

Review

Real-world medical diagnosis: Intuitive process revisited (review)

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One cannot overlook the fact that diagnostic errors which constitute the largest proportion of errors in medical care have a direct bearing on patient's outcomes. Clinical reasoning ability is closely related to the avoidance of diagnostic errors and clinical reasoning during diagnosis has been explained by a "dual processes model" comprising two elements. The first is the intuitive process (System 1), which emphasizes intuition-based rapidity and the other is the analytical process (System 2), which is an analytical and a scientific process. In this review, the underemphasized intuition-based approach of the first system is highlighted and examined from a clinical and practical perspective.

Key words: Diagnosis, analytical, clinical, System 1, System 2.

INTRODUCTION

Diagnostic errors comprise a large proportion of errors in medical care and have been noted to be highly correlated with morbidity (Kohn et al., 2000; Schiff et al., 2009; Kostopoulou et al., 2008; Brennan et al., 1991; Wilson et al., 1995; Thomas et al., 2000; Tokuda et al., 2011). Undiagnosed and erroneously diagnosed conditions exert a major temporal effect on patient outcomes particularly of patients suspected with diseases requiring urgent care and those with life-threatening diseases. Clinical reasoning ability has been noted as a major competency requirement of professional physicians. This ability is closely related to the avoidance of diagnostic errors (Graber et al., 2005).

THE DIAGNOSTIC PROCESS

The diagnostic process, which is generally termed clinical reasoning, has been explained by a "dual processes model" consisting of two elements (Norman, 2009). The first, the intuitive process (System 1), is based on intuitive thinking, while the other, the analytical process (System

2), is based on analytical thinking. This dual-process model has been widely explored in the field of psychology and has also been adopted into the clinical reasoning field of medicine (Evans, 2008; Stanovich, 1999; Croskerry, 2009; Thompson, 2011). The general features of both processes are shown in Table 1.

In System 1, diagnosis is based on intuitive mental simulations performed subconsciously and informed by the extensive clinical experience of the physician (Gary, 2004). Such a process is termed "heuristics" in cognitive psychology. In particular, this involves "pattern recognition" to determine the correct diagnosis from typical clinical symptoms and findings (Ark et al., 2006) or using "clinical pearls" to facilitate rapid diagnosis by methods similar to heuristics (Mangrulkar et al., 2002; Lorin et al., 2008). A skilled physician can often accurately and rapidly make a diagnosis using these processes. The prominent role of intuition in diagnosis has been noted in studies conducted to determine the same, particularly with respect to complex diseases (Shah et al., 2011; Smithline et al., 2003). A drawback of System 1 is its susceptibility to a range of cognitive biases because of its nature as a linear thought process associated with experience-based intuition.

The analytical process (System 2) uses logically and carefully prepared frameworks and algorithms; Bayes'

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Table 1. The general features of Systems 1 and 2.

System 1	↔	System 2
Intuitive	Complementary/switching	Analytical
Heuristics, clinical pearls	Examples	Frameworks, checklists, Bayes' theorem
One-shot diagnosis	Nature of cases	Complex cases
Rapid, artistic	Advantages	Analytical, scientific
May be affected by biases	Drawbacks	Time-consuming, sometimes inefficient, large burden of knowledge
Experts	Used by	Beginners

theorem, a method for determining post-test probability by pre-test probability and likelihood ratios (Moreira et al., 2008) and mnemonics. System 2 is a more logical and systematic approach than System 1. It is a diagnostic method that allows for a mental "safety net" in which few mistakes are made. However, it has the drawback of sometimes being lesser efficient than System 1, as it takes longer for the physician to perform the analysis and follow the pathways in their memory (Norman, 2009). Because of the safer-looking profiles by the use of System 2, there has been greater emphasis on System 2 rather than System 1. However, the time-consuming process as well as the unrealistic application for patients with common and typical presentations of System 2 has brought resurgence of a great interest of the System 1 intuition process.

DISCUSSION

One might well wonder which method is superior, although they differ so much in their features. Which should the clinician employ in the tradeoff between a speedy or comprehensive diagnosis? Let us consider the clinical site. What have we noticed in our experience of busy clinical settings?

In most cases, we seem to unthinkingly use both processes based on the context of the patient's clinical history and the conditions in real clinical settings. For example, it is often possible to make an intuitive diagnosis in cases involving a common differential diagnosis or in cases such as those previously encountered by the physician. Conversely, the analytical process is preferential for complex or unfamiliar cases, but a diagnosis can also be reached by flexibly using a combination of the intuitive and analytical processes. Thus, we flexibly switch between System 1 and 2, as befits the case in question. Cases that would be difficult for any physician can sometimes be diagnosed rapidly. This is often because of an intuitive diagnosis, the speed of which is its selling point. This property of the intuitive thinking process is part of the art of diagnosis and the use of tacit knowledge, and this rapid and skillful diagnostic technique is a source of infatuation among clinicians at present, considering that much remains unknown about the composition of the

thinking process.

When considering its advantages, there is a great clinical advantage to intuitive thinking. There are many cases in which an appropriate level of rapidity takes precedence over comprehensiveness and logic, particularly for clinicians facing the day-to-day reality of the clinical setting. From this perspective, rather than total commitment to a diagnostic style of logically and thoroughly noting differentiation, the development of clinical skills placing a greater emphasis on intuitive thinking, as well as striving toward such an education may be important. Important specific measures for improving intuitive diagnostic techniques include sharing a wealth of excellent, accumulated "clinical pearls." Positive and persistent efforts to apply heuristics with keen powers of observation and ample accumulation of daily clinical experience are additional essential points. Patients should be exposed to no undue risks because of intuitive thinking if the confounding bias that comprises the key point of concern is adequately mitigated by the counterpart method (the analytical process) to avoid cognitive biases.

CONCLUSION

Consciously and complementarily, using dual processing of intuitive and analytical processes lends range and flexibility to every physician's diagnostic technique. Dual processing is important for refining the diagnostic capability of clinicians. There have been intense discussions on the art of diagnosis and clarification of tacit knowledge. Generalizing these metaphysical concepts into an educational, transmittable form should improve the quality of medical care, especially the quality of primary care. Potential benefits include curbing the overreliance on special investigations. In view of health economics, this means striving toward major reduction in personnel and time costs for health professionals, in addition to positively impacting the health of patients as individuals.

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