Seeing The Wood From The Trees

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Seeing The Wood From The Trees
An Introduction to Teaching and Learning Clinical Reasoning Skills

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Objectives

• 1. Define clinical reasoning and explain why it is important in medical education
• 2. Describe the theoretical models of clinical reasoning
• 3. Reflect on clinical reasoning in your own clinical practice
• 4. Apply the theoretical models to common teaching techniques
• 5. Develop teaching and learning of clinical reasoning skills in your learning environment
Introductions
Objectives

• 1. Define clinical reasoning and explain why it is important in medical education
What is Clinical Reasoning?
What is Clinical Reasoning?

“Thinking and decision making associated with clinical practice”

Higgs & Jones, 2008
What is Clinical Reasoning?

“Thinking and decision making associated with clinical practice”

Higgs & Jones, 2008
What is Clinical Reasoning?

“The process of attempting to structure meaning from a mass of confusing data and experiences occurring within a specific clinical context and then making decisions based on this understanding”
Can you give examples where/when you engage in clinical reasoning in your day-to-day practice?
Discourses

- Reasoning as a **Skill**
  “Charge nurse thinks it would be better if the lady with jaundice and hepatomegaly went to the last gastro bed in the hospital”

- Reasoning as a **Process**
  “Let’s think logically about what diagnosis is most likely here”

- Reasoning as **Purpose Orientated**
  “Can you come and assess this patient with shortness of breath?”

- Reasoning as an **Outcome**
  “I think the reason your short of breath is you have pneumonia”

- **Contextualized Reasoning**
  “The man with the pneumonia seems critically unwell, I think I had best phone ITU”

Young et al (2016)
Diagnostic Reasoning

- Reasoning as a Process
  “Let’s think logically about what diagnosis is most likely here”

Young et al (2016)
What is Diagnostic Reasoning Important?
Why is Diagnostic Reasoning Important?

• Diagnostic errors are common and result in substantial patient morbidity and mortality.

• It helps us understand how we think during the diagnostic process.

• If we understand the process then it makes it easier to remediate diagnostic error and teach it well to limit the harm incurred.
Categories contributing to diagnostic error in 100 patients (Graber et al 2005)

- Both system-related and cognitive factors: 46%
- System-related error only: 19%
- Cognitive error only: 28%
- No fault factor: 7%
Can you give examples where/when diagnostic error was caused by cognitive failure rather than systems failure?
“There are some things they don’t teach you in medical school. I think you’ve got one of those things.”
There are some things they don’t teach you in medical school. I think you’ve got one of those things.”
“Impaired vision, bloated abdomen, cold hands...they could be symptoms of a severe peanut allergy.”
“Impaired vision, bloated abdomen, cold hands...they could be symptoms of a severe peanut allergy.”

“I’m stumped. We’ll have to wait for the autopsy.”
Objectives

• 1. Define clinical reasoning and explain why it is important in medical education

• 2. Describe the theoretical models of clinical reasoning
Models of Clinical Reasoning

• Dual-Process Theory
  - Script Theory
  - Cognitive load theory
  - Hypothetico-deductive reasoning
Dual-Process Theory
“Mini-Quiz”
Take a piece of paper, take 8 seconds and write down your answers to each of these three questions...
A bat and a ball cost £1.10 in total. The bat cost £1.00 more than the ball. How much does the ball cost?
It takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half the lake?
Now we’ll go back and you can check your answers...
Write down if you think your original answer is correct?
Take a piece of paper and write down your answers to each of these three questions...
A bat and a ball cost £1.10 in total. The bat cost £1.00 more than the ball. How much does the ball cost?
It takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half the lake?
Answers:

1. 5 pence
2. 5 minutes
3. 47 days
Dual Process Theory

• Two types of ‘minds’ or ‘thinking’:
  – **Type 1**: Fast, **Intuitive** Thinking
  – **Type 2**: Slow, **Analytical** Thinking
<table>
<thead>
<tr>
<th>Intuitive</th>
<th>Analytical</th>
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<tbody>
<tr>
<td>Experiential-inductive</td>
<td>Hypothetico-deductive</td>
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<tr>
<td>Bounded rationality</td>
<td>Unbounded rationality</td>
</tr>
<tr>
<td>Heuristic</td>
<td>Normative reasoning</td>
</tr>
<tr>
<td>Gestalt/pattern recognition</td>
<td>Robust decision-making</td>
</tr>
<tr>
<td>Modular responsivity</td>
<td>Critical, logical thought</td>
</tr>
<tr>
<td>Recognition-primed</td>
<td>Multiple branching</td>
</tr>
<tr>
<td>Unconscious thinking</td>
<td>Deliberate, purposeful</td>
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</tbody>
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<th>Cognitive feature</th>
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<td>Capacity</td>
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<td>Limited</td>
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<td>Automaticity</td>
<td>High</td>
<td>Low</td>
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<td>Lower</td>
<td>Higher</td>
</tr>
<tr>
<td>Cognitive awareness</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Reliability</td>
<td>Lower</td>
<td>Higher</td>
</tr>
<tr>
<td>Errors</td>
<td>More</td>
<td>Fewer</td>
</tr>
<tr>
<td>Scientific rigor</td>
<td>Lower</td>
<td>Higher</td>
</tr>
<tr>
<td>Users</td>
<td>Experts</td>
<td>Experts &amp; Novices</td>
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How can experienced clinicians spend so much time in Type 1 thinking?
Script Theory
Script Theory

- Proposes model of how we store and retrieve specialist information

- In medical context implies knowledge is stored into illness ‘scripts’ linking clinical and pathophysiologic information to broad categories regarding:
  - Broad Diagnostic Categories (e.g. Rheumatological Disease)
  - Specific Diseases (Rheumatoid Arthritis)
  - Individual Patients (Mrs Jones)

- Experts have highly organized knowledge and a large library of ‘scripts’.
Illness Scripts

- Ask and answer 3 questions to organise knowledge about disease into Illness Scripts

1. **Who gets it**: epidemiology and risk factors

2. **How it present with respect to time**: temporal pattern (ie. Onset, duration, constant/intermittent, and pattern of progression).

3. **How is presents with respect to key features**: symptoms and physical examination findings
<table>
<thead>
<tr>
<th>Disease</th>
<th>Who Gets It (Epidemiology and Risk Factors)</th>
<th>How It Presents With Respect to Time</th>
<th>Clinical Manifestations on Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheumatoid arthritis</td>
<td>Women (younger or older ages); men (older)</td>
<td>Typically gradual onset, insidious and chronic (years, at least &gt;6 weeks)</td>
<td>Inflammation of joints (red, warm, swollen, painful)</td>
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<td></td>
<td>Ratio of women to men, 2–3:1</td>
<td></td>
<td>Involvement of small joints of hands and feet; sometimes involves larger joints (wrists, knees, shoulders, cervical spine), but not lumbar or thoracic spine</td>
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<td></td>
<td>Most present between ages 40 and 75 y</td>
<td></td>
<td>Morning stiffness (&gt;30–60 min to resume full activity after prolonged rest)</td>
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<tr>
<td>Systemic lupus erythematosus</td>
<td>Typically women, ages 20–45 y</td>
<td>Can present acutely or more insidiously; can be persistent and progressive or intermittent with flares</td>
<td>Extra-articular manifestations uncommon at presentation:</td>
</tr>
<tr>
<td></td>
<td>Risk factors include African American ethnicity and countries with indigenous African population, family history,</td>
<td></td>
<td>Migratory, symmetric joint pain and swelling with mild inflammatory changes (tender, swollen PIP)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Extra-articular manifestations common (malar rash, mucocutaneous ulcers, alpecia, fatigue, fever, cardiopulmonary or renal involvement)</td>
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<td></td>
<td>Exam without joint deformity</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>Common, especially if age &gt;60 y; affects most people to some extent by age 70 y</td>
<td>Chronic, progressive; can have acute flares</td>
<td>Typically not inflammatory</td>
</tr>
<tr>
<td></td>
<td>Risk factors are obesity, trauma, and overuse (sports or work-related)</td>
<td></td>
<td>Pain worse with movement or activity, improved by rest and simple analgesics</td>
</tr>
<tr>
<td></td>
<td>Ratio men: women, 1:1, equally; men may develop earlier</td>
<td></td>
<td>“Gel effect”: short-term stiffness after short periods of inactivity</td>
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<td></td>
<td></td>
<td></td>
<td>Reduced range of movement on examination</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Joint deformation with bony changes</td>
</tr>
</tbody>
</table>

*PIP = proximal interphalangeal joint.*

Trowbridge, Rencic and Durning, 2015
A 30 year woman presents with a headache, what features predict meningitis?
Comparing and Contrasting Illness Scripts

**Headache**
- Sudden onset (Thunderclap)
- Occipital
- Severe 10/10

**Sub-Arachnoid Haemorrhage**

**Meningitis**
- Sub-acute onset
- Vomiting
- Neck stiffness
- Photophobia
- Rash
- Fever

- Occipital
- Sudden onset (Thunderclap)
- Severe 10/10
- Rash

- Fever
Cognitive Load Theory

Schank & Abelson, 1977
Cognitive Load Theory

Another information processing theory that focusing on limited human cognitive architecture.

- *Short term working memory can only process so pieces of information at one time*
- *Depending on the field this will vary between 4+/-2 or 7+/-2*
- *Explains why PINs, Passcodes and Telephone numbers are 4-7 digits long*
- *While RAM is limited LTWM is potentially endless*
How can clinicians engage in Type 2 thinking?
Hypothetico-deductive Reasoning

Clinicians generate hypotheses and arguments are made based on patients’ complaints.

• **Premise 1**: In Disease A, Finding B Occurs
• **Premise 2**: Finding B is absent
• **Conclusion**: Disease A is not this diagnosis.

Often can only rule out some hypotheses, and cannot ensure every diagnosis considered.

If original hypotheses and subsequent deductions are flawed can reach inaccurate conclusions
Dual Process Theory

Context
- Ambient conditions
- Task difficulty
- Task ambiguity
- Affective state
- Modular responsiveness

Type 1 Processes
- Recognized
- Pattern recognition
- Repetition

Type 2 Processes
- Not recognized
- Intellectual ability
- Education
- Training
- Critical thinking
- Logical competence
- Rationality
- Feedback

Patient Presentation
- Pattern Processor

Rational override
- Dysrationalia override

Calibration
- Diagnosis

Croskerry, 2009
Dual Process Theory

Croskerry, 2009
Expert vs Novice

Cooper, Da Silva & Powell, 2017

Pattern Recognition
Forward Thinking
(Type I)

Hypothesis Testing
(Type II)
Dual-Process Theory and Conscious-Competence Model

Appears in (Cutrer et al, 2013), Adapted from NPC, 2011
The mark of a well calibrated thinker is the ability to recognise what mode of thinking you are in and to anticipate and recognise situations in which cognitive biases and errors are more likely to occur...
Objectives

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Influences on Clinical Reasoning

Smith, Higgs & Ellis, 2007
Select one of the situations involving clinical reasoning from earlier.

Discuss what factors might influence the clinical reasoning process in practice.
Teaching Clinical Reasoning
Objectives

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Teaching Clinical Reasoning

Cooper, Da Silva & Powell, 2017
SNAPPS

• Summarise
• Narrow your findings to 2-3 differentials
• Analyse your findings based on what makes your diagnoses more or less likely
• Probe for any uncertainties
• Plan management
• Select case related incident for self study

Wolpaw, Wolpaw & Papp, 2003
One-Minute Preceptor

- Get Learner to commit to what they think is going on
- Probe for supporting evidence
- Teach one or two general principles
- Reinforce what was done well
- Correct one or two errors in reasoning
“Live Action Simulation”
What factors impacted on the student’s ability to reason in the first example?
Pitfalls in Clinical Reasoning

• Inadequate Knowledge (*Don’t know the scripts*)

• Faulty Data Gathering (*No working hypothesis*)

• Data Processing (*Difficulty analysing findings*)

• Metacognition (*Difficulty regulating own thinking*)

Adapted from Cutrer, 2013
Improving Knowledge

• **Scaffolding** – Actively comparing and contrasting similar scripts to widen knowledge base whilst teaching

• **Teaching from Presentation to Diagnosis** – ‘Managing Shortness of Breath’ vs ‘An Overview of Respiratory Medicine’
Data-Gathering

• Direct Observation of Data Gathering Skills

• Hypothesis-Driven History and Examination
Improving Data Processing

- RIME Framework – Reporter, Interpreter, Manager, Educator
- Using Semantic Qualifiers
- SNAPPS
- One-Minute Preceptor
Semantic Qualifiers

• A 74yrs male with sudden onset, right arm and leg weakness and speech disturbance. He has a PMHx of PVD and IHD. He normally smokes 20 cigarettes a day.
Semantic Qualifiers

• A 74yrs male with sudden onset, right arm and leg weakness and speech disturbance. He has a PMHx of PVD and IHD. He normally smokes 20 cigarettes a day.

Epidemiology: Elderly, Vasculopathy, Smoker

Temporal Patterns: Acute

Clinical Features: Hemiplegia and Dysarthria
Reflection-Metacognition

• Diagnostic Timeout

• Awareness of Identification of Cognitive Bias

• Reflective Practice – ‘Stop and Think’ Framework

• Simulation
Diagnostic Timeout

Take a moment to reframe the current problem based on available data, whilst avoiding the lens of the current working diagnosis.

Trowbridge, 2008
Cognitive Bias

• Anchoring Bias
  – “He works as a delivery driver, it's much more likely to be MSK chest pain”

• Ascertaintment Bias
  – “That young man is clearly just drunk, get him up and out as quickly as possible, please, would you?”

• Availability Bias
  – “The last patient I saw like this turned out to have endocarditis, I think we should ask cardiology to see”

• Search Satisficing
  – “I'm not sure it's that unusual if you're a 60yr old with Osteoarthritis to have a bit of back pain?”

Croskerry, 2013
‘Stop and Think’ Framework

- Name the problem
- Reframe the Problem
- Generate Hypotheses
- Deduct Hypotheses
- Test
- Monitor/Detect Likely Consequences
- Reflection-on-Action
Objectives

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5. Develop teaching and learning of clinical reasoning skills in your learning environment
Using the situation you analysed earlier, how could you use these methods to teach clinical reasoning skills to students or trainees?
Summary
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5. Develop teaching and learning of clinical reasoning skills in your learning environment
Thanks to...

- Dr Ross Cairns, Dr Kim Shields and Dr Andrew Tester for their assistance and acting skills during the live simulation
References

Further Resources

www.creme.org.uk