

## ARTICLES

# Teaching clinical thinking to first-year medical students

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## Abstract

**Background:** The ability to think clearly and critically is necessary to normal human conduct. Particular forms of reasoning characteristic of practitioners of medicine have been studied, but a principled pedagogical framework that also reflects clinical practice has not been delineated.

**Aims:** The goals are: identify the principles that underlie the clinical thinking of physicians, develop a pedagogical framework, and design and implement curricular modules for medical students in the first year of their studies.

**Methods:** The authors reviewed prior work on clinical thinking of physicians and medical students as well as reflective pieces by seasoned clinicians. They also examined modalities of logic and inference used by physicians and others. The designed modules were implemented at the Faculty of Medicine at McGill University and linked to training in attentive listening and clinical observation.

**Results:** Five core features of a pedagogic framework on clinical thinking were developed and used to design and implement a series of teaching modules for first-year medical students.

**Conclusions:** The core features, and the modules based upon them, can serve for further empirical work on clinical reasoning and lead to modules for advanced students as they progress in their acquisition of expertise.

*Hypothesis substitutes, for a complicated tangle of predicates attached to one subject, a single conception*

Charles Sanders Peirce (1878)

## Introduction

The curriculum for entering medical students at the Faculty of Medicine, McGill University, includes modules on clinical thinking that are parts of a continuum with preceding units on attentive listening (Boudreau et al. 2009) and clinical observation (Boudreau et al. 2008). These, together, form the core of the *Clinical Method*, which is in turn a central theme of our curriculum on 'Physicianship' (Boudreau et al. 2007). We aim to impress upon students at the outset of their training, that hearing, seeing and thinking in the clinical context are special exemplars of their quotidian counterparts and are skills that must be learned explicitly and practiced continually. In other words, a clinician develops, with training and exercise, special ways of interacting with patients and their worlds. The skills of the clinical method – applied repeatedly in the crucible of the clinical context, enriched by the experiences of numerous patients, shaped by the ethical exigencies of providing medical care, and infused with the personal values that these engender – are transformed into practical wisdom. We have chosen to call this *clinical pronesis*, following a suggestion made previously by Pellegrino in his work in biomedical ethics (Davis 1997). This basket of

## Practice points

- The modes of clinical thinking implicit in the teaching of medical students do not reflect actual practice by physicians.
- Clinicians quickly acquire cues from patients and develop several hypotheses that serve as explanatory stories of the illness.
- Abduction is the form of inference used by clinicians in generating these hypotheses.
- Such hypotheses are evaluated by further inquiry and an informal application of Bayesian reasoning.
- Clinical judgment, in the context of an introductory course, refers to the process of choosing amongst hypotheses whilst accommodating the particularities of the individual patient.
- Videotape clips of an experienced clinician interviewing simulated patients are useful in teaching clinical thinking to medical students in 'think-aloud' exercises.

pragmatic skills, together with knowledge and skills in therapy and clinical management taught later in the curriculum, form the armature upon which the patient–physician relationship is anchored, and the explanatory core of the medical curriculum, and of medicine. The ethos and guidelines termed professionalism (Steinert et al. 2007), when enacted through the clinical method, enable the process of healing that is the goal of the clinical relationship.

## Why teach clinical thinking?

Clinical skills were traditionally imparted in piecemeal fashion. The medical interview and physical examination were taught at the outset of the student's clinical experience on the presumption that the prerequisite skills of observation, listening and reasoning were absorbed by witnessing role models, generally in the hospital setting. It is clear that this is no longer feasible, nor desirable. Clinicians are increasingly busy and have less time dedicated to instruction of students during the course of clinical care; hence specific attention to acquisition of these skills is necessary. In addition, the skills of the interview and communicating with patients were taught separately from those of observation and thinking, forcing students to independently forge links amongst these related aptitudes. By contrast, we endeavour to demonstrate their connectedness by grouping these training units under the rubric of physician-ship, a longitudinal component that extends throughout the entire medical school curriculum.

A more cogent pedagogical rationale for teaching clinical thinking in the early phase of a medical curriculum is to promote encapsulation (Schmidt & Rikers 2007), a process by which biomedical knowledge becomes linked to and understood as explicating the causal chains of illnesses and diseases taught in courses in pathology and medicine and later observed in the clinic. Clinical reasoning thus serves as a cognitive link by providing a process in which biomedical knowledge is utilized, a bridge for transition into the clinic, and a framework whose interstices are then filled with clinical content. Teaching clinical reasoning provides a means of transforming for the students and encapsulating the basic notions of biomedicine with the higher-order content of the illnesses of patients. We propose that teaching the clinical method early in the curriculum may help to eliminate the gap between basic and clinical knowledge that continues to plague the Flexnerian curriculum (Boudreau et al. 2007). As Elstein (Elstein et al. 1978) and others (Bowen 2006) have noted, clinical thinking cannot be taught simply as a process of logic or heuristics alone – it must be imparted with content that makes it, literally, 'memorable'.

One important motivation for our strategy is the recognition that the traditional approach to teaching case histories, physical examination and diagnostic analysis does not reflect how physicians actually work and think (Barrows & Tamblyn 1980). Clinical educators insist that students carry out a history and a review of systems by following a prescribed path suspending until the end of all formulations of the illness in question. Teachers pretend that such an agnostic mode is actually possible and that a list of putative diagnoses will emerge naturally if the job is done right. No clinician would actually testify that such is his method of work. To quote Elstein et al. (1978) who have actually investigated how physicians think, '...the teacher is frequently unaware of the real system he uses to make his expert judgments. He may even believe that he operates in a very different fashion from the way in which he actually does operate. Imagine the frustration of students who must learn to ignore what he says they should do, and instead must themselves infer the model

Barrows and Tamblyn note the 'myth' (Barrows & Tamblyn 1980, p. 22) of the review of systems being taught in courses on the medical interview. In fact, Elstein et al. (1978, pp. 66, 168) have demonstrated that clinicians, as well as medical students in training, begin to generate hypotheses regarding the putative illness very quickly after gathering cues and information from the patient. Within minutes, several such hypotheses are formulated and these then guide the actual inquiry. In fact, they note that this approach is a means of coping with the open-ended problem presented by a patient. They state, 'The function of early hypotheses, therefore, is to limit the size of the space that must be searched for solutions to the problem. Some way of progressively constraining the size of the search space must be found or else a clinical workup could never end in the time that is actually available' (Elstein et al. 1978, p. 65). In other words, hypotheses transform an open problem into one with several hypothetical solutions and the goal of the interview and physical examination is to carry out a comparative evaluation of these competing 'diagnoses'. Thus, we detriment our students in the traditional training approach by teaching a scheme that is more difficult to apply to complex problems, and, in any event, is not actually the one we expect them to utilize a scant year or two later.

Our initial evaluations have indicated that students enjoy the experiences of problem-solving that clinical thinking presents and the opportunity to develop their nascent skills. As noted in the companion manuscripts on teaching listening (Boudreau et al. 2009) and observation (Boudreau et al. 2008), we consider that the explicit teaching of how a doctor thinks aids in their identity formation as physicians and as scientific healers. To cite Barrows and Tamblyn, 'The physician's experiment is his inquiry strategy, utilizing clinical skills' (Barrows & Tamblyn 1980, p. 43). Finally, such learning is a source of motivation and enjoyment for our students who, after all, applied to medical school to become skilled in the arts of 'doctoring'.

## What do we teach?

We have constructed our modules around the following five main features:

- (1) The elements of clinical thinking: Inquiry and judgement.
- (2) The goal of the clinical encounter: Therapy and management.
- (3) The process of clinical thinking: Hypothesis generation and evaluation.
- (4) The clinician's mode of logic: Abduction.
- (5) The clinician's mode of evaluation: Probability, natural frequencies and Bayesian reasoning.

(1) The elements of clinical thinking: Inquiry and judgement

Clinical thinking has also been termed clinical reasoning, clinical problem-solving and clinical judgement. We have found the following distinctions useful in teaching first-year

