Overview

I. Define clinical reasoning
   - Brief overview of components and some research
II. Give examples of assessments that can be used in didactic, laboratory and clinical settings
   - Description
   - Formal and Informal
   - Considerations

I. CLINICAL REASONING: A BRIEF OVERVIEW
How Can I Get My Students To Think?

Clinical Decision Making

- Ill-Structured Problems
- Multiple Variables and Individuals
- Dynamic Context
- Diverse Knowledge Base
- Growing Body of Evidence
- Action Feedback Loops

Clinical Reasoning

- The thinking and/or decision-making processes that are used in clinical practice.
- Knowledge
  - Discipline specific knowledge base
- Cognition
  - Thinking skills that allow clinician to process clinical data against knowledge base
- Metacognition
  - Bridges knowledge and cognition; thinking about thinking

Theoretical Models of Reasoning

There are two typical reasoning modes taught in medical education.

1. Hypothetico-Deductive (Elstein et al, 1978)
2. Pattern Recognition (Barrows and Feltovich, 1987)

Hypothetico-Deductive Reasoning

• A process of generating a limited number of hypotheses early in the encounter and using them to guide the subsequent data collection.
• AKA backwards reasoning or analytic reasoning
• Backwards reasoning is causal. Look for the relationship between S & Sx and Dx
• Requires both induction (to generate hypothesis) and deduction (to test hypothesis)

Pattern Recognition

• Direct automatic retrieval of information from a well organized knowledge base
• Non-analytic or forward reasoning
• Experts recognize patterns or “clinical scripts” then perform assessments to provide further evidence to support their hypothesis. This requires experience.
Novices

• Novices use hypothetico-deductive reasoning
• When novices use case pattern they gather too much information, ignore relevant information, and place too much emphasis on extraneous data. (Bordage et al., 1990)
• Inadequacies: incomplete solicitation of patient concerns and inconsistent exploration of psychosocial issues.

Expert Characteristics

• Expert clinical decision making is marked by making decisions despite uncertainty
• Experts recognize patterns
  – Unfamiliar situations lead to hypothetico-deductive reasoning
• Monitor cognitive process – self-regulate
• “Reflect in action” versus “reflect on action”
• Interactions are central to care


II. METHODS FOR ASSESSING CLINICAL REASONING
Assumptions

• To assess clinical reasoning, it must be taught.
• Students acquire thinking frames through explicit instruction and can’t be expected to infer thinking frames from modeling alone
  – So modeling alone without instruction is not helpful
• Not all of these techniques will work for your program.

Breakdown

1. Didactic (4 techniques)
2. Laboratory (3 techniques)
3. Clinical Education (3 techniques)

Didactic

1. Extended Matching Questions (EMQ)
2. Script Concordance Testing (SCT)
3. Clinical Reasoning Problems (CRPs)
4. Key Features Exams
Extended Matching Questions (EMQ)

- Four Components
  1. A theme
  2. An option list
  3. A lead-in statement or question
  4. A stem

- Method has been established as valid and reliable (Case et al., 1994, Fenderson et al., 1994, Coderre et al., 2004)

- Focuses on hypothetico-deductive reasoning.

Extended Matching Question

Theme: Shoulder Injuries

Answer Choices - Answers may be used once, more than once, or not at all.
A. Impingement  D. Upper Cross Syndrome
B. Slap Lesion  E. Glenohumeral Instability
C. GIRD  F. SICK Shoulder

Lead-in Statement: For each case described below, select the most likely condition and write in the letter in the blank.

Stems:
1. _____ A 21 year old volleyball patient that has notably rounded shoulders and forward head posture accompanied by pectoralis major tightness.
2. _____ A 19 year old gymnast who complains of frequent giving way of the R shoulder when the shoulder is placed into external rotation during a gymnastics move. The patient has a positive Apprehension test and Sulcus Sign.
3. _____ A 25 year old pitcher that complains of posterior shoulder pain with deceleration during overhead throwing. The patient displays 120 degrees of external rotation and 45 degrees of internal rotation of the GH joint.
4. _____ A 28 year old swimmer complains of deep shoulder pain accompanied by a clicking sensation. He began to experience the pain and clicking after one episode during the tail end of practice while completing the backstroke when he experienced a pop.
5. _____ An 18 year old softball athlete with notable coracoid tenderness, rounded shoulder, and descended R scapula.

Script Concordance Testing (SCT)

- Based on scripts which make a link between conditions, clinical features and management options.
- Make judgments about the effect on a new piece of information in clinical reasoning process.
- The judgment made by the student can be tested for their concordance with those of experts.
- Assesses reasoning in uncertain situations

Fournier et al. Script concordance tests: Guidelines for construction. SMC. 2008;8(18): 1-7
Script Concordance Test

<table>
<thead>
<tr>
<th>Short scenario with case presented here,......</th>
</tr>
</thead>
</table>
| If you were thinking of (a diagnosis hypothesis) | And then you find (new clinical information) | This hypothesis becomes: 
| -2 = the hypothesis is almost eliminated | -1 = the hypothesis becomes less probable | 0 = the information has not effect on the hypothesis  
| +1 = the hypothesis is becoming more probable | +2 = it can only be this hypothesis |  
| Action | New Information | Likert Scale  

A 22 y/o female presents to you c/o pl after a FOOSH mechanism

<table>
<thead>
<tr>
<th>If you were considering the following diagnosis,......</th>
<th>...and the following new information were to become available,......</th>
<th>...you would then consider this diagnosis,......</th>
</tr>
</thead>
</table>
| Lunate dislocation | Unable to flex the wrist and significant weakness of forearm flexors | A | B | C  
| Colles Fracture | Normal radiographs | A | B | C  
| Elbow dislocation | (+) Tinel's sign at the elbow | A | B | C  
| Hook of hamate fracture | The patient reports that all pain is located in the thenar eminence | A | B | C  
| Shoulder dislocation | You note a step-off deformity of glenohumeral joint | A | B | C  

A = probably correct; B unaffected by the information; C = probably wrong

SCT Test Construction

- Determine the purpose of the test.
  - Time intensive
  - Can be used for Ther Ex, Ther Mod, Eval, Med Conditions, etc.....
- Tests can be written by one person or a team
  - Identify clinical situations that contain uncertainty
  - Identify the relevant options for the situation
  - Identify the key features that help progress toward a solution
SCT Scoring

• Create a reference panel of experts
  – We used our AT faculty and staff
• Experts say that high stakes exams should have a reference panel of at least 10 persons.
• Scoring is completed based on expert panel responses using a combined scoring method.
  – Points are awarded based on the number of experts that choose the same answer.

<table>
<thead>
<tr>
<th>Expert Panel Answers</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Question</td>
<td>-2</td>
<td>-1</td>
</tr>
<tr>
<td>#1</td>
<td>8 (80%)*</td>
<td>2 (20%)</td>
</tr>
<tr>
<td>#2</td>
<td></td>
<td>2 (70%)</td>
</tr>
<tr>
<td>#3</td>
<td>10 (100%)*</td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td>3 (30%)</td>
<td>4 (40%)*</td>
</tr>
</tbody>
</table>

• Your fictitious student earned 2.5 out of 4 points.

Your patient is a 15 y/o with a CC “I don’t feel well and I have a sore throat.”

<table>
<thead>
<tr>
<th>If you were considering the following diagnosis...</th>
<th>...and the following new information became available...</th>
<th>...this information helps to...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strep pharyngitis</td>
<td>The patient’s monospot test was positive</td>
<td>A   B  C</td>
</tr>
<tr>
<td>Mononucleosis</td>
<td>The patient has a high grade fever and tender posterior cervical lymph nodes</td>
<td>A   B  C</td>
</tr>
<tr>
<td>Influenza</td>
<td>The patient’s temperature is 99.2</td>
<td>A   B  C</td>
</tr>
<tr>
<td>Common cold</td>
<td>The patient c/o severe fatigue and myalgia</td>
<td>A   B  C</td>
</tr>
<tr>
<td>Allergic rhinitis</td>
<td>The patient notices the sore throat upon waking up in the morning but the pl significantly diminishes as the day progresses</td>
<td>A   B  C</td>
</tr>
</tbody>
</table>

A = rule out the diagnosis
B = this information has no effect on the hypothesized diagnosis
C = rule in the diagnosis
A 22 y/o soccer athlete presents c/o an injury to her lateral ankle

If you were considering treating with a(an):

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Condition</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ice bag</td>
<td>The pt has a 1 day old lateral ankle sprain</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Hydrocollator pack</td>
<td>Clinical examination reveals no heat or redness over a 3 day old muscle strain</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>E-stim for sensory-level pain modulation</td>
<td>The pt c/o pt that is a 2/10 on a 7 day old lateral ankle sprain</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Pulsed ultrasound</td>
<td>The pt is 5 days post-injury with no signs of the acute inflammatory process in a peroneal tendon injury</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>E-stim for edema prevention</td>
<td>The pt is 4 days post ankle sprain with pitting edema over the lateral ankle</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
</tbody>
</table>

A = not useful or even detrimental;  
B = no less or no more useful;  
C = useful or absolutely necessary

Clinical Reasoning Problems

- Focuses on process rather than the end product of a clinical encounter (diagnostic accuracy)
- Focuses on hypothetico-deductive reasoning.
- Examine the rationale for nominating a diagnosis to evaluate aspects of clinical reasoning.
- Testing method has been shown to be reliable and valid when compared to the DTI.

CRP Development

- Contains a clinical scenario with the presentation, hx and physical exam of a patient
- The student is asked to nominate two likely diagnosis, list the key features (KF), indicate whether the KF were (+) or (-) predictive, and to weight each.
- Each scenario can have several possible conditions as a correct answer.
Present a detailed Hx and PE of a fictitious pt. here...........

1) What do you think the most likely diagnosis is for this patient?
2) Please list the features of the case which you consider to support your diagnosis and those which oppose it, giving an appropriate sign [positive (+) or negative (-)].

<table>
<thead>
<tr>
<th>Features</th>
<th>Supports (+) or Opposes (-)</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1: slightly relevant; 2: somewhat relevant; 3: very relevant</td>
</tr>
</tbody>
</table>

3) If this diagnosis proved incorrect, what would your next choice be?
4) Please list the features of the case which you consider to support your diagnosis and those which oppose it, giving an appropriate sign [positive (+) or negative (-)].

<table>
<thead>
<tr>
<th>Features</th>
<th>Supports (+) or Opposes (-)</th>
<th>Weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1: slightly relevant; 2: somewhat relevant; 3: very relevant</td>
</tr>
</tbody>
</table>

CRP Scoring Process

- Use a panel of expert to create reference standards
  - 1st and 2nd dx of each member is tabulated and ranked in order of likelihood
  - A list of “critical features” is identified for each dx (2/3rd nomination)
  - Reference weightings for each critical feature averaged from panel scores.
    - 2 points for each correct diagnoses
    - 3 points for each correct critical feature

Key Features Examination

- Clinical decision making is case specific and dependent on the identification of “key features” essential to diagnosis (Bordage and Page, 1987)
- They allow more than 1 correct answer so mirrors real-life practice.
- Considers two areas of clinical decision making:
  1. Steps where students are most likely to make an error
  2. A difficult aspect of the identification or management of a patient problem.

Paul, a 56 y/o man comes into your facility because of pain in his left leg, which began two days ago and has been getting progressively worse. He states his leg is tender below the knee and swollen around the ankle, but can’t recall a MOI. He has never had any similar problems. His other leg is fine.

**Question 1**
What diagnosis would you consider at this time? List up to three.
1.  
2.  
3.  

**Question 2**
With respect to your diagnosis, what elements of his history would you particularly want to elicit? Select up to seven.
A. Activity at onset of sx  
B. Alcohol intake  
C. Allergies  
D. Angina pectoris  
E. Anti-inflammatory therapy  
F. Cigarette smoking  
G. Cough  
H. Headache  
I. Low back pain  
J. Paresthesia  
K. Polydipsia  
L. Previous knee problems  
M. Recent dental procedure  
N. Wounds on the foot

---

**Key Features Exam**

- Involve any aspect of patient interaction (elicit hx, interpret sx, diagnosis, management)
- Use multiple writers to develop a list of important clinical problems.
  - What are the essential steps for resolving the problem?
  - Focus on critical steps/decisions (appropriate vs. critical) or focus on steps that produce errors
- Create a qualifier to reflect urgency of the decision.
  - Ex. Most important, most likely, must not miss, immediate, urgent

---

**Key Features Exams**

- KFEs consist of
  - Case scenario
  - Question that tests key features (2-3 Qs)
  - Answer options (between 1-10) can be fill in the blank or short-menu format. The number of desired responses from the student should be stipulated.

- H &P: What special tests would you perform?
- Diagnosis: What is the most likely dx
- Management: What are your short-term management steps

Guidelines for the Development of Key Feature Problems and Test Cases
Laboratory

1. Clinical Sieve
2. Objective Structures Clinical Exam (OSCE)

Clinical Sieve

- This is an informal technique that can be used in class to assess student comprehension.
- This exercise requires that the student a type of VAS to describe their certainty of a presence of a condition (used for eval courses).
- To do:
  - Students to partner up (one is the evaluator and the other is the simulated patient)
  - Patient Script
  - Whiteboard

Clinical Sieve

- Provide time for the patient interaction to take the Hx.
- After the Hx require the examiner to create a differential diagnosis list.
  - Use the clinical sieve to show their degree of certainty about the differentials.
  - Can use a think-pair-share method to verbalize rationale

<table>
<thead>
<tr>
<th>Diff # 1</th>
<th>Diff # 2</th>
<th>Diff # 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>
Clinical Sieve

- Use a whole class discussion to come to some consensus and to clarify uncertainties
- Allow time for the PE
  - Use the clinical sieve to show their degree of certainty about the differentials now.
  - Can use a think-pair-share method to verbalize rationale.

Objective Structured Clinical Exam

- Used to assess clinical competence with pt. scenarios using standardized patients and themed encounters
- Use multiple stations (8-20) where the students spend b/w 3-30 minutes to perform various clinical tasks (history, physical exam, patient education, treatment, rehab, documentation, case presentation, etc…)
- Use a rubric to grade and a debriefing session
Structured Oral Self-Directed Learning Evaluation (SOSLE)

- An oral examination that evaluates a student's problem-solving ability & self-directed learning skills in rehabilitation.
- Consists of 3 parts conducted over a 24-hour period (triple jump exercise).
  - Part I: Problem definition and learning issue generation (20 minutes)
  - Part II: Information search and study (24 hours)
  - Part III: Final problem formulation, management strategies and self-evaluation process (30 minutes)


**SOSLE**

- **Part I** 20 min - Student reads case material, identifies potential problems, puts them in order of priority
  - 10 min - Oral discussion of above, plus management issues and learning goals

- **Part II** 24 hours - Information search and study (use resources)

- **Part III** 20 min - Oral presentation of final formulation of problem and proposed plan
  - 5 min - Self-appraisal
  - 5 min - Shared appraisal
**SOSLE Evaluation Form**

For each of the evaluation items, please read both statement I and II then check the most appropriate box on the rating scale below.

<table>
<thead>
<tr>
<th>Problem Identification: Evaluation to be based on the student’s initial summary of most likely explanation(s).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statement 1: Inaccurate and imprecise statement of main rehab problem(s). Unable to offer suggestions for management</td>
</tr>
<tr>
<td>Statement 2: Accurate and precise outline of main rehab problem(s). Good prioritization of issues. Appropriate speculation of management approaches</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Essentially Like I</th>
<th>More Like I than II</th>
<th>Between I and II</th>
<th>More Like II than I</th>
<th>Essentially Like II</th>
<th>Unable to Assess</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


---

**Clinical Education**

1. SNAPPS
2. One Minute Preceptor
3. Chart Simulated Recall

---

**SNAPPS**

- Student-centered pneumonic used for case presentations in clinical education setting.
- Promotes the articulation of clinical reasoning, case uncertainties and self-directed learning.
- Students that use SNAPPS perform significantly better on case summaries and clinical reasoning than those who are not taught the technique. (Heinerichs & Vela, in press)
  - Cases are longer but more concise.

SNAPPS

S  summarize the patient case
N  narrow the differential
A  analyze the differential
P probe the clinical instructor
P  plan the management of the patient
S  self-directed learning
The One Minute Preceptor

Chart Simulated Recall

• AKA: Case Based Discussion
• Student presents patient files to evaluator who starts a discussion on aspects related to clinical decision making and reasoning
  – Evaluator uses Q’s to elicit critical reasoning.
• Evaluator uses a criterion scoring rubric to grade clinical decision making

https://www.youtube.com/watch?v=P0XgABFzcgE
Chart Simulated Recall Qs

- Premature diagnostic closure
  – What features of the patient’s presentation led you to your top three diagnoses?
  – Is there anything else you wish you would have asked?
- Inappropriate management choices
  – Were there other tests that you thought of but deferred or ruled out?
  – What did you decide was appropriate for follow up?
- Patient – centeredness
  – What did you learn about the patient’s concerns about the illness?


Sample CnD Score Sheet

<table>
<thead>
<tr>
<th>Clinical Setting</th>
<th>CHD</th>
<th>MISC</th>
<th>EXTERNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case Complexity</td>
<td>LOW</td>
<td>MBD</td>
<td>HIGH</td>
</tr>
</tbody>
</table>

- Made the following areas using scale indicating to appropriate
- Balanced Expectations
- Meets Expectations
- Above Expectations
- Complexity Exceeds Expectations

- Key Learning Points
- Discussion with Faculty

THANK YOU