity. For instance, LRs
for a positive history of cancer are calculated as 0.31/1-0.98 = 14.7. Physicians can multiply their pretest estimate of presence of the disease by this measure to reach a posttest estimate.\textsuperscript{7}

Evidence-based approaches convey the presence of uncertainty in every clinical decision in terms of “probabilistic reasoning.”\textsuperscript{2,3} Using this approach, we cannot (and really do not need to) completely prove or disprove a diagnosis. Rather, we usually intend to refine our estimate of the probability of a disease in order to decrease our uncertainty and refine our position regarding a predefined diagnostic threshold.

It is essential to consider results of each test in clinical practice within the context of information obtained from other tests. Likelihood ratios are dynamic because they can be easily used in a sequence of tests.\textsuperscript{1,3} Using LRs, clinicians can reestimate the probability of a disease according to the integration of history, physical examination, and laboratory results.

**Clinical scenario**

You are consulted by a 62-year-old man who has had severe back pain for 3 months. As he has a history of cancer, he is worried about recurrence. His weight has remained stable, and results of x-ray examination of the lumbar and thoracic spine were normal. If you know that the prevalence of cancer in patients with low back pain is about 0.7\%, how would you approach this patient? Would you recommend magnetic resonance imaging? (Diagnostic properties of characteristics and tests are summarized in Table 1.\textsuperscript{9})

**Resolution of clinical scenario**

Using the sensitivity and specificity of the given tests, diagnosis of cancer could not be proved or disproved. Using positive and negative LRs, however, gives a combined LR of 37.1 (by multiplying 2.7, 14.7, 0.9, 2.6, and 0.4). This number can change the position of the pretest estimate from 0.7\% to about 20\%; that cannot be ignored. Thus, the patient requires further evaluation, including magnetic resonance imaging.

**Summary**

The evidence-based diagnostic approach appreciates physicians’ inability to eliminate uncertainties in clinical medicine. Likelihood ratios can be a dynamic tool for refining probability in clinical settings. Family physicians can use these parameters for better estimation of the strength of clinical evidence.

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**References**


| Table 1. Characteristics of patients and properties of various tests for diagnosing cancer |
|---------------------------------------------|-------------|-----------------|-----------------|
| Age > 50 y | 77 | 71.0 | 2.7 | 0.32 |
| History of cancer | 31 | 98.0 | 14.7 | 0.70 |
| Unexplained weight loss | 15 | 94.0 | 2.7 | 0.90 |
| Duration of pain > 1 mo | 50 | 81.0 | 2.6 | 0.62 |
| Plain radiography | 60 | 99.5 | 120 | 0.40 |
| Magnetic resonance imaging | 93 | 97.0 | 31 | 0.07 |

*Values are adapted from Jarvik and Days.*\textsuperscript{8}