Clinical reasoning: an introduction for clinicians

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Outline

• What is clinical reasoning?
• Why is it important?
• What do we know about clinical reasoning?
  – Brief overview of the literature
  – Components of clinical reasoning
• How do people become good ‘clinical reasoners’ (thinkers and decision makers)?

Difficult material .. Important you understand the basic concepts underpinning diagnosis and management in medicine
What is clinical reasoning?
Clinical reasoning is, ‘A clinician’s ability to make decisions, often with others, based on the available clinical information, which includes history (sometimes from multiple sources), physical examination findings and test results – against a backdrop of uncertainty. [It] also includes choosing appropriate treatments (or no treatment at all) and decision-making with patients and/or their carers.’

In most definitions in the literature, several ‘components’ (i.e. elements of a larger whole) of the clinical reasoning process are described:

- History
- Physical examination
- Use and interpretation of diagnostic tests
- ‘Reasoning’ and ‘metacognition’
- Shared decision making (e.g. with patients, carers, teams, decision aids etc.)
- Formal and experiential knowledge of medicine

Not necessarily in order!
Clinical reasoning describes the thinking and decision-making processes associated with clinical practice.

Clinical reasoning is not the same as ‘critical thinking’ ... critical thinking is a component of rationality – one’s ability to reason based on facts – and rationality is only one component of clinical reasoning.

Reason is a philosophical term
Formal / logic (deductive, inductive, abductive)
Informal (intuitive)
Reasoning, or an aspect of it, is sometimes referred to as rationality. Being rational is an important in clinical reasoning ability but is only one component. More of that later!
However, clinical reasoning does not happen only inside a clinician’s head – it is “situated” in the messy clinical environment, and influenced by many external factors (as well as internal ones)

Figure 1. Situated cognition and the clinical encounter.

Why is clinical reasoning important?

Ideas?
There is growing interest in diagnostic error as a significant cause of preventable harm.
This publication (IoM improving diagnosis in healthcare) was published in 2015 and highlights diagnostic error as a leading cause of preventable harm. [read slide]
Studies into the NATURE of diagnostic error have been the subject of debate. Graber et al identified 100 cases of diagnostic error through autopsy reports, quality assurance activities and voluntary reports. 90 cases involved injury, including 33 deaths. An average of 6 system or cognitive factors were found in each case. [read slide].

One def of diagnostic error is doctor has all info to make diagnosis then makes wrong diagnosis.

They stated that premature closure, faulty context generation, misjudging of the salience of findings, faulty perception, and errors arising from the use of heuristics (i.e. cognitive biases) were the common causes of faulty synthesis and diagnostic error ... AND they stated that ‘faulty or inadequate knowledge was uncommon.’ But controversial!
Other researchers have studied diagnostic error and found that the major source of error is ‘mistakes’, defined as an intended act, but the physician does not know it is incorrect.

Other research demonstrates that diagnostic accuracy correlates with both previous experience with similar true clinical cases AND formal knowledge measured by written exams.

Educational strategies directed at recognising and reducing biases are ineffective in reducing errors. But strategies that build understanding, that encourage clinicians to mobilise and re-organise their knowledge (including basic science knowledge) or to reflect on the content of the case have shown benefit, which is presumably a consequence of directing participants to identify additional knowledge that is relevant to the problem.
What do we know about clinical reasoning?

Brief overview of the literature

So on that note – let’s explore this a bit more!
But before that, I’d like to start with an unfamiliar scenario – this is termed a ‘Eureka problem’ in psychology. Once you know it, it’s obvious. What do you think? [Answer: send a smaller no of troops via each drawbridge – spread em out].

King Arthur’s troops come upon a fort that is surrounded by a moat

None of the drawbridges are strong enough to hold the number of men required to capture the fortress

How can the fortress be overthrown?
In the 1970s, expertise in medicine was considered to be similar to general thinking skills. However, this famous comprehensive study by Elstein, Shulman and Sprafka changed all that.

Using simulated patients and cases they observed two things:

1) There was no difference in the process or strategy used by expert clinicians and students – both quickly came up with one or more diagnostic hypotheses and this guided the search for further information. However, when the experts produced a diagnosis, their rationales were more accurate because they knew more as a result of clinical experience, and probably organised their knowledge differently as a consequence.

2) Success in one problem was a poor predictor of success in another. The performance of even experienced physicians varied markedly from case to case within their own specialty.

Elstein and colleagues concluded that [read slide].

Their findings were evidence against the notion that clinical reasoning was a general problem solving skill, and this led to a change in direction, examining the role of knowledge in expertise.
In the years that followed, researchers studied medical expertise as the **amount of knowledge** (i.e. memory) but they got some surprising results.

Given unlimited time, novices could remember as much as experts – but intermediates (final year students) remembered more than either novices or experts. (Schmidt and Boshuizen called this the ‘intermediate effect’).

But experts appeared to acquire information more efficiently and paid attention to more critical information. And they had superior recall if they only had short exposure (30s) to information.

Experts appeared to have ‘encapsulated knowledge’ – so they performed worse on laboratory memory tests because they focused their attention specifically on the critical features of a case at the expense of extraneous details.

Studies of how experts **organised their knowledge** showed - *cutting a very long story short* - that knowledge is organised differently in the brains of experts ... relying more on ‘problem representation’ and experiential knowledge, and less on formal rules. What we might call ‘pattern recognition’. This mirrored studies in chess expertise ... [explain chess experiments].
Pattern recognition is what we do all the time in everyday life. Is that animal a cat or a dog? The human brain has two systems that drive problem solving and decision making in life and in clinical practice. In the cognitive psychology literature, there is good evidence that human thinking and decision making mostly relies on rapid intuitive processing or heuristics (shortcuts/pattern recognition) – or ‘System 1 thinking’. And we also have a slower, more analytical way of thinking and decision making – System 2. The two operate independently, simultaneously and always.
For example – what is this?
NOW – what is this?
You have seen this before – now you can recognise it.
While working memory has limited capacity, long term ‘associative’ memory has limitless capacity (pattern recognition/intuition), and memories are retrieved based on the strength of their association with new information effortlessly. The likelihood of retrieving a similar example is related to the strength of the association – which can be influenced by a number of factors, such as the number of times it has been encountered before, but also extraneous characteristics such as recency or vividness – which can lead to errors.

Solve this puzzle – don’t spend too much time on it, just use your intuition. Most people come up with the answer 10p. This is fast, intuitive, and wrong. Do the maths – the answer is 5p.

These ‘mistakes’ are termed cognitive biases … we all know how to do the maths (we have the knowledge), we jumped to a conclusion.
The two Systems work together – independently, simultaneously and always. They can interplay though. You can stop to reflect what mode of thinking you are in. Experts typically use System 1, but in unfamiliar cases resort to System 2 (more deliberate, analytical). Thinking about one’s thinking = metacognition – an important component of clinical reasoning, and learning.

A form of laser has been developed that can kill tumours

However, for the intensity to be strong enough it would also kill the surrounding healthy tissue

How can you avoid killing the healthy tissue while still destroying the tumour?

But before we get on to that I’d like to give you a medical problem to solve.

Did anyone recognise this is the same problem as the King Arthur problem? This illustrates the problem of transfer. The initial solution was learned in the context of military operations. Unfortunately in medical education general problem solving knowledge does not necessarily translate to solving new problems. Which is why we have to learn medicine with many different examples in as many different contexts as possible, rather than just learning problem solving principles.
Let's Recap...

What have you learned so far?
What do we know about clinical reasoning?

Components of clinical reasoning
These are the components of clinical reasoning, used in stages of the clinical enquiry (although not necessarily in any order).

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Each component is described in more detail in separate workshops/lectures and also in the chapters of ABC of Clinical Reasoning.

Please see separate workshops/lectures on:

- Evidence-based history and physical examination
- Use and interpretation of diagnostic tests
- Thinking about thinking
- Human factors and team communication
What do we mean by ‘knowledge’?

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<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>A. Factual knowledge</td>
<td>The basic elements that students must know to be acquainted with a discipline or solve problems in it</td>
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<tr>
<td></td>
<td>- Terminology</td>
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<td></td>
<td>- Specific details and elements</td>
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<tr>
<td>B. Conceptual knowledge</td>
<td>The inter-relationships among the basic elements within a larger structure that enable them to function together</td>
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<td></td>
<td>- Classifications and categories</td>
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<td>- Principles and generalisations</td>
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<td></td>
<td>- Theories, models and structures</td>
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<tr>
<td>C. Procedural knowledge</td>
<td>How to do something; methods of inquiry, and criteria for using skills, algorithms, techniques and methods</td>
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<td>- Subject-specific skills and algorithms</td>
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<td>- Subject-specific techniques and methods</td>
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<td>- Criteria for determining when to use appropriate procedures</td>
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<td>D. Metacognitive knowledge</td>
<td>Knowledge of cognition in general as well as awareness and knowledge of one's own cognition</td>
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<td>- Strategic knowledge</td>
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<td>- Knowledge about cognitive tasks, including appropriate contextual and conditional knowledge</td>
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<td>- Self-knowledge</td>
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Important to note what we mean by “knowledge” – not just facts – facts are insufficient for good medical practice. Knowing what we don’t know for example is a higher order skill (metacognitive monitoring).
Metacognition

From Wikipedia, the free encyclopedia

Metacognition is thinking about thinking, knowing about knowing, becoming aware of one's awareness, and higher-order thinking skills.

Metacognition can take many forms: it includes knowledge about when and how to use particular strategies for learning or for problem-solving. There are generally two components of metacognition: (1) knowledge about cognition and (2) regulation of cognition.
Reason

From Wikipedia, the free encyclopedia

This article is about the human faculty of reason and rationality.

Reasoning is a philosophical term to do with making sense of things, establishing and verifying facts, applying logic, and changing practice or beliefs based on new or existing information.

Reasoning can be formal (e.g. deductive reasoning) or informal (e.g. intuitive reasoning).

Reasoning, or an aspect of it, is sometimes referred to as rationality (but they are not quite the same thing).
There are different forms of rationality e.g. in medicine -

**Instrumental rationality**
Instrumental rationality is concerned with achieving goals. More specifically, instrumental rationality is the art of choosing and *implementing* actions that steer the future toward outcomes ranked higher in one's preferences. Said preferences are not limited to 'selfish' preferences or unshared values; they include anything one cares about.

**Epistemic rationality**
Epistemic rationality is that part of rationality which involves achieving accurate beliefs about the world. It involves updating on receiving new evidence, mitigating cognitive biases, and examining why you believe what you believe. It can be seen as a form of instrumental rationality in which knowledge and truth are goals in themselves, whereas in other forms of instrumental rationality, knowledge and truth are only potential aids to achieving goals. Someone practising instrumental rationality might even find falsehood useful.

This is Croskerry’s summary of rationality in medicine.
The areas of the brain required for system 2 processes are most affected by sleep deprivation and fatigue ...
This is the science of “human factors” – the limitations of human performance.
‘Good clinicians are not those who don’t make mistakes; good clinicians are those who expect to make mistakes and act on that expectation.’

James Reason

Human factors of course is about systems as well – making it easy for people to do the right thing: rota design, staffing, breaks, as well as workspaces and so on.
How do people become good ‘clinical reasoners’ (thinkers and decision makers)?
What teaching strategies are effective in developing clinical reasoning ability?

- Strategies that build understanding
- Strategies that optimise long term recall*
- Practice with as many different ‘cases’ as possible in as many different contexts as possible
- Corrective feedback as necessary


There is experimental evidence from education, psychology and medicine that some teaching and learning strategies are more effective than others in developing clinical reasoning ability.
Deliberate practice theory, Anders Ericsson.
Expertise in medicine and other domains

• Experience does not = expertise
• Deliberate practice
• Coaching
• Feedback (Hattie & Timperley, 2007)
• Reflection
• Study
• Personal attributes
Figure 4. Two trends for development of medical performance as a function of experience and instruction.

Stanovich describes the reflective mind as a subsystem of System 2. Reflection fairly consistently is beneficial in improving diagnostic performance in studies. It is ongoing reflection on action that accounts for continuing expertise with age in medicine (as opposed to other older physicians whose performance declines with age due to their ‘autopilot’ System 1 mode of practicing - see Eva.)
‘The interplay between the formal knowledge of medicine and experiential knowledge has emerged as a central issue in understanding medical expertise.’


(Knowledge = factual, conceptual, procedural, metacognitive)

Remember that knowledge includes procedural, conceptual and metacognition not just ‘facts’ ...
Components of the clinical enquiry
(which can occur in any order)

- Shared decision-making (patients, carers, teams, guidelines)
- Reasoning & metacognition
- Use and interpretation of diagnostic information
- Physical examination
- History (the patient’s story)
- Formal & experiential knowledge of medicine

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Further resources

www.clincial-reasoning.org