You Too Can Teach Clinical Reasoning!

As part of the ongoing Council on Medical Student Education in Pediatrics series on skills and strategies used by great clinical teachers, this article focuses on practical knowledge and skills for teaching clinical reasoning. Building on SNAPPS and One Minute Preceptor models, we will address the clinical assessment portion of oral and written presentations that represents the culmination of the clinical reasoning process. Using the concepts of problem representation, semantic qualifiers, and illness scripts defined below, we will outline how you can guide your students’ clinical reasoning development.

PROBLEM REPRESENTATION AND SEMANTIC QUALIFIERS

A problem representation is “the one-liner” at the end of a presentation that synthesizes the entire patient story (history details, physical findings, and investigations) into 1 “big picture” statement. To create a problem representation, physicians restructure pertinent patient details into abstract terms called semantic qualifiers. Semantic qualifiers are abstractions in medical rather than lay terminology and generally exist in divergent pairs, such as acute versus chronic and severe versus mild (Table 1, step 2). Here is an example of a problem representation, with the semantic qualifiers in italics: A previously well, 2-year-old unimmunized girl presents with an acute history of respiratory distress. She is febrile, looks unwell, and is drooling.

TEACHING HOW TO ARTICULATE PROBLEM REPRESENTATIONS BY USING SEMANTIC QUALIFIERS

Novice clinicians can be taught to generate problem representations by using semantic qualifiers. First, have your students write out a 1- to 2-sentence problem representation (summary of patient information) based on either a written case or a real patient they have seen. Second, ask them to replace as many details as possible by using semantic qualifiers (Table 1, steps 1–3). Remind them that semantic qualifiers usually come in opposing pairs. For example:

First Draft of a Problem Representation:

The patient is a 16-year-old boy with a history of 2 ear infections who presents with 3 days of fever and abdominal pain that started with dull pain in the periumbilical region and moved to the right lower quadrant (RLQ) with 10/10 pain on the day of admission, 2 days of decreased food intake, and 1 day of vomiting. The physical examination revealed abdominal tenderness, rebound tenderness, and guarding, and the white blood cell count was 20,000.

Rather than making an assessment, the details of the case in this example are merely restated. When semantic qualifiers are used, 2 ear infections becomes “otherwise well,” 3 days becomes “acute,” and decreased food intake becomes “anorexia,” and the key findings of history, physical examination, and laboratories are synthesized to offer the most plausible diagnosis.

ABBREVIATIONS

HSP—Henoch-Schonlein Purpura
RLQ—right lower quadrant
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TABLE 1 Teaching Steps for Clinical Reasoning

| Step 1: Student Presents the Data About a Patient |
| Example: The patient is a 16-year-old boy with a history of 2 ear infections who presents with 3 d of fever and abdominal pain. The patient is initially dull and in the peri-umbilical region but is now right sided and 10/10 pain. He has vomited twice and has not eaten anything for 2 d. |

| Step 2: Discuss Relevant Semantic Qualifiers |
| Teaching Questions | Examples of Semantic Qualifiers |
| Which medical descriptors apply to this patient? | Acute | Chronic |
| | Severe | Mild |
| | Localized | Diffuse |
| | Previously healthy | Significant past medical history |
| | Right sided | Left sided |

| Step 3: Construct a Problem Representation That Incorporates Semantic Qualifiers |
| Example: The patient is an otherwise well 16-year-old boy who presents with acute onset of fever, severe, localized abdominal pain, vomiting, and anorexia. |

| Step 4: Compare Illness Scripts for the Most Likely Diagnoses (eg, appendicitis and gastroenteritis) |
| Teaching Questions | Appendicitis | Acute Gastroenteritis |
| Predisposing Condition: | Predisposing Condition: | Predisposing Condition: |
| What epidemiologic factors influence the probability that a patient is at risk for disease (eg, age, gender, past medical history, and environmental influences)? | | |
| | no clear predisposing factors | sick contacts |
| | overseas travel | |
| Pathophysiologic Insult: | Pathophysiologic Insult: | Pathophysiologic Insult: |
| What are the major pathophysiologic insults that contribute to the disease state? | | |
| | fecalith | effacement of villi |
| | ischemia of bowel wall | Viral or bacterial invasion |
| | local inflammation | local inflammation |
| | perforation | |
| Clinical Consequences: | Clinical Consequences: | Clinical Consequences: |
| What are the symptoms and signs that may result from the predisposing condition or pathophysiologic insult? | | |
| | severe, localized pain | mild, diffuse pain |
| | nausea, vomiting, anorexia, diarrhea | nausea, vomiting, anorexia, diarrhea |
| | fever | fever +/- |

| Step 5: Select the Illness Script That Best Matches the Patient’s Presentation |
| This patient’s presentation is most consistent with acute appendicitis. |

Revised Draft of Problem Representation:
The patient is an otherwise well 16-year-old boy who presents with acute onset of fever, severe, localized abdominal pain, vomiting, and anorexia. The physical examination and laboratories were significant for right lower quadrant pain, guarding, rebound tenderness, and an elevated white blood cell count. This patient’s presentation is most consistent with acute appendicitis.

ILLNESS SCRIPTS

Unlike problem representations and semantic qualifiers that are concrete, the concept of illness scripts is abstract. Illness scripts are what experienced physicians unconsciously use when they assess and diagnose a patient; they are based on real patient experiences, and contain extensive clinically relevant information about how diseases present but few pathophysiological data. They are structured in our brains, whether we know it or not, as predisposing condition, pathophysiologic insult, and clinical consequences. After hearing a chief complaint, expert clinicians engage in a process of script search, script selection, and script verification. They begin by creating a working differential diagnosis and accessing multiple illness scripts from past clinical experience. Then, they gather further data and explore discriminating features between illness scripts comparing and contrasting their patient with numerous other patients they have seen in the past. Finally, they select the most appropriate illness script and create a working diagnosis. All of this often happens in seconds or minutes and occurs without the physician's conscious thought so that when the student asks "How did you know that so fast?", he or she may be unable to answer.

Here is an example of accessing an illness script. Read each line below to determine when you are fairly confident you know the diagnosis.

1. 16-year-old boy.
2. Admitted for acute abdominal pain.
3. Has poor P0 intake.
4. Pain started around his umbilicus but has moved to the RLQ.
5. Fever to 39.4°C.
6. Has associated nausea, vomiting, and anorexia.

We imagine that many of you reached number 4 and felt confident the diagnosis is appendicitis. Why? Because you accessed the illness script for appendicitis, and you started with 2 or 3 illness scripts after reading the first 3 statements (perhaps acute gastroenteritis, appendicitis, or inflammatory bowel disease). The movement of pain from peri-umbilical to RLQ helped you choose the appendicitis illness script, and further information about fever, anorexia, and nausea reinforced your choice. If we had given you a 16-year-old...
you would still be comparing the illness scripts for pelvic inflammatory disease or ectopic pregnancy and would need further information to narrow down the appropriate illness script. Let’s repeat this process with a more pediatric-specific diagnosis:
1. 8-year-old boy
2. Admitted for acute abdominal pain
3. Has poor PO intake for the past day
4. Has a purpuric rash in a waist-down distribution
5. Presents with large joint pain
6. Has proteinuria on urinalysis

Note both cases start in similar ways suggesting similar illness scripts (appendicitis, gastroenteritis), yet when pediatricians reach number 4, they change to the illness script of Henoch-Schonlein Purpura (HSP). The purpuric rash described does not match the initial 2 illness scripts and instead correlates with HSP. Joint pain and proteinuria reinforce the HSP illness script. Try this with your nonpediatric colleagues and the second case will be a challenge (they understandably do not recall the illness script for HSP). If you possess the appropriate illness scripts, the process is quick and typically accurate. Trainees, in contrast, have only a few illness scripts, and therefore usually rely on deliberately analyzing case details to determine the diagnosis.

TEACHING HOW TO COMPARE AND CONTRAST ILLNESS SCRIPTS
Although the concept of illness scripts can and should be explained to students, we cannot build their illness scripts for them (they must be constructed by each learner based on the patients they have seen). What we can do is maximize clinical experiences, suggest students read approximately 2 diagnoses at the same time and compare and contrast their similar and discriminating features, and encourage them to articulate the 3 components of an illness script: predisposing conditions, pathophysiologic insults, and clinical consequences. Table 1, step 4, outlines a process for teaching by using illness scripts.

POTENTIAL PITFALLS OF ILLNESS SCRIPTS
Although illness scripts usually point an experienced clinician to the correct diagnoses, errors do occur. Discussing the types of errors that happen enhances the process of student clinical reasoning development. Errors include fixating on a specific clinical feature too soon in the clinical encounter (anchoring bias), setting on a given diagnosis before fully examining other options (premature closure), and interpreting information so that it supports a previous conclusion (confirmation bias).

CONCLUSIONS
Great clinical teachers recognize the challenge that students face in synthesizing the details of patient information into concise, accurate clinical assessments. We can help by teaching students to articulate clear problem representations by using semantic qualifiers and to compare and contrast their patients with similar cases to develop accurate illness scripts.

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REFERENCES
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