Teaching, Evaluating, and Remediating Clinical Reasoning

Clinical reasoning is a cornerstone of competence in internal medicine. The best methods for teaching and evaluating clinical reasoning skills among medical students have not yet been elucidated. This article outlines methods used at Rush Medical College and Ohio State University to teach, evaluate, and remediate clinical reasoning skills in medical students and residents.

Teaching Clinical Reasoning

Novices approach diagnostic problems in a fundamentally different way than experts. Novices ask many and often redundant questions when collecting information to solve problems; experts ask fewer questions yet have much higher rates of diagnostic accuracy.

Expertise is achieved by refining and adding depth to classic illness scripts through clinical experience, further research, and knowledge.

As clinicians develop reasoning skills, a variety of strategies are utilized: hypothesis testing, forward thinking, and pattern recognition (1). Hypothesis testing is driven by a single symptom and generates long lists of hypotheses, which are then tested against the patient's presentation, analyzing by a compare and contrast method. It is not an efficient method, but is effective as long as the diagnosis is somewhere on the list.

Forward thinking uses branched decision points to narrow the list of possible diagnoses **(Figure 1)**. The patient's symptoms and signs are processed to a syndrome. The approach of gathering data to define the syndrome that identifies a narrower list of diagnostic options is more efficient and uses less data to arrive at an accurate diagnosis.

Pattern recognition is the third and most efficient strategy. It uses the instantaneous recognition of a patient's presentation as matching a specific disease. The memory framework that facilitates pattern recognition is one of interwoven branched networks of knowledge built on processing, compare/contrast analysis, and memory bundles called illness scripts. The clinician's representation of the patient's problem is matched to classic illness scripts for a disease.

Classic disease illness scripts have three basic components: epidemiology, time course, and clinical manifestations. The clinician's representation of the patient's problem contains the same three components. Expertise is achieved by refining and adding depth to classic illness scripts through clinical experience, further research, and knowledge.

All three problem-solving strategies are used throughout a clinical career. Novices tend to use more hypothesis testing whereas experts rely on pattern recognition. However, hypothesis testing continues to be needed for all clinicians in cases of atypical presentations, emergence of new diseases, or new disease manifestations.

At Ohio State University, an explicit three-step approach provides learners, even early medical students, with a strategy for solving clinical problems **(Figure 2)**. As an introduction to

FIGURE 1: Memory Framework for Forward Thinking

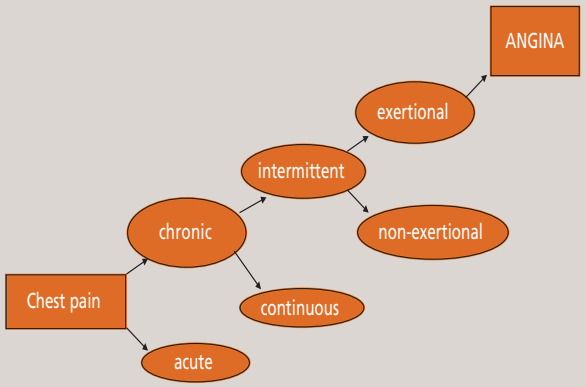

FIGURE 2: Stepwise Approach

STEP ONE	*STEP TWO*	*STEP THREE*
Problem List	**Synthesize**	**Prioritized Differential Diagnoses**
Identify all abnormalities in case	Summarize identifying key features	Match patient's illness script to classic disease illness scripts
Process into uniformly descriptive medical terminology	• Epidemiology • Temporal pattern • Syndrome	"Fit" determines the likelihood of diagnosis

the method, we explain the underlying cognitive theory. Then, employing a problem-based learning format, we work through cases. For each case, the learner identifies a comprehensive problem list, processes this list into descriptive medical terminology, then synthesizes and summarizes information to develop a case illness script and prioritized differential. Later in development, nuances of uncertainty and common diagnostic errors are added (2). Our intention is to help learners practice the cognitive processes and lay down the branched memory networks that will enable them to develop expert clinical reasoning skills.

Assessing Clinical Reasoning

Student reasoning skills are often assessed in direct patient care settings, during oral presentations, and when evaluating patient write-ups and subjective, objective, assessment, and plan (SOAP) notes. Unfortunately, many notes do not contain enough information to assess diagnostic reasoning.

The IDEA method was developed to address the lack of diagnostic reasoning documented in patient write-ups (3). IDEA is based on structural semantics as described by Georges Bordage (4) and is further refined using the taxonomy of reporter, interpreter, manager, and educator as described by Pangaro et al (5).

The IDEA method asks students to organize the assessment section of their write-ups in a simple paragraph form.

- I Interpretive summary
- D Differential diagnosis with commitment to the most likely diagnosis
- E Explanation of reasoning in choosing the most likely diagnosis
- A Alternative diagnoses with explanation of reasoning

In the interpretive summary, students summarize the most important findings and transform the patient's findings into semantic qualifiers to interpret and represent the problem. The two or three most likely diagnostic possibilities are then listed and students commit to one diagnosis as most likely. The data from the interpretive summary as well as knowledge about the disease are then used to defend the choice of the most likely diagnosis, with alternative diagnoses being compared to the most likely diagnosis (6).

The IDEA assessment tool is a two-page instrument that asks evaluators to rate student documentation of the history, physical exam, assessment, and plan; then student reporting, diagnostic reasoning, and decision making skills are rated. Does it work? In a preliminary study, over several iterations and with a small number of evaluators, agreement in categorizations was found in 85.7% of write-ups (7). The overall goal is to demonstrate both reliability and generalizability by successfully using the tool in multiple settings and with multiple types of evaluators.

Remediating Clinical Reasoning

This section is based on anecdotal experience with students and early residents in addition to a review of the literature.

Effective remediation requires accurate diagnosis of the learner. It is important to recognize that when trying to assess reasoning, documentation may not accurately reflect the thoughts of the author. The sloppy SOAP note is the note that is task-oriented and omits a thoughtful assessment to jump right into the plan (or a list of orders) (8). As faculty, we can help our learners by better modeling documentation of a thoughtful assessment. Separating reporting from interpreting skills using paper cases can help pinpoint the deficiency in an individual learner.

Excluding documentation problems, skill deficiencies can occur in one or more dimensions, including:

- Reporting/data collection
- Diagnostic reasoning
  - Problem identification and prioritization
  - Synthesis
  - Matching to differential
- Decision making

Common problems with diagnostic reasoning include a lack of knowledge, premature closure, and dispersed and non sequitur reasoning **(Figure 3)**. It is interesting to note that both novice and more advanced clinicians make errors of premature closure or reduced logic; in experienced clinicians, this oversight might be due to busy schedules and limited time that contributes to premature acceptance of an

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FIGURE 3: Problems with Reasoning

Problem	Solution
Lack of knowledge or knowledge organization	Review with compare and contrast
Reduced logic or premature closure	Attention to problem list & processing to summary
Dispersed	Attention to synthesis & compare/ contrast
Non sequitur	Clear articulation of assessment, explanation of reasoning

Twelve programs (67%) plan to use milestones as they move forward in their projects, with only four currently using milestones in their evaluation systems.

Two specific collaborations are active within the EIP programs. Baystate Medical Center Associate Program Director Lauren Meade, MD, has been leading the competency-based progression and milestone collaboration with Henry Ford Hospital Department of Internal Medicine Associate Program Director Kelly Caverzagie, MD, and American Board of Internal Medicine Director of Academic Affairs William Iobst, MD, among others. During EIP's fall meeting, Maureen Francis, MD, associate professor at Southern Illinois University School of Medicine, presented the work to date of the continuity measurement collaboration group. The group continues to work toward a multi-institutional study, currently defining the timeframe, institutional review board needs, and anticipated costs of such a pilot.

The inaugural issue of the new *Journal of Graduate Medical Education*, published September 2009, provided a platform for dissemination of some of the EIP innovations, and future issues are likely to include more. The full sum of scholarly dissemination of the 20 programs was recently catalogued and provides impressive evidence of the value of the EIP accreditation model: 80 published articles in peer-reviewed journals, 183 national presentations and workshops, and 74 local and regional presentations and publications.

The new website at www.im.org provides more information on the various projects, new assessment tools, and a complete list of EIP scholarship products. The developing EIP learning community will continue to provide synergy to each other and to the internal medicine community at large. Its value in demonstrating progress and evidence in curricular reform may serve as a model for other like-minded groups within the alliance.

AUTHOR

Lia Logio, MD
Program Director, Department of Internal Medicine
Indiana University School of Medicine

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early hypothesis. Learners using dispersed and non sequitur reasoning consider multiple diagnoses simultaneously without regard to the illness script and the likelihood of the diagnostic possibilities.

The intervention planned for remediation should target the area of challenge for the individual physician-in-training. The learner lacking knowledge benefits from a review of typical illness scripts for common disease processes. Following the approach outlined earlier helps learners avoid premature closure. For individuals who have difficulty prioritizing and synthesizing information, explicitly comparing and contrasting a patient's presentation with typical illness scripts helps learners consider the appropriate diagnostic possibilities.

Conclusion

Diagnostic reasoning is an essential competence that is based on the acquisition of certain cognitive skills. We recommend using teaching methods that make the cognitive processes transparent and create opportunities for explicit practice. Assessment of a learner's competence in this area is aided by clear documentation of thought processes and structured evaluation. For physicians-in-training who struggle with reasoning, isolation of the cognitive skills in question can allow for added practice and improvement.

AUTHORS

Elizabeth Baker, MD
Clerkship Director, Department of Internal Medicine
Rush University Medical Center

Cynthia Ledford, MD
Clerkship Director, Department of Internal Medicine
Ohio State University College of Medicine

Beth Liston, MD, PhD
Assistant Professor, Department of Internal Medicine
Ohio State University College of Medicine

REFERENCES

1. Lucey, CR. From Problem Lists to Illness Scripts: Teaching Clinical Problem Solving in Small Groups. APDIM Fall Meeting. October 17-20, 2002.
2. Davidoff F. Chapter 5: The Voytovich Solution. In: *Who Has Seen a Blood Sugar, Reflections on Medical Education.* Philadelphia: American College of Physicians, 1996, pp. 25-28.
3. Baker EA, Connell KJ, Bordage G, et al. Can diagnostic semantic competence be assessed from the medical record? *Acad Med.* 1999;74:S13-S15.
4. Bordage G. Elaborated knowledge: A key to successful diagnostic thinking. *Acad Med.* 1994;69:883-885.
5. Pangaro L. A new vocabulary and other innovations for improving descriptive in-training evaluations. *Acad Med.* 1999;74(10Suppl):S13-15.
6. Baker EA. Challenging students to expose their thoughts in write-ups: The IDEA method. *JGIM.* 2003;18(Suppl 1):235.
7. Baker EA, Riddle J. IDEA in evolution: An attempt to use RIME to more accurately assess medical student write-ups. *JGIM.* 2005;20(Suppl 1):157.
8. Ledford CH. No more sloppy "SOP" notes? *Academic Internal Medicine Insight.* 2007;5(1):7.