

## Web Extras

### ❖ Activity: Compare-and-Contrast Readings

#### Rationale

Learners are more reliably able to access information that is mentally stored in their memory in a structure that reflects how it is actually used in the clinical setting. This activity employs comparison and contrast between diagnoses, a technique that experienced clinicians frequently use.

#### Overview

On the basis of a patient the learner has recently seen, assign the learner to research short descriptions of 2 to 3 diseases or conditions that have a similar presentation. Ask the learner to identify at least 3 clinical findings that are similar across the 3 diseases and 3 that are discordant.

#### Details

1. Identify 2 to 3 diseases that have a substantial degree of overlap in terms of clinical presentation but that also have key features that help differentiate them (i.e., chronic obstructive pulmonary disease and asthma, Crohn disease and ulcerative colitis, acute pericarditis

and acute coronary syndrome). Base this choice on a patient the learner has recently encountered.

2. Direct the learner to specific resources that have sufficient detail but are not lengthy. UpToDate and standard full-length texts are too detailed and not as useful for this exercise. Good alternatives include the following:

- *Current Medical Diagnosis & Treatment*
- *Cecil's Essentials of Medicine*
- *IM Essentials*

3. Ask the learner to identify at least 3 clinical findings that are similar across the 3 diseases and 3 that are discordant.

4. Have the learner report back his or her findings, emphasizing the value of comparison and contrast in diagnosis

- For example, ST-segment elevation is focal with acute coronary syndrome but widespread with pericarditis.

5. **Advanced:** Have the learner apply the information to the specific patient who prompted the assignment by building a script selection table (See *Explicit Script Selection* activity)

6. **Advanced:** Have the learner research likelihood ratios for each of the clinical findings associated with each disease and describe the relative strength of each finding in establishing or discounting each diagnosis

**Source/Reference:**

Bowen JL. Educational strategies to promote clinical diagnostic reasoning. *N Engl J Med* 2006;355:2217-25; Stuart E, Blankenburg B, Butani L, Johnstone N, Long M, Marsico N. Thinking about thinking: coaching strategies to promote clinical reasoning. In: Council on Medical Student Education in Pediatrics. San Diego, CA; 2011.

## ❖ Activity: Evidence-based Clinical Examination Reading

### Rationale

Learners often struggle with knowing and identifying the key elements of the presentation of a patient with a particular disease or symptom. Applying the principles of evidence-based medicine to the clinical examination can help learners recognize the important aspects of the presentation.

### Overview

Assign learners reading reviewing the evidence supporting the role of specific clinical findings in making a specific diagnosis.

### Details

1. Assign the learner readings describing the evidence base behind the utility of clinical findings in the diagnosis of a specific disorder or condition he or she has recently encountered. Specific resources include the following:

- The “Rational Clinical Examination” series from *JAMA* (92 topics)
- *Symptom to Diagnosis: An Evidence Based Guide*

2. Have the learner report the findings and apply them to the particular patient (and future patients with a similar presentation)

3. **Advanced:** Ask the learner to use the likelihood ratios to assign a specific post-test probability of disease for a specific condition in the patient.

### Source/Reference:

Rencic J. Twelve tips for teaching expertise in clinical reasoning. *Med Teach*. 2011;33:887-92.

## ❖ Activity: Explicit Script Selection

### Rationale

Making a diagnosis involves the matching of a patient script (the characteristics of the clinical presentation along with epidemiologic factors) with the illness scripts (the clinical and epidemiologic characteristics) of specific diseases.

### Overview

After a case is heard and a summary statement that includes all of the pertinent clinical information of the case is built, the case findings are compared explicitly against the illness scripts of the diseases or conditions being actively considered.

### Details

1. After the summary statement has been completed (see Problem Representation activity), a table (**Table w-1**) is completed that lists the relative effect that each case finding has on the likelihood of each diagnosis under consideration, as below.

**Table w-1. Likelihood of Potential Diagnoses**

Patient Findings	Potential Diagnoses			
	Interstitial Lung Disease	Congestive Heart Failure	COPD	Lung Cancer
Chronic onset				
Lack of PND				
No orthopnea				
Lack of hemoptysis				
Tobacco use				
Hypertension				
Physical examination				
Lack of JVD				
Bibasilar rales				
Lack of S <sub>3</sub>				
Normal cardiac examination results				

COPD = chronic obstructive pulmonary disease; JVD = jugular venous distention; PND = paroxysmal nocturnal dyspnea; S<sub>3</sub> = third heart sound.

2. After construction of the table, the teacher leads a discussion of the most likely diagnoses based on the relative number of + and – in each column. Enter + to ++ to denote confirmatory findings and – to – – for refutatory findings based on how strongly a given finding affects the probability of the specific diagnosis relative to the other diagnoses. Use of ++, for example, would indicate that the presence of that finding strongly supports that specific diagnosis, whereas the use of – – indicates that the presence of that finding argues strongly against that specific diagnosis. If the finding is not negatively or positively associated with the disease, leave the field blank.

3. **Advanced:** Instead of using + and –, fill in the table with the pertinent likelihood ratios for a more numeric expression of the effect of each test on the likelihood of disease

4. **Advanced:** Use serial Bayesian analysis and determine the post-test probability of each of the diagnoses under consideration.

**Source/Reference:**

Bowen JL. Educational strategies to promote clinical diagnostic reasoning. *N Engl J Med.* 2006;355:2217-25; Rencic J. Twelve tips for teaching expertise in clinical reasoning. *Med Teach.* 2011;33:887-92; Stuart E, Blankenburg B, Butani L, Johnstone N, Long M, Marsico N. Thinking about thinking: coaching strategies to promote clinical reasoning. In: Council on Medical Student Education in Pediatrics. San Diego, CA; 2011.

## ❖ Activity: Forcing Analytical Reasoning

### Rationale

Learners may be overly dependent on pattern recognition (system 1 thinking) in making diagnoses. Coming to diagnostic conclusions too rapidly may also lead to diagnostic error as a result of premature closure. Although slow and effort-dependent, analytical reasoning (system 2 thinking) can be a powerful means of countering an overreliance on pattern recognition.

### Overview

The teacher leads the learner through 1 or more of several analytical methods of clinical reasoning.

### Details

1. To determine the thought processes the learner used in coming to a diagnostic conclusion, the teacher asks specifically how the learner reached a diagnosis and what other alternative diagnoses the learner also considered. The teacher also asks about the rationale behind excluding any other diagnoses that are mentioned.

2. The teacher selects 1 of the following methods of analytical reasoning and walks the learner through the process while emphasizing the benefits of an analytical/methodical approach (see below for brief descriptions of these):

- Causal reasoning
- Bayesian analysis
- Worst-case scenario medicine
- Building structured differential diagnoses

### *Causal Reasoning*

This process entails going back to “first concepts” of physiology, anatomy, and the like to explain the specific manifestations of a presentation. For example, in a patient with aortic dissection, the differential pulses can be explained by the process of the origin of the arteries supplying the arms being pinched off by the dissection. In using causal reasoning, the specific pathophysiologic basis for a symptom in a particular disease is thus explicitly described. In teaching, causal reasoning takes the form of asking the learner to make this explanation for each piece of clinical data or simply by asking “Why does the patient have that symptom/exam finding/lab result?”

### *Bayesian Analysis*

Using Bayesian analysis involves explicitly calculating the pretest probability of a disorder and then determining the effect that a clinical finding

has on the likelihood of that disorder. This may be done effectively by using likelihood ratios and online calculators.

#### *Worst-Case Scenario Medicine*

With this technique, the teacher simply asks the learner what the worst possible diagnoses would be for a patient with a particular presentation and how the learner knows these diagnoses are not present. For a patient with presumed cellulitis, for example, the learner is asked how he or she knows it is not actually necrotizing fasciitis or deep venous thrombosis.

#### *Building Structured Differential Diagnoses*

Have the learner build a full and detailed differential diagnosis for a particular presentation by using a structured approach. For example, the mnemonic VINDICATE (**Table w-2**) can be applied to the structures near and in the chest to build a differential diagnosis for chest pain.

**Table w-2. Differential for Chest Pain by Using VINDICATE**

VINDICATE Mnemonic	Heart	Lungs	Great Vessels	Mediastinum	Esophagus	Musculoskeletal System and Nerves	Upper Abdomen
<b>Vascular</b>	Acute coronary syndrome (includes all causes of myocardial ischemia from plaque rupture to anemia)	PE Pulmonary hypertension	Aortic dissection				
<b>Infection</b>	Pericarditis Myocarditis	Pneumonia Bronchitis	Syphilis		Esophageal ulcer Candidiasis Cytomegalovirus infection	Costochondritis Herpes zoster	Gastritis Cholecystitis Peptic ulcer disease
<b>Neoplasm</b>		Lung cancer Mesothelioma		Hodgkin lymphoma Lung cancer	Esophageal cancer		Gastric cancer Pancreatic cancer
<b>Drugs</b>					Pill esophagitis (e.g., doxycycline)		Gastritis (e.g., nonsteroidal anti-inflammatory drugs)
<b>Inflammatory/idiopathic/iatrogenic</b>					Esophageal spasm	Degenerative joint disease	
<b>Congenital</b>	Myocardial bridging		Marfan syndrome		Esophageal web		
<b>Autoimmune/allergic</b>		Asthma					
<b>Trauma/mechanical</b>	Contusion Penetrating trauma	Pneumothorax			Esophageal stricture with food impaction Gastroesophageal reflux disease	Rib fracture or contusion	
<b>Endocrine/metabolic/environmental</b>					Ingestions (e.g., hydrocarbons)		

Source/Reference: Rencic J. Twelve tips for teaching expertise in clinical reasoning. *Med Teach*.2011;33:887-92; Stuart E, Blankenburg B, Butani L, Johnstone N, Long M, Marsico N. Thinking about thinking: coaching strategies to promote clinical reasoning. In: Council on Medical Student Education in Pediatrics. San Diego, CA:2011.

## ❖ Activity: Highlighter

### Rationale

A critical skill in clinical reasoning is the ability to identify the key features of the clinical presentation. Learners may struggle with separating important information from extraneous data.

### Overview

The learner is provided with a written note that contains inadequate information or a large amount of distracting data. The learner is asked to identify 1) the key clinical data that is present (by highlighter) and 2) the crucial information that is missing from the note.

### Details

1. Write or copy a note (not written by the learner) that is overly detailed with a large amount of extraneous data or that lacks data critical for making a diagnosis.
2. Ask the learner to highlight the key data present (or cross out the extraneous data) and to suggest what further information is necessary to make a diagnosis.
3. Meet with the learner and provide specific feedback regarding his or her recommendations, providing a specific rationale for your thoughts.

### Source/Reference:

Stuart E, Blankenburg B, Butani L, Johnstone N, Long M, Marsico N. Thinking about thinking: coaching strategies to promote clinical reasoning. In: Council on Medical Student Education in Pediatrics. San Diego, CA; 2011.

## ❖ Activity: Using the IDEA Critique Method

### Rationale

Clinical reasoning is a complex process that requires an accurate problem representation and consideration of multiple diagnoses via comparison of the patient presentation with illness scripts. Determining at which stage in the process the learner is struggling can be difficult without using a structured approach to evaluation.

### Overview

The learner is asked to structure clinical notes following the IDEA construct. The teacher then evaluates the notes by using the IDEA assessment tool.

### Details

1. The learner is asked to structure the assessment and plan of his or her notes by using the IDEA criteria. As such, the notes should include the following:

- Interpretative summary
  - This 2- to 3-sentence summary of the patient's problems includes the key features (history, physical, laboratory/imaging results) of the patient presentation. The use of semantic qualifiers should be emphasized in constructing this summary.
- Differential diagnosis with commitment to the most likely diagnosis
  - The student lists a differential diagnosis (with at least 3 possibilities) and then specifically designates 1 as the most likely.
- Explanation of reasoning in making this choice
  - This includes an explicit and specific explanation of why the learner chose the particular diagnosis as most likely as well as why the other diagnoses were discounted.
- Alternative diagnoses and explanation of reasoning as to why they were excluded
  - Each alternate diagnosis is discussed, including the rationale for discounting them as the likely diagnosis

2. The teacher then evaluates the note in real time and *with* the student present by using the IDEA Assessment Tool. The teacher provides direct and specific behavioral feedback to the learner.

### Source/Reference:

Baker E, Ledford C, Liston B. Teaching, evaluating and remediating clinical reasoning. *Acad Intern Med Insight*. 2010;8:12-7.

## ❖ Activity: Illness Script Flash Cards

### Rationale

Specific diseases frequently have “key features,” which are the common and prototypical characteristics of a disease presentation. Knowing these key features is essential to the ability to generate diagnostic hypotheses and to recognize clinical patterns. Inexperienced clinicians may be unaware of the key features of many diseases.

### Overview

On the basis of a presenting complaint, the learner constructs a series of flash cards. Each card contains 3 to 4 key features of the common and life-threatening diagnosis that cause the presenting complaint.

### Details

1. After identification of a specific presenting complaint, discuss with the learner the diagnoses associated with this complaint that are common or life-threatening.
2. For each diagnosis, have the learner identify 3 to 4 key features of the prototypical presentation of each diagnosis. Key features may be elements of the history, physical examination, or laboratory/imaging studies.
  - For acute coronary syndrome, for example, the key features may be presence of risk factors, substernal chest pain radiating to the shoulders/jaw, associated diaphoresis and nausea, electrocardiographic changes (ST-segment elevation/depression), and elevated cardiac enzyme levels.
3. The learner constructs flash cards with the above information.
4. The teacher or learners may then regularly quiz each other using the flash cards.
5. **Advanced:** Have the learners rank the key features in terms of strength of association with the diagnosis, using likelihood ratios when available.

## ❖ Activity: Problem Representation

### Rationale

A skill central to the ability to make a diagnosis is the ability to recognize the key features of the clinical presentation while discounting extraneous or useless information. In addition, it is important to be able to qualify these features in terms of acuity and other core characteristics (i.e., the differential diagnosis for *acute* diarrhea is remarkably different from that of *chronic* diarrhea).

### Overview

A case is presented and the learners are asked to build a summary statement that contains all of the key features of the presentation (including the applicable history, physical findings, and laboratory/imaging results). Semantic qualifiers are used to further describe these key findings.

### Details

1. A patient case is presented to an individual learner or a group of learners in sequential chunks (history, then physical examination, then laboratory/imaging results).

2. After each chunk, the learner is asked to construct a summary statement of the key features of the presentation.

3. The summary statement should include only features that are pertinent to the case and furthermore should include the appropriate semantic qualifiers.

- Examples of semantic qualifiers include the following:
  - Acute
  - Subacute
  - Chronic
  - Progressive
  - Intermittent
  - Sudden
  - Gradual

4. Before the providing the next chunk of information, the attending physician critiques the summary statement, pointing out features that may have been over- or underemphasized.

5. The next chunk of information is then provided and the previously constructed summary statement is modified on the basis of the newly available information. The teacher then critiques the new summary statement.

**Alternative Activity**

The attending physician models the approach to problem representation and provides the learner with his or her own summary statement and problem representation at various points during the presentation.

**Source/Reference:**

Bowen JL. Educational strategies to promote clinical diagnostic reasoning. *N Engl J Med.* 2006;355:2217-25; Stuart E, Blankenburg B, Butani L, Johnstone N, Long M, Marsico N. Thinking about thinking: coaching strategies to promote clinical reasoning. In: Council on Medical Student Education in Pediatrics. San Diego, CA; 2011.

## ❖ Activity: Reason Aloud Technique (Learner)

### Rationale

It is often difficult to discern the exact clinical reasoning of a learner, even when the correct answer is achieved. This activity serves to lay bare the learner's clinical reasoning processes.

### Overview

As the learner hears a case that is unknown to him or her, the teacher asks the learner how each piece of clinical information affects the differential diagnosis. In doing so, the teacher can evaluate the learner in terms of ability to appropriately generate and refine hypotheses at the bedside.

### Details

1. This activity may be done at the bedside or in the conference room. If it is to be done at the bedside, select patients carefully, including only those who are not likely to be disturbed by a discussion of all of the diagnostic possibilities (including those unlikely in that particular patient).
2. Tell the learner you will be interrupting frequently to discuss the case.
3. Present a case in which the diagnosis is unknown to the learner. If more than 1 learner is present, your questions can be directed to a learner who is not presenting the case and does not know the diagnosis.
4. As the learner hears each sequential bit of information, ask the learner how the new data affects the likelihood of the diagnoses under active consideration at that time (most clinicians have only 3 to 4 potential diagnoses in their mind at a time).
5. The questions can come with even the most minimal amount of information (i.e., where the pain radiates or an element of the medical history).
6. Point out when a piece of information should prompt the learner to generate a new hypothesis (e.g., the presence of chest pain radiating to the back raises the possibility of aortic dissection).
7. The process may continue throughout the clinical examination. Ask the learner how the findings on physical examination or laboratory/imaging affect the likelihood of the diagnoses under active consideration.
8. Mention specifically when the threshold to treat is reached (this occurs when the likelihood of disease is high enough that no further testing is necessary and treatment is initiated, if appropriate).

Mention that this threshold will be high when the treatment is associated with substantial risk but may be lower if further testing itself is associated with risk.

**Source/Reference:**

Bowen JL. Educational strategies to promote clinical diagnostic reasoning. N Engl J Med. 2006;355:2217-25.

## ❖ Activity: Reason Aloud Technique (Teacher)

### Rationale

Learners are often unclear as to the rationale behind many diagnostic decisions made by experienced clinicians. This activity demystifies the diagnostic process by increasing the transparency of clinical thought.

### Overview

As the learner presents a case that is unknown to the teacher, the teacher comments on how each “chunk” of additional information affects his or her differential diagnosis. The clinical process is thus laid bare as the teacher demonstrates how the diagnostic process unfolds in his or her mind, while also showing the pieces of information critical to the process for that specific presentation.

### Details

1. This activity may be done at the bedside or in the conference room. If it is to be done at the bedside, select patients carefully, including only those who are not likely to be disturbed by a discussion of all the diagnostic possibilities (including those unlikely in that particular patient).

2. Tell the learner you will be interrupting frequently to discuss the case.

3. Have the learner present a case in which the diagnosis is unknown to you, the teacher.

4. As the learner presents each sequential bit of information, mention how the new data affects the likelihood of the diagnoses that you have under active consideration at that time (most clinicians have only 3 or 4 potential diagnoses in their mind at a time).

5. Your comments can come with even the most minimal amount of marginal information (i.e., where the pain radiates or an element of the medical history).

6. Be sure to mention when a piece of information prompts you to generate a new hypothesis (e.g., the presence of chest pain radiating to the back raises the possibility of aortic dissection).

7. The process may continue throughout the clinical examination. Again, ask how the findings on physical examination or laboratory/imaging affect the likelihood of the diagnoses under active consideration.

8. Mention specifically when the threshold to treat is reached (this occurs when the likelihood of disease is high enough that no further testing is necessary and treatment is initiated, if appropriate). Mention that this threshold will be high when the treatment is associated with

substantial risk but may be lower if further testing itself is associated with risk.

**Source/Reference:**

Bowen JL. Educational strategies to promote clinical diagnostic reasoning. N Engl J Med. 2006;355:2217-25.

## ❖ Activity: Symptom-based Reading

### Rationale

Learners are more reliably able to access information that is mentally stored in their memory in a structure that reflects how it is actually used in the clinical setting. Patients present with symptoms and not diseases, and learning in a symptom-based manner more closely approximates the actual clinical reasoning process.

### Overview

Assign the learner to read about the presentation of a specific symptom or physical finding rather than a specific disease. In doing so, have the learner identify the diseases and conditions that are associated with that symptom or sign and are common or life-threatening.

### Details

1. Direct the student to a specific reading assignment regarding a clinical finding (symptom, physical finding, or presentation) in a symptom-oriented resource.

- Examples include:
  - *Symptom to Diagnosis: An Evidence Based Guide*
  - Symptom-based text chapters (e.g., in *Current Medical Diagnosis & Treatment* and *Cecil's Essentials of Medicine*)

2. Have the student return with 2 written lists of diagnoses and conditions associated with the sentinel finding: 1 for common disorders and 1 for life-threatening ones.

3. **Optional:** Have the student list at least 2 other key features of the diseases on the list that will help him or her differentiate among the various entities on the list.

- For example, for common causes of chronic cough, the student may return with the following list, with other key features in parentheses:
  - Postnasal drip (nasal congestion, seasonal variation)
  - Gastroesophageal reflux disease (substernal burning worse when supine)
  - Asthma (wheezing, dyspnea)

### Source/Reference:

Bowen JL. Educational strategies to promote clinical diagnostic reasoning. *N Engl J Med.* 2006;355:2217-25; Eva KW. What every teacher needs to know about clinical reasoning. *Med Educ.* 2005;39:98-106.

## ❖ Activity: The Rewrite

### Rationale

A critical skill in clinical reasoning is the ability to identify the key features of the clinical presentation. Learners may struggle with separating important information from extraneous data and with using the key information to synthesize a pertinent representation of the clinical presentation.

### Overview

The learner is presented with the written summary of a patient presentation that is unorganized and contains a substantial amount of extraneous and nonpertinent data. The learner is asked to streamline and restructure the information while also providing a coherent summary statement and problem representation.

### Details

1. Write or obtain a patient note (not written by the learner) that is unorganized or contains a large amount of distracting or extraneous information.

2. Ask the learner to rewrite the note, deleting extraneous data and reorganizing the presented data as needed.

3. Also require the learner to write a 1- to 3-sentence summary statement that includes the key information (positive and negative) necessary to make a diagnosis.

4. Provide the student with very specific and detailed feedback on the rewrite, including the following:

- The appropriate degree to which important data were retained and unnecessary data were deleted
- The structure of the rewrite, including use of the chronological narrative
- The summary statement/problem representation

### Source/Reference:

Stuart E, Blankenburg B, Butani L, Johnstone N, Long M, Marsico N. Thinking about thinking: coaching strategies to promote clinical reasoning. In: Council on Medical Student Education in Pediatrics. San Diego, CA; 2011.