VIEWPOINT

DIAGNOSTIC EXCELLENCE

Improving Efficiency in Medical Diagnosis

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The US health care system experiences wide variation in diagnosis rates for common conditions, much of which is driven by differences in diagnostic practice rather than by underlying patient health.[1] Diagnosis-related errors are common, and a report from 2014 estimated that 12 million patients may experience an outpatient diagnostic error each year.[2] To improve health outcomes and reduce unnecessary spending, the US health system should move toward greater efficiency in medical diagnosis.

It is not correct to equate efficiency with spending less, for example, by reducing testing and potentially diagnosing fewer patients. Efficiency is not only about saving money—it is about making the best use of resources to promote patient health.

In the case of diagnosis, clinicians and patients value the assignment of correct diagnoses, or equivalently, the reduction of diagnostic errors. Diagnostic errors include falsely diagnosing patients with a condition they do not have (false-positive or type I error), and failing to diagnose patients who have a condition (false-negative or type II error). An accurate diagnostic process would correctly diagnose all patients who have the disease and none of the patients who do not.

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But even an accurate diagnostic process is not necessarily efficient because efficiency must balance the clinical value to the patient of detecting the disease against the costs of greater accuracy. The costs of diagnostic accuracy include not only the financial costs of testing and assessment, but also the potential physical harms of initial or downstream testing, and the opportunity costs of clinician time and facility resources. In cases for which treatments are costly and unlikely to improve health outcomes, detecting additional cases could be inefficient. For example, concerns about low benefits from treatment have surfaced in the context of screening for thyroid cancer and prostate cancer in certain populations.[3]

Diagnostic decisions often require detailed evaluation (including testing, imaging, or physical examination) and then clinical judgment about how to interpret the resulting information. Clinicians may apply different diagnostic reasoning for deciding whether to evaluate, test, and diagnose.[4-6] Furthermore, diagnostic decisions in a population of patients depend on systems of care, which determine how information is elicited, recorded, communicated, and processed.

There are at least 2 paths to improving diagnostic efficiency. The first option, given existing diagnostic technologies, is to make the right trade-offs in evaluation and diagnosis. Which risk factors should trigger further diagnostic evaluation? Which criteria should determine diagnosis once an evaluation is performed? Expanding the set of patients who undergo testing or relaxing the diagnostic criteria generally results in fewer false-negative but more false-positive diagnoses. The recognition of these substantive trade-offs between false-positive and false-negative diagnoses has spurred debates among patient and physician groups (eg, in the setting of guidelines for mammography screening and prostate-specific antigen testing).[7,8]

The second option for improving diagnostic efficiency, changing the way in which clinicians gather and process information, has the potential to simultaneously reduce both false-negative and false-positive diagnoses, which has been confirmed in several studies.[4-6] Optimal decision processes are extremely complex, and may depend on a wide array of factors, including patient preferences, history, physical examination, laboratory values, vital signs, and imaging studies. In practice, clinicians often apply simple heuristics and intuition, making diagnostic decisions vulnerable to behavioral biases. A study of 246 265 emergency department visits suggested that some clinicians often overweight salient symptoms, while neglecting to consider the full range of clinical information.[5] As a result, some high-risk patients might not undergo testing and remain undiagnosed, whereas other low-risk patients might be subjected to costly, low-yield tests.[4,5]

Diagnostic efficiency is good in theory, but how can clinicians and care systems put these ideas into practice? The first step toward improving diagnostic efficiency is to measure performance (**Box**). Measuring diagnostic performance is challenging. In many individual cases, it is neither possible to know with certainty whether the patient truly has the disease, nor whether the patient could benefit from treatment. Two potential sets of metrics could be applied to assess the efficiency of the diagnostic process and to measure improvement at the physician, hospital, and system level.

The first set of metrics applies to diagnostic decisions that depend primarily on the findings of resource-intensive testing. Test yields (ie, the percentage of

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Box. Key Points for Diagnostic Excellence

- Efficiency means making the best use of resources to promote patient health.
- Diagnostic efficiency is improved when clinicians make effective use of information to reduce both false-positive and false-negative diagnoses.
- The first step toward improving diagnostic efficiency is to measure diagnostic performance by combining measures of decisions with measures of outcomes.
- Appropriate policy solutions should be tailored to the sources of diagnostic inefficiency.

positive diagnoses relative to total tests) could provide valuable information about diagnostic efficiency for many acute conditions such as pneumonia, acute coronary syndrome, and pulmonary embolism with costly imaging or testing processes. If 2 physicians with similar patients perform about the same number of tests but have different test outcomes (eg, for one physician, the rate is 8 positive test results per 100 patients tested and for the other physician, the rate is 2 positive test results per 100 patients tested), this may suggest the first physician is better able to identify which patients need testing and which patients do not. Improved risk assessment allows clinicians to discern more accurately which patients would benefit from testing. In the emergency department setting for example, this could facilitate the reallocation of tests for pulmonary embolism or acute coronary syndrome from low-risk patients to those at highest risk, potentially leading to substantial improvements in the detection of true-positive cases without changing the total number of tests performed.[4,5]

The yield rate, while informative, is not sufficient on its own to judge diagnostic efficiency because a care system may attain a high yield rate by not testing enough patients. Undertesting will lead to an excess of false-negative test results (ie, people who have the disease but were not correctly diagnosed). Depending on the underlying condition, patients not correctly diagnosed on their first visit may eventually return with worsening symptoms and have the appropriate diagnosis identified.[5,6,9] Thus, a second metric for assessing diagnostic efficiency would be to track revisits by condition. For example, emergency departments could report rates of patients who return within 30 days of an initial visit and receive a diagnosis of acute coronary syndrome, pneumonia, or other common diseases during the second visit. Clinicians who evaluate similar patient populations but experience a higher rate of delayed diagnosis are likely less efficient than some other clinicians.

To improve diagnostic efficiency, efforts should focus on ensuring that clinicians have easy access to decision-relevant information. Better communication and integration of clinical opinions (eg, between radiologists and clinicians at the point of care) could ensure that diagnostic decisions reflect the insight of the full clinical team. Improved health information technology interfaces could support diagnostic decision-making by making the most clinically relevant information (such as prior diagnostic reasoning and laboratory test results) more accessible and clearly contextualized.

Augmented intelligence that partners human insight and machine predictions is another potential pathway to future improvements in diagnostic efficiency. Current practice often relies on coarse risk scores and clinician gestalt to make diagnostic decisions. Machine learning provides new opportunities to construct more accurate predictions of disease risk and could inform smarter decision-making algorithms.[5]

Algorithmic predictions will not replace the need for patient interaction and communication. Patient preferences and values are important determinants of optimal diagnostic practice, and should remain an important consideration in care decisions, even as new decision aids are incorporated into practice. Federal and state policies to support more efficient diagnostic systems are also essential, including payment policies and publicly available quality metrics.[10]

There are important opportunities to improve diagnostic efficiency, matching many patients who currently remain undiagnosed and untreated to high-value care.[1,5,6] Moving closer to this goal would require alignment of physicians, other health care professionals, health systems, and policy design, but could contribute to substantial improvement in the quality of health care with little influence on costs.

ARTICLE INFORMATION

Published Online: May 23, 2022. doi:10.1001/jama.2022.8587

Conflict of Interest Disclosures: Dr Skinner reported receiving personal fees from Sutter Health, Quality Cancer Care Alliance, and Eurasia Group and having equity in Dorsata. Dr Chan reported receiving personal fees from the Analysis Group. No other disclosures were reported.

Funding/Support: Drs Agha and Skinner were supported by grant P01AG019783 from the National Institute on Aging. Dr Agha also was supported by grant 10798 from the Gordon and Betty Moore Foundation. Dr Chan was supported by grant IIR 18-146 from the VA Health Services Research and Development Service.

Role of the Funders/Sponsors: The funders/sponsors had no role in the preparation, review, or approval of the manuscript or decision to submit the manuscript for publication.

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