PERSPECTIVE

Medical education: Theories on clinical reasoning

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Abstract

Formulating an appropriate working diagnosis and plausible differential diagnoses is the hallmark of good clinical practice. Clinical reasoning is defined as the cognitive process that leads to a diagnosis and the formulation of a diagnostic plan. The process of clinical reasoning is discussed in terms of analytic, nonanalytic, and dual-process theories. Nonanalytic processes are experiential, intuitive, and are often triggered automatically. Analytic processes are hypothetico-deductive, and they operate during unfamiliar or complex scenarios. Both process categories are at play in the dual-process theory of clinical reasoning, which is often associated with better diagnostic competence. Developers of medical education curricula, therefore, should use heuristic techniques that trigger dual-process clinical reasoning.

Keywords: clinical reasoning, analytic reasoning, nonanalytic reasoning, dual-process theory, medical education

Theories on clinical reasoning

Clinical reasoning involves the cognitive processes that clinicians execute to formulate, plan, and implement diagnostic and clinical management strategies.

It is the basis of professional practice, and it integrates clinical problem-solving with diagnostic reasoning.

Clinical reasoning requires a dynamic process of gathering information about the problem presented, analysing and assessing the available data, and formulating appropriate hypotheses.[1] It is a core competency expected of all clinicians.

Thinking relies on 2 major systems: a quick, nonanalytic, intuitive approach and a more conscious but slower analytic approach.[2]

When a clinician is faced with a problem, the intuitive process is automatically triggered, beginning with the quick and spontaneous recognition of the problem. In the clinical context, this largely involves memorized experiences, based on pattern recognition, which may lead to a working diagnosis that is based largely on comparisons with previous examples from memory.[3] Therefore, the knowledge base in this largely Bayesian model is purely probabilistic.

Nonanalytic reasoning is important, as it is likely to lead to new and useful information through inference and logic. It is referred to as ampliative (Pierce's typology of reasoning).[4] Ampliative reasoning can be inductive or abductive.

Inductive logic is "the expectation that similar episodes will have similar sequels".[5] This rule, however, seems to have more relevance in research, as opposed to clinical practice, and clinicians tend to use inductive reasoning only in treatment planning, wherein the risks and benefits of treatment options are considered educated guesses.[6]

Abductive ampliative inference, alternatively called hypothesis or retroduction, is the method of finding explanations for surprising phenomena, which involves studying the facts and devising explanatory theories. Abductive reasoning may technically be referred to as "inference to the best explanation".[7] Abduction searches for a theory that explains a situation that is not easily understood through routine explanation, and the clinician then either considers this surprising situation as a variant of the known or invents a hypothesis to make sense of the presentation. Once the hypotheses have been generated, the clinician makes choices for the best fit based on "testability", "explanatory power", and "cost of verification".[4] This 2-step approach of hypothesis generation and selection thus best explains the nonanalytic abductive reasoning process.

The nonanalytic reasoning strategy is well adapted to the strengths and limitations of human information handling and is not simply a suboptimal form of processing. Indeed, some reliance on correlations with similar past clinical cases is a healthy strategy for expert performance in practice. Clinicians often exhibit remarkable recall of individual patients and situations encountered after years or even decades.

Analytic reasoning is the other mode of inference in clinical practice. Deduction is the only form of analytic reasoning wherein the connection between premise and

conclusion is logical: if the premise is true, the conclusion is also logically true.[6]

This hypothetico-deductive analytic process is triggered when the clinician faces an unfamiliar clinical problem or a complex case, for which the intuitive system is unable to generate a conclusion. Hypotheses are generated via the activation of stored knowledge and are accepted, rejected, modified, or further tested based on how well the unfolding scenario fits with the hypothesis generated.[8] In such situations, clinicians often fall back on their pathophysiological knowledge and apply "forward reasoning" approaches to generating differential diagnosis lists.[9]

The dual-process theory suggests that both analytic and nonanalytic reasoning processes are often simultaneously at play in clinical decision-making. Indeed, the use of both types of processes may be associated with better diagnostic competence.[10]

The intuitive and experience-based process is activated first, virtually subconsciously, in the reasoning process, resulting in the genesis of possible solutions from the working memory. The analytic and more rational mode is then prompted to confirm or annul the significance of these conclusions.[11]

Theoretically, the analytic system plays a monitoring role over the intuitive system.

In the clinical context, intuitive (nonanalytic) pattern recognition allows the clinician to rapidly formulate diagnostic assumptions[12] and confirm these assumptions through a hypothetico-deductive (analytic) process.

Implications for medical education

As clinical reasoning is a major determinant of a clinician's expertise, it needs to be incorporated into the educational objectives of medical curricula.

Students should be given opportunities to use intuitive reasoning and formulate diagnostic hypotheses at index patient encounters. Discussions about how these hypotheses arise from intuition must then be initiated, allowing for feedback that explores the students' intuitive reasoning. The development of intuition is encouraged by exposing students early to a variety of clinical cases and by problem-based learning.

Emotion also plays a role in the clinical reasoning process, with the intuitive system being particularly sensitive to the clinician's affective state.[11] Moreover, the reliability of intuitive responses can be influenced by the feelings of the physician towards the patient. Perceiving the patient as "difficult" or "manipulative", for example, will influence the clinician's reasoning process.[13] The affective valence of intuitive judgement, therefore, should be bridged to the need to teach emotional intelligence—the awareness of one's feelings and those of others—to clinicians.

The ability of the student to identify relevant "hints" during patient encounters determines the effectiveness of the intuitive process. Underappreciation or overappreciation of these cues could lead to diagnostic inaccuracies. The development of expertise and the ability to recognize misleading or distracting cues is enhanced by repeated exposure to targeted skills.[14]

An understanding of intuitive and analytical thinking processes will, therefore, provide a guide for instruction. How knowledge is stored is critical to expertise in clinical reasoning, and curricula should be designed so that trainees store knowledge in a way that is clinically relevant. Trainees can learn clinical reasoning effectively in everyday practice if instructors provide guidance on the cognitive processes involved in making diagnostic decisions.[15]

One way of enhancing this process is via the use of scripts, which are goal-oriented systems of data designed to aid in the efficient performance of tasks. Features of the patient's presentation are perceived by the clinician, who is then able to activate illness scripts that effectively link components of these features with knowledge about how they relate to each other.

The illness script then leads the clinician to make inferences, which are then used to rule hypotheses in or out in the diagnostic process. Deeper reasoning occurs if 2 or more illness scripts are activated simultaneously for each clinical encounter, or if findings do not fully fit any illness scripts known to the clinician.[16] Ignoring such misfits may lead to diagnostic errors.

The activation of illness scripts is based on pattern recognition and occurs without conscious awareness, with prior experiences helping in the acquisition of these schemas, making such activation largely a nonanalytic reasoning process.

Conclusions

Challenges in formulating appropriate diagnosis and treatment plans often occur because of inadequate knowledge, flaws in data gathering, or inappropriate approaches to information processing. Some of the educational strategies for facilitating the acquisition of clinical reasoning skills are exposure to a wide variety of clinical cases; activation of previous knowledge; development of illness scripts; sharing expert diagnostic strategies; motivating students to prioritize differential diagnoses; and encouraging reflection, metacognition, deliberate practice, and formative feedback.[17]

Most medical curricula rely heavily on the hypothetico-deductive approach to diagnosing clinical problems; however, incorporating intuitive reasoning through experiential learning, as well as early exposure to clinical encounters and appropriate use of illness scripts, will enhance clinical reasoning potential and diagnostics competence.

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