

VIEWPOINT

DIAGNOSTIC EXCELLENCE

The Rational Diagnostician and Achieving Diagnostic Excellence

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The act of diagnosis begins with human cognition, and diagnostic excellence requires sound thinking. The skill set to acquire accurate and complete information, distill important clinical signals from the noise of irrelevant or distracting elements, interpret data, and synthesize the parts into a cohesive whole is complex and deserves study.

Having medical knowledge and knowing how to perform each step of diagnosis are not sufficient to avoid errors if the reasoning process is flawed or lacking self-awareness or insight into its limitations. Challenges abound to potentially interfere with human rationality,¹ including the constant noise that runs interference against human judgment.² According to one model,³ the diagnostic process entails more than 50 independent factors that cluster into 6 domains: the clinician's individual characteristics (sex, age, experience, and others); features of individual cognitive processes; factors that could adversely affect individual homeostasis; ergonomic and other characteristics of the workplace; features of the particular disease, its manifestness, presentation, and context; and characteristics of the patient and their presentation of the disease.

While each of these factors may exert its own main effect, the diagnostic process may be complicated further when 2 factors interact in a first-order interaction (eg, physician sex with the patient's cultural background) or through a second-order interaction in which 3 factors may be involved. All of these factors and their interactions are capable of generating noise that may interfere with the detection of the diagnostic signal. Well-calibrated, rational decision-making is difficult to achieve, reflected in a significant diagnostic failure rate (defined as "the failure to (a) establish an accurate and timely explanation of the patient's health problem(s) or (b) communicate that explanation to the patient"⁴). Such errors account for an estimated 6% to 17% of hospital adverse events.⁴ Even assuming a diagnostic accuracy rate of 85%, most physicians and patients would likely prefer an even greater level of accuracy and certainty.

Awareness of cognitive factors that may contribute to errors of judgment and decision-making has been known since at least the time of the ancient Greeks. In the 1970s, experimental evidence from Kahneman and Tversky illustrated the nature of cognitive bias and also provided proof of its influence on judgment and decision-making, culminating, in 2002, in the second of 2 Nobel prizes that have been awarded for decision-making (the earlier one having gone to another psychologist, Herbert Simon in 1978). Not surprisingly, vulnerability to cognitive bias is considered the major potential threat against sound clinical decision-making, the medical

exegesis of rationality. Other sources of judgment and decision-making failure include breakdowns in logic, error-producing conditions, and knowledge deficits.⁵

The work of Kahneman and Tversky on heuristics and biases added an important dimension to the understanding of clinical judgment and decision-making. Heuristics are often simple associations, mental shortcuts, or conventional rules widely used to make rapid, intuitive decisions. Clinicians need to be aware that these processes are not deliberately selected but, instead, are largely unconscious and autonomous. Among the heuristics that can introduce cognitive bias are anchoring (judgment set against a specific level), premature closure (judgment reached too quickly), and availability (judgment based on what is easiest to bring to mind).

At the same time, some heuristics, as may be captured in a proverb, can safeguard against bias or error. For instance, routine use of the heuristic "measure twice, cut once" in advance of some tightly-coupled clinical act (such as the "time out" in the operating room before a procedure begins) most likely would lead to fewer irrevocable errors. Many heuristics are the product of repeated practice and deeply ingrained habit. Others may be inherent, surviving as proof of effective decision-making from the past. Still others may arise from emotions, positive or negative, acquired or learned. Overall, heuristics are a useful and indispensable adjunct to everyday living, including the process of medical diagnosis.

As valuable and necessary as heuristics are to function in everyday life, there is a cost to using them. Ironically, these shortcuts ultimately may involve more time and effort. Biases in judgment and decision-making can result in systematic errors in mental activity that influence choices and judgments. The word *bias* connotes negative features, such as weakness of judgment, lack of objectivity, and vulnerability to invisible forces. To the psychologist, however, bias is also an aspect of behavior worthy of study, a unique aspect of human cognition and (social biases aside) not necessarily a failing. Importantly, judgment and decision-making biases provide consistent explanations for why clinicians do the things they do.⁵

Through recognizing the potential implications of judgment and decision-making bias on diagnostic and therapeutic judgments, physicians can take the first step toward ameliorating its potentially detrimental effect. As Pinker noted: "...it's better to work with the rationality people have and enhance it further than to write off the majority of our species as chronically crippled by fallacies and biases."¹ Individuals vary by their degree of rationality as much as by their intelligence, and the

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former can be measured as their RQ (rationality quotient).⁶ Given that psychologists consider vulnerability to cognitive bias as an index of rationality,⁶ a high RQ might be considered a valuable asset in clinical judgment and decision-making. Even so, regardless of a physician's innate or developed capacity for rational thinking, several ancillary approaches could potentially serve to improve the calibration of their diagnostic judgments and other clinical judgments.

Approaches to Improve Diagnostic Judgment

Establish Awareness of How Cognition Works

Some basic elements of cognitive science should be incorporated into medical education. Medical students need a good grounding in common biases in medical decision-making,⁵ as well as familiarity with the dual process approach that differentiates type 1 (intuitive) and type 2 (analytical) processing in decision-making.

Coach Critical Thinking

Thinking patterns and processes determine to some extent how rational clinicians are, in particular, how well they recognize and mitigate potential biases.⁶ Coaching trainees in critical thinking just as they are coached for other of the softer clinical skills in medicine (such as communication, attitudinal awareness, professionalism, and teamwork) appears to be an effective approach.⁷

Make the Work Environment More Conducive to Sound Thinking

Several conditions predispose toward suboptimal decisions, including fatigue, cognitive loading, sleep deprivation, and dysphoria. More effort is needed to address work conditions and design the ambient environment to optimize decision-making.

Circumvent Type 1 Distortion

While clinicians might not stop autonomous processes arising in type 1 (intuitive) processing, metacognitive strategies allow a second chance to examine those processes and control them, if necessary, with an "executive override" using type 2 (analytic) processing. Essentially, such monitoring can be achieved through mindfulness and reflection.

Expand Individual Expertise

While routine expertise is that which develops with basic training and several years of deliberate practice, adaptive expertise is a broader construct that encourages more flexibility and innovation in problem-solving, especially in a dynamic clinical setting.³ This is particularly useful in evaluating patients with atypical, rare, or novel

Key points for diagnostic excellence

1. Cognitive biases and other shortcomings in rational thinking underlie many diagnostic failures.
2. Scientific understanding of cognitive processes, development, and limitations has progressed markedly in recent decades.
3. Techniques to improve clinical reasoning and to counteract cognitive limitations can be taught and applied to the diagnostic process specifically and to clinical decision-making more generally.

medical presentations, for which the usual routine and rules may be insufficient.

Promote Team Cognition

Patients are usually cared for by teams of individuals with a wide range of skills. Yet physicians are primarily responsible for diagnostic decision-making. There is now a growing imperative to share and expand cognition such that the input to the final common pathway of diagnosis is a team effort. More interdisciplinary interaction and shared cognition could be beneficial. The simple act of verbally discussing issues around diagnosis immediately moves the cognitive management of a problem into less vulnerable type 2 (analytical) processing.

Mitigate Judgment and Decision-making Failure

Cognitive forcing strategies, such as promoting clinical maxims like "always develop a differential diagnosis," "rule out worst-case scenario," "until proved otherwise," and "consider the opposite," offer some protection against biases that commonly interfere with the diagnostic process. The routine use of differential checklists, alerting the decision maker to diseases commonly missed, as well as those that must not be missed,⁸ the judicious use of clinical decision support, and the application of clinical decision rules could help overcome some predictable intuitive pitfalls. Mitigating judgment and decision-making biases is emerging as a critical goal for many human endeavors.

Once the antecedents of judgment and decision-making failure are recognized, there is an ethical imperative to remediate them.⁹ When the consequences are diagnostic failures, significant morbidity and mortality may follow. Proactive approaches may help improve the cognitive calibration of clinicians and potentially mitigate distress in patients and families by forestalling avoidable diagnostic errors.

ARTICLE INFORMATION

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REFERENCES

1. Pinker S. *Rationality: What It Is, Why It Seems Scarce, Why It Matters*. Viking; 2021.
2. Kahneman D, Sibony O, Sunstein CR. *Noise: A Flaw in Human Judgment*. William Collins; 2021.
3. Croskerry P. Adaptive expertise in medical decision making. *Med Teach*. 2018;40(8):803-808. doi:10.1080/0142159X.2018.1484898

4. National Academies of Sciences, Engineering, and Medicine. *Improving Diagnosis in Health Care*. National Academies Press; 2015.

5. Croskerry P. *The Cognitive Autopsy: A Root Cause Analysis of Medical Decision Making*. Oxford University Press; 2020. doi:10.1093/med/9780190088743.001.0001

6. Stanovich KE, West RF, Toplak ME. *The Rationality Quotient: Toward a Test of Rational Thinking*. MIT Press; 2016. doi:10.7551/mitpress/9780262034845.001.0001

7. Abrami PC, Bernard RM, Borokhovski E, Waddington DI, Wade CA, Persson T. Strategies for

teaching students to think critically: a meta-analysis. *Review of Educational Research*. 2015;85(2):275-315. doi:10.3102/0034654314551063

8. Ely JW. "Preflight checklists" for diagnosis: a personal experience. *Diagnosis (Berl)*. 2014;1(1):131-134. doi:10.1515/dx-2013-0008

9. Stark M, Fins JJ. The ethical imperative to think about thinking. *Camb Q Healthc Ethics*. 2014;23(4):386-396. doi:10.1017/S0963180114000061