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Evidence and its uses in health care and research: The role of critical thinking

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Summary

Obtaining and critically appraising evidence is clearly not enough to make better decisions in clinical care. The evidence should be linked to the clinician's expertise, the patient's individual circumstances (including values and preferences), and clinical context and settings. We propose critical thinking and decision-making as the tools for making that link.

Critical thinking is also called for in medical research and medical writing, especially where pre-canned methodologies are not enough. It is also involved in our exchanges of ideas at floor rounds, grand rounds and case discussions; our communications with patients and lay stakeholders in health care; and our writing of research papers, grant applications and grant reviews.

Critical thinking is a learned process which benefits from teaching and guided practice like any discipline in health sciences. Training in critical thinking should be a part or a pre-requisite of the medical curriculum.

key words: **critical thinking and decision making in medicine • patient safety • quality of care • clinical reasoning and argumentation • logic of medicine • using evidence**

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Background

Sackett et al. originally defined evidence based medicine (EBM) as '… *the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients', and its integration with individual clinical expertise* [1].' In the nearly two decades that have intervened, there has been significant uptake of the idea that clinical care should be based upon sound, systematically researched evidence. There has been less emphasis on how clinical expertise itself might be improved, perhaps because the concept is more amorphous and difficult to define.

Clinical expertise is an amalgam of several things: there must be a solid knowledge base, some considerable clinical experience, and an ability to think, reason, and decide in a competent and well-calibrated fashion. Our focus here is on this last component: the faculties of thinking, reasoning and decision making. Clinicians must be able to integrate the best available critically appraised evidence with insights into their patients, the clinical context, and themselves [2]. To accomplish this integration, physicians need to develop their critical thinking skills. Yet historically this need has not received explicit attention in medical training. We believe that it should.

As an illustration of the use of critical thinking in clinical care, consider the following clinical scenario from emergency medicine*: A 52-year-old male presents to the emergency department of a community centre with a complaint of constipation and is triaged with a low level acuity score to a 'minors' area. The department is extremely busy and several hours elapse before he is seen by the emergency physician. His principal complaint is constipation; he hasn't had a bowel movement for 4 days. His abdomen is soft and non-tender. A large amount of firm stool is evident on rectal examination. He recalls a minor back strain a few days earlier. The physician orders a soapsuds enema and continues seeing other patients. After about 30 minutes he finds the nurse who administered the enema; she reports that it was ineffective. He orders a fleet enema which again proves ineffective. The nurse expresses her opinion that the patient is taking up too much time and suggests he be given an oral laxative and another fleet enema to take home with him. She is clearly unwilling to continue investing her effort in a patient with a trivial complaint. Nevertheless, the physician decides to administer a third enema himself. The third enema is only marginally effective and he then decides to disimpact the patient. The physician notes poor rectal tone and enquires further about the patient's urination. He says he has been unable to urinate that day. On catheterisation he is found to have 1200cc. Neurological findings are equivocal: reflexes are present in both legs and there is some subjective diminished sensation.*

A diagnosis of cauda equina syndrome is made and the emergency physician calls the neurosurgery service at a tertiary care hospital. It is now late in the evening. The neurosurgeon is reluctant to accept the working diagnosis. He suggests that the loss of sphincter tone might be due to the disimpaction, and argues that there was no significant history of back injury or convincing neurological findings. When the ED physician persists, the neurosurgeon suggests transferring the patient to the tertiary hospital ED for further evaluation and asks for a CT investigation of the patient's lower spine before seeing him. The CT reveals only some minor abnormalities and the patient is kept overnight. An MRI is done in the morning. It shows extensive disc herniation with compression of nerve roots. The patient subsequently undergoes prolonged back surgery.

This case had a good outcome, although things might have been dramatically different. The patient might have suffered permanent neurological injury requiring lifelong catheterisation for urination.

Our scenario illustrates some key points about clinical decision making. At the outset, the patient presents with an apparently benign condition – constipation. The impression of a benign condition is incorporated at triage and results in a low-level acuity score and prolonged wait. The patient's nurse also incorporates this diagnosis and exerts coercive pressure on the physician to discharge the patient. The neurosurgeon is dismissive of a physician's assessment in a community centre ED, creating considerable inertia against referral. Thus the ED physician faces a variety of obstacles to ensure optimal patient care. These have little to do with EBM. He must resist and overcome a variety of cognitive, affective and systemic biases, his own as well as others', and various contextual constraints. He must continue to think critically and persist in a course that has become increasingly challenging.

Our scenario also illustrates some key points about critical thinking. The initial impression of a benign condition of constipation is not the only diagnosis compatible with the patient's symptoms. A health care professional reaching a preliminary diagnosis must be aware of the danger of fixing prematurely on this diagnosis and ignoring (or failing to look for) subsequent evidence that tells against it, as the nurse in our scenario was inclined to do. Observational and textual studies both indicate that the most common source of errors in reasoning is to close prematurely on a favoured conclusion and then ignore evidence that argues against that conclusion [3]. It is also important to keep in mind that a patient's signs or symptoms may have more than one cause. Data that may confirm one of the causes does not necessarily rule out all the others. Attentive listening to the patient and careful looking in the data-gathering stage are essential to good medical practice, as Groopman has recently pointed out [4]. From a logical point of view, the physician's diagnostic task is to gather data that will determine which one (or ones) of the possible causes is (or are) responsible for the patient's problem. This goal will guide the selection of data and of additional tests. 'Parallel' or 'lateral' thinking [5] will help with the differential diagnosis.

Critical Thinking

Dewey's original conceptualization [6] of what he called "reflective thinking" has spawned in the intervening century a variety of definitions of critical thinking, most notably that of Ennis as "*reasonable reflective thinking that is focused on deciding what to believe or what to do" [7].* Scriven and Paul have elaborated this definition as "… *the intellectually disciplined process of actively and skilfully conceptualizing, applying, synthesizing or evaluating information gathered from, or generated by observation, experience, reflection, reasoning, or communication as a guide to belief or action*" [8].

The consensus of 48 specialists in critical thinking from the fields of education, philosophy and psychology was that it should be defined as '*purposeful self-regulatory judgment which results in interpretation, analysis, evaluation and inference, as well as explanation of the evidential, conceptual, methodological,*

Table 1. Specific abilities underlying critical thinking in medical practice.

- Understanding the principles of argumentation
- Knowing and understanding dual System 1 and System 2 thinking processes and their interaction (see below)
- Awareness and understanding of evolutionary influences on decision making
- Recognizing distracting stimuli, propaganda, bias, irrelevance
- Identifying, analyzing, and challenging assumptions in arguments
- Awareness and understanding of cognitive fallacies and poor reasoning
- Awareness and understanding of the impact of major cognitive and affective biases on thinking
- Recognizing deception, deliberate or otherwise
- Capacity for assessing credibility of information
- Understanding the need for monitoring and control of one's own thought processes
- Understanding of the importance of monitoring and control of one's own affective state
- Awareness of the critical impact of fatigue and sleep deprivation on decision making
- Imagining and exploring alternatives
- Capacity for effectively working through problems
- Understanding of the importance of the context in which decisions are made
- Systematic and effective decision making
- Understanding the dynamics and properties of individual vs. group decision making
- Capacity for anticipating the consequences of decisions

criteriological, or contextual considerations upon which that judgement is based" [9]. The list of additional definitions remains impressive [10,11].

Even more useful than these definitions are various lists of dispositions and skills characteristic of a "critical thinker" [7,9,12]. More useful still are criteria and standards for measuring possession of those skills and dispositions [13], criteria that have been used to develop standardized tests of critical thinking skills and dispositions [14–17] including some with specific reference to health sciences [18].

The elements of critical thinking subsume what has variously been described as *clinical judgment* [19], *logic of medicine* [20,21], *logic in medicine* [22], *philosophy of medicine* [23], *causal inference* [24], *medical decision making* [25], *clinical decision making* [26], *clinical decision analysis* [27], and *clinical reasoning* [28]. An increasing number of monographs on logic and critical thinking in general have appeared [29–34] and their content is being adapted for medicine [35–37].

Everyday medical practice, whether in physicians' offices or emergency departments or hospital wards, clearly involves "*reasonable reflective thinking that is focused on deciding what to believe* (meaning the **understanding** of the problem) *and/or what to do* (i.e. **deciding** what to do to solve the problem)" [7,38]. Table 1 lists specific abilities underlying critical thinking in medical practice.

Critical thinking is also called for in medical research and medical writing. Editors of leading medical journals have called for it. Edward Huth [39,40], former editor of *Annals of Internal Medicine*, has urged that medical articles reflect better and more organized ways of reasoning. Richard Horton [41,42], former editor of *The Lancet*, has proposed the use in medical writing of a contemporary approach to argument along the lines used by the philosopher Toulmin [40,41]. Subsequently, two of us have developed this approach in detail for medicine [43,44]. Dickinson [45] has called for an argumentative approach in medical problem solving and brought it to the attention to the world of medical informatics and beyond.

Dual Process Theory

An important component of critical thinking is being aware of one's own thinking processes. In recent years, two general modes of thinking have been described under an approach described as dual process theory. The model is universal and has been directly applied to medicine [46–48] and nursing [49]. One mode is fast, reflexive, autonomous, and generally referred to as intuitive or System 1 thinking. The other is slow, deliberate, rule-based, and referred to as analytical or System 2 thinking. The mechanisms that underlie System 1 thinking are based on associative learning and innate dispositions: the latter are hard-wired, as a result of the evolutionary history of our species, to respond reflexively to certain cues in the environment. We have discrete, functionally-specialized mental programs that were selected when the brain was undergoing significant development especially spanning the last 6 million years of hominid evolution [50]. Although these programs may have served us well in our ancestral past, they may not be appropriate in some aspects of modern living. Some of this System 1 substrate

also underlies various heuristics and biases in our thinking – the tendency to take mental short-cuts, or demonstrate reflexive responses in certain situations, often on the basis of past experience. Not surprisingly, most error occurs in System 1 thinking.

Contemplative**,** or fully reflective thinking, is System 2 thinking. It suits any practice of medicine or medical research activity where there is time to utilise the best critically appraised evidence in a step-by-step process of reasoning and argument. Contemplative, fully reflective thinking is appropriate, for example, in internal medicine, psychiatry, public health, and other specialties, in etiological research and clinical trials, and in writing up the results of such research [35].

In contrast, a shortcut or heuristic approach [51] with somehow truncated thinking is often dictated by the realities of emergency medicine, surgery, obstetrics or any situation where there is incomplete information, bounded rationality, and insufficient time to be fully reflective. The extant findings and the decision maker's experience are all that is available. The quintessential challenge for well-calibrated decision making is to optimise performance in System 1. Hogarth [52] sees this challenge as educating our intuitive processes and has delineated a variety of strategies through which this might be accomplished.

No responsible physician would engage in reflective thinking on every occasion when a decision has to be made. Such acute emergencies as sudden complications of labour and delivery, ruptured aneurysms, multiple trauma victims and other immediately life-threatening situations generally leave no time for fully reflective thinking. A shortcut or heuristic approach is required [51], involving pattern recognition, steepest ascent reasoning, or algorithmic paths [21,53]. There is of course a place for reflective thinking before and after such time-constrained emergency decisions. More generally, reflective thinking is called for in any aspect of medical practice where there is time and reason for it.

The distinction should be made between the involuntary autonomous nature of System 1 thinking and a deliberate decision to use a shortcut for expediency, which is System 2 thinking. There is normally an override function of System 2 over System 1 but this may be deliberately lifted under extreme conditions.

Future Direction

Critical thinking is a learned process which benefits from teaching and guided practice like any other discipline in health sciences. It was already proposed as part of an early medical curriculum [54]. If we are to train future generations of health professionals as critical thinkers, we should do so in the spirit of critical thinking as it stands today. Clinical teachers should know how to run a Socratic discourse, and in which situations it is appropriate. They should be aware of contemporary models of argument. Clinical teachers should be trained and experienced in engaging with their interns and residents in meaningful discourse while presenting and discussing morning reports, at floor and other rounds, in morbidity and mortality conferences, or at less informal 'hallway', 'elevator' or 'coffee-maker/drinking fountain' teaching sites for busy clinicians. Such discourse is better than so-called "pimping", i.e. quizzing of juniors with objectives ranging from knowledge acquisition to embarrassment and humiliation [37,55].

Also, somebody should point out to trainees the relevance to the health context of some basics of informal logic, critical thinking and argumentation, if those basics have been acquired as the result of studying for their first undergraduate degree.

Unquestionably, the appropriate critically appraised best evidence should be used as a foundation for reasoning and argument about how to care for patients. But, if we want to link the best available evidence to a patient's biology, the patient's values and preferences, the clinical or community setting, and other circumstances, we should take all these factors into account in using the best available evidence to get to the beliefs and decisions that have the best possible support.

Such a reflective integration cannot be mastered by mere exposure. A learning experience is required. Trainees in medicine need to learn how to think critically [56], just as they need to learn contemporary approaches to 'rational' medical decision making: how to use Bayes' theorem in the diagnostic process, how to determine the sample size in a clinical trial, how to analyze survival curves in prognosis and outcomes studies, and how to calculate odds ratios in case control research. To understand each other, the teacher and the learner should both know the fundamentals of reasoning and argument in medicine. To achieve this understanding, we can either offer separate and distinct courses on critical thinking and decision making in medicine; or spread learning, practice and experience in critical thinking and decision making across various specialties; or do both. Only the future will show which of the alternatives is better. The integrated approach seems more promising, but harder to implement. Given the limitations on the current medical undergraduate curriculum, we might be hard-pressed to persuade a curriculum committee that precious space and time should be allocated to such concepts. The overriding rationale, however, should be that the knowledge of critical and reflective thinking is declarative knowledge (knowing how) and not simply an addition of procedural knowledge (know-how) or explicit knowledge. The old adage about it being preferable to teach someone how to fish rather than giving them fish applies. Any new additions will need to be streamlined and practical. A teaching module on critical thinking might for example include attention to how we reason and make decisions, factors that may impair decision making, the concept of critical thinking, situations where critical thinking is appropriate, some basic principles of logic and some logical fallacies. However the teaching, learning and practice of critical thinking is incorporated in the medical curriculum, it will need to include not only the contemplative, fully reflective thinking on hospital floors and in clinics but also the shortcut thinking [57] in such heuristic environments as operating theatres or emergency departments [46,48,58–60].

Similar education is required as a basis for framing grant applications and research reports as reasoned arguments, especially in the discussion section [61,62]. We may see a day when most medical journals are what Paton [63] terms

"reflective journals". If an application for a research grant, a research proposal, or a group of research findings (systematically reviewed or not) presented in a medical article are all exercises in argumentation and critical thinking, their authors, readers, and editors should find a common language for all these types of scientific and professional communication.

Almost four decades ago Feinstein [64] asked what kind of basic science clinical medicine needs. At that time, he had mostly clinical biostatistics and epidemiology in mind. Recently, Redelmeier et al. [65] proposed to add cognitive psychology as one more basic science. It is time, we think, to add critical thinking to that list.

Competing interests

None declared.

REFERENCES:

1. Sackett DL, Rosenberg WMC, Muir Gray JA et al: Evidence based medicine: what it is and what it isn't. BMJ, 1996; 312: 71–72
2. Straus SE, Scott Richardson W, Glasziou P, Haynes RB: Evidence-Based Medicine. How to Practice and Teach EBM. 3rd Edition. Edinburgh, London, New York, Toronto: Elsevier/Churchill Livingstone, 2005
3. Finocchiaro MA: Two empirical approaches to the study of reasoning. Informal Logic, 1994; 16: 1–21. (See also reprint, pp. 65–91 in: Finocchiaro MA. Arguments about Arguments. New York and Cambridge: Cambridge University Press, 2005)
4. Groopman J: How Doctors Think. New York: Houghton Mifflin Company, 2007
5. De Bono E: Lateral Thinking. A Textbook of Creativity. London: Penguin Books, 1990 (current printing; first published by Ward Lock education, 1970)
6. Dewey J: How We Think. (Boston: D.C. Heath, 1910). Mineola, NY: Dover Publications, 1997
7. Ennis RH: Critical thinking: A streamlined conception. Teaching Philosophy, 1991; 14(1): 5–25
8. The Critical Thinking Community. Defining Critical Thinking. A statement by Michael Scriven & Richard Paul for the National Council for Excellence in Critical Thinking Instruction. 2 pages at *http://www.criticalthinking.org/aboutCT/definingCT.cfm*, retrieved March 12, 2010
9. Facione PA: Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction. Research findings and recommendations prepared for the Committee on Pre-College Philosophy of the American Philosophical Association. ERIC Document # ED 315-423, 1990
10. Fowler B: Critical Thinking across the Curriculum Project. Critical thinking definitions. 5 pages at *http://mcck.edu/longview/ctac/definitions.htm*, retrieved Oct 24, 2007
11. AUSTHINK. Definitions (of Critical Thinking). 4 pages at < *http://www.austhink.org/critical/pages/definitions.html*, retrieved Oct 24, 2007.
12. Ennis RH: A taxonomy of critical thinking dispositions and abilities. In Baron JB, Steinberg RJ (eds.), Teaching Thinking Skills: Theory and Practice. New York: WH Freeman, 1987; 9–26
13. Ennis RH: A concept of critical thinking: a proposed basis for research in the teaching and evaluation of critical thinking ability. Harvard Educational Review,1962; 32: 81–111
14. Ennis RH, Millman J, Tomko TN: Cornell Critical Thinking Tests Level X & Level Z. Third Edition. Pacific Grove, CA: Midwest Publications, 1985
15. Ennis RH, Weir E: The Ennis-Weir Critical Thinking Essay Test. Pacific Grove, CA: Midwest Publications, 1985
16. Facione PA: California Critical Thinking Skills Test, Forms A and B. Millbrae, CA: California Academic Press LLC, 1998
17. Facione PA: California Critical Thinking Disposition Inventory. Milbrae, CA: California Academic Press, 1994
18. Facione NC, Facione, PA: The Health Sciences Reasoning Test: A test of Critical Thinking Skills for Health Care Professionals. Millbrae CA: California Academic Press LLC, 2006
19. Feinstein AR: Clinical Judgment. St.Louis, MO: CV Mosby, 1967
20. Murphy EA: The Logic of Medicine. Baltimore, MD: The Johns Hopkins University Press, 1976. (Second Edition, 1997)
21. Jenicek M: Epidemiology. The Logic of Modern Medicine. Montreal: EPIMED International, 1995
22. Logic in Medicine. Edited by CI Philips. London, England: BMJ Publishing Group, 1995
23. Wulff HR, Pedersen SA, Rosenberg R: Philosophy of Medicine: An Introduction. Oxford, England: Blackwell Publishing, 1986
24. Albert DA, Munson R, Resnik MD: Reasoning in Medicine: An Introduction to Causal Inference. Baltimore, MD: The Johns Hopkins University Press, 1988
25. Sox JC Jr, Blatt MA, Higgins MC, Morton KI: Medical Decision Making. Boston: Butterworths, 1988
26. Eddy DM: Clinical Decision Making. From Theory to Practice. A Collection of Essays from the Journal of the American Medical Association. Boston: Jones and Bartlett Publishers, 1996
27. Weinstein MC, Fineberg HV, Elstein AS et al: Clinical Decision Analysis. Philadelphia: WB Saunders, 1980
28. Kassirer JP, Kopelman RI: Learning Clinical Reasoning. Baltimore: Williams and Wilkins, 1991
29. Hitchcock DL: Critical Thinking. A Guide to Evaluating Information. Toronto: Methuen Publishing, 1983
30. Ennis RH: Critical Thinking. Upper Saddle River, NJ: Prentice-Hall, 1996
31. Fisher A: Critical Thinking. An Introduction. Cambridge and New York: Cambridge University Press, 2001
32. Thomson A: Critical Reasoning. A Practical Introduction. 2nd edition. London and New York: Routledge, 2002
33. Bowell T, Kemp G: Critical Thinking. A Concise Guide. London and New York: Routledge, 2002 (2nd Edition, 2007)
34. Paul R, Elder L: Critical and Creative Thinking. Dillon Beach, CA: The Foundation for Critical Thinking, 2004
35. Jenicek M, Hitchcock DL: Evidence-Based Practice. Logic and Critical Thinking in Medicine. Chicago: American Medical Association (AMA Press), 2005
36. Jenicek M: A Physician's Self-Paced Guide to Critical Thinking. Chicago: American Medical Association (AMA Press), 2006
37. Jenicek M: Fallacy-Free Reasoning in Medicine. Improving Communication and Decision Making in Research and Practice. Chicago: American Medical Association (AMA Press), 2009
38. Jenicek M. Medical Error and Harm. Understanding, Prevention, and Control. Boca Raton/London/New York: CRC Press/Taylor & Francis/Productivity Press, 2011
39. Huth EJ: How to Write and Publish Papers in Medical Sciences. Philadelphia: iSi Press, 1982
40. Huth EJ: Writing and Publishing in Medicine. 3rd Edition. Previously titled How to Write and Publish Papers in Medical Sciences. Baltimore, MD: Williams & Wilkins, 1999
41. Horton R: The grammar of interpretive medicine. CMAJ, 1998; 159: 245–49
42. Horton R: The rhetoric of research. BMJ, 1995; 310: 985–87
43. Toulmin SE: The Uses of Argument. Cambridge, England: Cambridge University Press, 1958 (Updated edition, 2003)
44. Toulmin SE, Rieke R, Janik A: An Introduction to Reasoning. 2nd Edition. New York, NY: Collier Macmillan Publishers, 1984
45. Dickinson HD: Evidence-based decision-making: an argumentative approach. Int J Med Informatics,1998; 51: 71–81
46. Kovacs G, Croskerry P: Clinical decision making. An emergency medicine perspective. Acad Emerg Med,1999; 6(9): 947–52
47. Sandhu H, Carpenter C: Critical decision making: Opening the black box of cognitive reasoning. Ann Emerg Med, 2006; 48(6): 713–19
48. Croskerry P: A universal model for diagnostic reasoning. Acad Med,2009;84:1022–28.
49. Paley J, Cheyne H, Dalgleish L et al: Nursing's way of knowing and dual process theories of cognition. J Adv Nursing, 2007; 60: 692–701
50. Tooby J, Cosmides L: Conceptual foundations of evolutionary psychology. In: The Handbook of Evolutionary Psychology. Edited By DM Buss. Hoboken, NJ: J Wiley & Sons, 2005; 5–67
51. Croskerry P: Clinical cognition and diagnostic error: applications of a dual process model of reasoning. Adv in Health Sci Educ, DOI 10.1007/s10459-009-9182-2

52. Hogarth RM: Educating Intuition. Chicago, Il: The University of Chicago Press, 2001
53. Jenicek M: Foundations of Evidence-Based Medicine. Boca Raton, London, New York, Washington: The Parthenon Publishing group/ CRC Press/Taylor & Francis, 2003
54. Haburchak DR, Mitchell BC, Boomer CJ: Quixotic medicine: Physical and economic laws perilously disregarded in health care and medical education. Acad Med, 2008; 83(12): 1140–45
55. Brancati FL: The art of pimping. JAMA, 1989; 261(1): 89–90
56. Rao G: Rational Medical Decision Making: A Case-Based Approach. New York: McGraw Hill, 2007
57. Croskerry P: Critical thinking and reasoning in emergency medicine. In: Patient Safety in Emergency Medicine. Croskerry P, Cosby KS, Schenkel SM, Wears RL (eds.),. Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins, 2009; 213–18
58. Facione NC, Facione PA: Thinking and Reasoning in Human Decision Making: The method of Argument and Heuristic Analysis. Milbrae, CA: Insight Assessment / California Academic Press LLC, 2007
59. Croskerry P: Context is everything or how could I have been so stupid? Healthcare Quarterly, 2009;12 (Special Issue: Understanding Decision-Making in Healthcare and the Law), e171–e177
60. Jenicek M: Towards evidence-based critical thinking medicine? Uses of best evidence in flawless argumentations. Med Sci Monit, 2006; 12(8): RA149–53
61. Jenicek M: How to read, understand, and write 'Discussion' sections in medical articles. An exercise in critical thinking. Med Sci Monit, 2006; 12(6): SR28–36
62. Jenicek M: Writing a 'discussion' section in a medical article: An exercise in critical thinking and argumentation. In: Biomedical Research. From Ideation to Publication. G. Jagadeesh, S. Murthy, YK Gupta, A Prakash (eds.), New Delhi/Philadelphia/Baltimore/New York/London/Buenos Aires/Hong Kong/Sydney /Tokyo: Wolters Kluwer Health/Lippincott Williams & Wilkins, 2010; Chapter 27: 455–65
63. Paton M: Reflective journals and critical thinking. In: UniServe Science Assessment Symposium Proceedings 2006 at *www.usyd.edu.au/su/SCH/pubs/procs/2006/paton.pdf*, retrieved January 12, 2008; 97–100
64. Feinstein AR: What kind of basic science for clinical medicine? N Engl J Med, 1970; 283: 847–52
65. Redelmeier DA, Ferris LE, Tu JV et al: Problems of clinical judgment: introducing cognitive psychology as one more basic science. CMAJ, 2001; 164(3): 358–60