Medical Knowledge and Clinical Reasoning

I have no conflicts of interest to report.
Agenda

• Medical Knowledge and Traditional Assessment
• Diagnostic/clinical Reasoning
  • What is it?
  • How do you teach it?
  • How do you assess it?

Table Work

Take a few minutes and discuss at your tables where and how in your program you assess medical knowledge.

How do you use and track the data to advance the learner’s medical knowledge?
Med Knowledge: Components

Acquisition - Level of Knowledge
Develop clinically applicable knowledge of the basic and clinical sciences that underlie the practice of medicine

Application of Knowledge - Patient Care
Apply this knowledge to clinical problem solving, clinical decision making, and critical thinking

In-training Examinations (ITE)

• First ITE - early 60s
• Orthopedics
• Provide formative assessment for MK
  • Correlates with Board exam pass rate
  • More accurate measure of global knowledge than assessment of faculty
ITE

Advantages
• Time friendly
• Low faculty demand for time
• Predictive validity for Board exams
• Feedback to trainees
• Feedback to programs
• Knowledge - important foundation

Disadvantages
• Shifts focus away from patient care
• Cost
• Uncertain ability to predict specific deficits
• Only given once a year
• Limited to mainly evaluation of level of knowledge

Clinical Reasoning

“We’re pretty sure it’s the West Nile virus.”
Clinical Reasoning

- The cognitive engine that drives problem-solving and decision-making.

“The most critical of a physician’s skills. It is every physician’s measure of his/her abilities. It is the most important ingredient in his/her professional self-image.”

Sherwin Nuland

Table Work

Take a few minutes and discuss at your tables where in your program you teach and assess clinical reasoning skills. How do you use and track this data to advance competence in this skill?
Developing Clinical Reasoning

“I expect you all to be independent, innovative, critical thinkers who will do exactly as I say!”

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Table Work

Think about a student or resident who was a good clinical thinker. What made them good?
Next, think about a bad clinical thinker. What made them bad?

Critical Thinking

“Good Thinking”
- Sensitivity
  - Interest in gaining more information
  - Seeking alternatives
- Inclination
  - Willing to invest energy in thinking the matter through
- Ability
  - Possess the cognitive ability

“Bad Thinking” – “cognitive misers”
- Chose to take mental shortcuts, engage in heuristic thinking,
- without interest in “good thinking”

Krupat E, Medical Education 2011
Clinical Reasoning

- Internal process influenced by context
- To externalize:
  - Appreciate metacognition and the concept of “situated cognition”
  - Identify the K/S/A that define clinical reasoning
  - Identify assessment methods (formative and/or summative)
  - Provide actionable feedback to learners
Clinical Reasoning Model

Key Elements of Diagnostic Reasoning

- Patient's story
- Data acquisition
- Accurate problem representation
- Generation of hypothesis
- Search for and selection of illness script
- Diagnosis

Bowen JL. NEJM; 2006: 2217

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Problem Representation

- Non-analytical - The behavior of experts
  - Pattern Recognition
  - Heuristics
    - The rapid non-analytic mental shortcuts that humans use to recognize and categorize things.
- Analytical - The work of early learners
  - Hypothesis based deductive reasoning
  - The default when a pattern is not apparent

Clinical presentation

Type 1 thinking: Fast, frequent and subconscious

Type 2 thinking: Slow, logical and conscious

Illness script
- Pattern identified
  - Selected (Non-analytic)

No clear Pattern

Hypothesis based Deductive reasoning (Analytic)

Kahneman, Thinking Fast and Slow

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Properties of the 2 types of decision-making

<table>
<thead>
<tr>
<th></th>
<th>Type I</th>
<th>Type II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Style</td>
<td>Heuristic</td>
<td>Systematic</td>
</tr>
<tr>
<td>Cognitive Awareness</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Automaticity</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Rate</td>
<td>Fast</td>
<td>Slow</td>
</tr>
<tr>
<td>Effort</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Emotional Component</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Scientific Rigor</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Errors</td>
<td>More</td>
<td>Less</td>
</tr>
</tbody>
</table>

Dual Process Theory

- In reality, physicians often use both non-analytic (system 1; fast) and analytic (system 2; slow) thinking.
- We will often switch back and forth depending in the situation.
Illness Scripts

• Pattern Recognition in Medicine
  - The near instantaneous recognition that all (or almost all) components of a known disease are present
• Disease Specific Packets of Information
  - those critical elements which distinguish among like diseases
• Storage Strategy of Experts
• Fairly regimented structure

A Case

You evaluate a 78-year-old male with a 2-week history of joint pain beginning after cardiac catheterization. Both knees and one wrist are red, painful, and swollen and the patient complains of daily pain. Symptoms began in the left knee and quickly spread to the other joints. The right knee is more swollen than the left, but the left knee hurts more. X-ray is pending. He denies fever, weight loss or malaise, and recent labs reveal an ESR of 50. Past medical history includes CAD and hypothyroidism.
78 year old male with a two week history of multiple joint pains after a cardiac catheterization. Began in the left knee but the right knee is more swollen. They hurt all day. The joints are swollen, red, and warm to touch. He has no other important symptoms.

Minimal processing – Just abbreviated

78-year-old (ELDERLY) male for evaluation of a 2-week (SUBACUTE) history joint pain. Symptoms began 1 week after a cardiac catheterization (RECENT MEDICAL INTERVENTION). Both knees and one wrist (OLIGO-ARTICULAR). He has no fever, weight loss, or malaise (NON-SYSTEMIC). Recent labs are significant for an ESR of 50 (INFLAMMATORY).

Semantic Qualifiers
You evaluate a 78-year-old male with a 2-week history of joint pain beginning after cardiac catheterization. Both knees and one wrist are red, painful, and swollen and the patient complains of daily pain. Symptoms began in the left knee and quickly spread to the other joints. The right knee is more swollen than the left, but the left knee hurts more. X-ray is pending. He denies fever, weight loss or malaise, and recent labs reveal an ESR of 50. Past medical history includes CAD and hypothyroidism.
### Semantic Qualifiers

<table>
<thead>
<tr>
<th>Acute</th>
<th>Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudden</td>
<td>Gradual</td>
</tr>
<tr>
<td>Delayed</td>
<td>Abrupt</td>
</tr>
<tr>
<td>Progressive</td>
<td>Waning</td>
</tr>
<tr>
<td>Constant</td>
<td>Intermittent</td>
</tr>
<tr>
<td>Unilateral</td>
<td>Bilateral</td>
</tr>
<tr>
<td>Painful</td>
<td>Painless</td>
</tr>
<tr>
<td>Mild</td>
<td>Severe</td>
</tr>
</tbody>
</table>

Kalet A, Remediation in Medical Education

### Key Elements of Diagnostic Reasoning

- **Knowledge**
- **Context**
- **Experience**
- **Patient’s story**
- **Data acquisition**
- **Accurate “problem representation”**
- **Generation of hypothesis**
- **Search for and selection - illness script**
- **Diagnosis**

Bowen JL. NEJM; 2006: 2217

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Diagnostic Error

Any mistake or failure in the diagnostic process leading to a misdiagnosis, a missed diagnosis, or a delay in diagnosis.

Schiff et al. AHRQ 2005

Errors and Adverse Events

- Graber¹ adverse event study:
  - Most errors combination of individual and systems factors
  - Average 5.9 system +/- cognitive error per case
  - “Cognitive factors”
    - 320 cognitive factors in 74 cases
    - 45 due to faulty data gathering
    - 264 due to faulty synthesis (problem representation – clinical reasoning)

¹ Arch Intern Med. 2005; 165: 1493.
I think the error was here, but was it a type 1 or 2 problem?

from *What's so Funny about Science?* by Sidney Harris (1977)
Type 1 and Heuristics

Experience-based techniques for problem solving, learning or discovery (rules of thumb)

Good:
- provide cognitive “short cuts”
- Help us to be efficient

Bad:
- Thinking traps – so beware!
- Cognitive bias or “Dispositions to Respond” (CDRs)*


Resident Identified Heuristics Errors

- Anchoring – locked on a diagnosis
- Availability – diagnosis is common, serious or recently seen
- Framing Effect - influence of presenter, presentation and location
- Blind Obedience – deference to authority/technology
- Unpacking – failing to elicit all relevant information
- Confirmation – weighting supportive data, ignoring outliers
- Diagnostic momentum – favoring previous dx
- Visceral Bias – influence of personal feelings

Von Feldt
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Type 2 - Diagnostic errors and the analytic approach

- Knowledge deficits

No matter how analytical you are, if you did not think of the possibility you will be wrong!

- Knowledge matters!

Diagnostic Errors (2015)

IOM Report
Released September 2015

- At least 5 percent of outpatient’s each year experience a diagnostic error.
- Postmortems shows diagnostic errors contribute to ~10 percent of patient deaths.
- Diagnostic errors account for 6 to 17 percent of hospital adverse events.
Makary and Daniel (2016)

Most Common Missed Diagnosis resulting in Dx error

- Pulmonary embolism
- Drug reaction or overdose
- Lung cancer
- Colorectal cancer
- Acute coronary syndrome
- Congestive heart failure
- Fracture
- Abscess
- Pneumonia

Table Work

At your tables, discuss how your program could identify “misses” and “near misses” regarding diagnosis error for formative assessment?

The Reality of Type 1 and 2 Errors

- Teaching cognitive bias (heuristic errors) improve learner recognition but does not reduce diagnostic errors.
- Encouraging reflection and the reorganization of existing information show some benefit.
- The jury is out!

"First of all, Mr. Hawkins, let's get the gus down.... I would guess it's no fifty lighter frags but I want to take a closer look...."

Key Elements of Diagnostic Reasoning

Patient's story
Data acquisition
Accurate "problem representation"
Generation of hypothesis
Search for and selection - illness script
Diagnosis

Knowledge
Context
Experience

Situated Cognition

Physician factors
Patient factors
Practice factors

Expertise, self-regulation, deliberative practice, sleepiness, well being
Literacy
Numeracy
Activation
Advocacy
Appointment length, care setting, type of presentation

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Approach to the assessment of clinical reasoning?

Assessment Approaches

- Student Driven
  - IDEA
  - SNAPPS
- Preceptor Driven
  - BSCO
  - One Minute Preceptor
  - Chart Stimulated Recall
  - ART
SNAPPS

- SUMMARIZE
- NARROW
- ANALYZE
- PROBE
- PLAN
- SELECT

Wolpaw T. Acad Med 2009

The One Minute Preceptor

- Get a commitment
- Probe for supporting evidence
- Teach a general rule
- Reinforce what was done right
- Correct mistakes
- (create time for reflection)

Chart Stimulated Recall

• Uses the medical record as a reference point for structured clinical questioning
• Inexpensive
• Conducted by medical faculty
• Uses clinical scenarios familiar to the trainee (context of care)
• Ideally, the medical record is reviewed in advance to identify specific questions (PARS)

Table Work

Review one of the provided resident notes. One is a medicine resident covering a firm partner in clinic. The other is a surgical prelim seeing a patient in the ER.

Are there opportunities to explore the resident’s diagnostic reasoning?
Night Float Rotation

• Challenge
  • What is the curriculum/assessment during night float rotation?

• Reality
  • Responsibilities include admission and management of patients (patient care), and sign out to the clinical team (IPCS)
  • Residents can call faculty, but little else

• Solution
  • Night float morning report with CSR

<table>
<thead>
<tr>
<th>Clear Chief Complaint</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delineation of sick vs non sick</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Appropriate History</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Appropriate Physical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate analysis of lab data</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Accurate differential diagnosis</td>
<td></td>
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<tr>
<td>Documented thought process for differential diagnosis</td>
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<td></td>
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<tr>
<td>Treatment appropriate for diagnosis</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Documented thought process for treatment plan</td>
<td></td>
<td></td>
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<tr>
<td>Appropriate incorporation of labs in diagnosis and plan</td>
<td></td>
<td></td>
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<tr>
<td>Are you comfortable responding to a change in clinical status</td>
<td></td>
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<tr>
<td>Based upon the history and physical?</td>
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</tbody>
</table>

Overall Note:
Clarity __________________________
Organization _______________________
Documentation _______________________

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Night Float CSR

Table 3 Results of Random History and Physical Review

Score

<table>
<thead>
<tr>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
</tr>
<tr>
<td>9</td>
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<td>7</td>
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<td>3</td>
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<tr>
<td>2</td>
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<td>1</td>
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</tbody>
</table>

Academic Month

Table 3 Results of Random History and Physical Review

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www.improvediagnosis.org/art<http://www.improvediagnosis.org/art
Twelve Tips “to prevent diagnostic error” – The “Good Thinker” Entrustment

- Understand heuristics
- Use “diagnostic timeouts”
- Think “worst-case scenario medicine”
- Systematic approach to common problems
- Ask why
- Teach/emphasize physical exam
- Teach Bayesian theory
- Acknowledge your emotions
- Identify what doesn’t fit
- Embrace zebras
- “Slow down”
- Admit mistakes

Trowbridge Medical Teacher 2008

The One Minute Preceptor

- Clinical teaching strategy
- 5 microskills
  - Get a commitment
  - Probe for supporting evidence
  - Teach a general rule
  - Reinforce what was done right
  - Correct mistakes
  - “Create time for reflection”

“The System”

Structure + Process = Outcome

$S$(curricular experience) + $P$ (Chart Stimulated Recall) = $O$ (“Good thinkers”)

What does this look like in your program?

Questions