Can We Improve Our Diagnostic Acumen?: A Clinical Reasoning Toolkit

Ryan Kraemer, MD, FACP
June 1, 2018
85% correct

40K-80K deaths annually

Malpractice claims

4% knowledge deficit


The Diagnostic Process

Psychology, expertise, educational literature
Roadmap

• How we (humans) think
• How we (doctors) make diagnoses
• Cognitive biases that can lead to wrong diagnoses
• Cognitive strategies to improve diagnosis
• Development of expertise
Roadmap

• How we (humans) think
• How we (doctors) make diagnoses
• Cognitive biases that can lead to wrong diagnoses
• Cognitive strategies to improve diagnosis
• Development of expertise
• Impressions
• Intuitions
• Quick Responses
I’m Rational and logical
2 systems of thinking

1. Intuitive
   • Automatic mode
   • Fast

2. Analytical
   • Effortful mode
   • Slow

Your unconscious mind processes information faster than your conscious mind.
Intuitive Thinking (system 1)

Intuitive Thinking (system 1)

• Always on

• Generates answers
  • Automatically
  • Quickly
  • Effortlessly
  • No sense of voluntary control

Intuitive Thinking (system 1)

2 + 2 =

The capital of France is ________

17 \times 24 = \\

Deliberate, effortful, orderly
Choice, concentration
Thinking in Action

System 1
Impressions, intuitions, intentions, feelings

System 2
Endorses system 1 suggestions
Engaged when system 1 has no answer

Effortless = confidence
SO_P

Effortless = confidence
Anchoring

What is the percentage of African nations in the UN?

WOF 10 = 25%

WOF 65 = 45%

A bat and a ball cost $1.10
The bat costs one dollar more than the ball
How much does the ball cost?

10¢
• Alan
  intelligent industrious impulsive critical stubborn envious

• Ben
• Alan

• Ben
  envious  stubborn  critical  impulsive  industrious  intelligent

Halo Effect

• Alan
  intelligent industrious impulsive critical stubborn envious

• Ben
  envious stubborn critical impulsive industrious intelligent

Order matters

Neighbors say:

“Steve is very shy and withdrawn, invariably helpful but with little interest in people or in the world of reality. A meek and tidy soul, he has a need for order and structure, and a passion for detail.”

Is Steve more likely to be a librarian or a farmer?

Male Farmers 20 : 1 Male librarians

Confirmation Bias

• Is Sam friendly?

• Is Sam mean?

System 1

• System 1 usually has an answer with cognitive ease by use of shortcuts...

• We need to know when those answers may lead us to the wrong answer

• A poor statistician

• Can be manipulated
### Dual process theory

<table>
<thead>
<tr>
<th>System 1</th>
<th>System 2</th>
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</thead>
<tbody>
<tr>
<td>Automatic</td>
<td>Deliberate</td>
</tr>
<tr>
<td>Fast</td>
<td>Slow</td>
</tr>
<tr>
<td>Uses first impressions</td>
<td>Requires cognitive effort</td>
</tr>
<tr>
<td>Little cognitive effort</td>
<td>Uses knowledge and logic</td>
</tr>
<tr>
<td>Prone to specific errors</td>
<td></td>
</tr>
<tr>
<td>Uses experience/pattern</td>
<td></td>
</tr>
<tr>
<td>recognition</td>
<td></td>
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</table>

Roadmap

• How we (humans) think

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• Cognitive biases that can lead to wrong diagnoses

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• Development of expertise
52 yo African-American Man
CC: Knee pain

• Pain began in right knee 1 day ago
• Awoke him from sleep with severe pain
• Same thing happened 9 months ago and 2 years ago
• Prior episodes resolved in a few days
• Asymptomatic between episodes
• Overweight, drinks 6 beers daily, loves seafood
Pattern Recognition

My knee hurts

Knee pain
Pattern Recognition

My knee hurts

Knee pain
My knee hurts

Knee pain

Osteoarthritis

Gout

Patellofemoral syndrome

Meniscal Injury
Illness Scripts

Disease

Who gets it?

How does it present?
  Typical history
  Typical physical exam findings
  Typical lab and imaging findings

How does it respond to treatment?

Trowbridge et al. Teaching Clinical Reasoning. ACP Teaching Medicine Series. 2015, p. 83.
Problem Representation

• One sentence summary defining the case in abstract terms

• **Semantic qualifiers**: abstract, often binary terms that help clarify the meaning of a symptom

<table>
<thead>
<tr>
<th>Acute</th>
<th>Chronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent</td>
<td>Constant</td>
</tr>
<tr>
<td>Mono</td>
<td>Poly</td>
</tr>
<tr>
<td>42 year old</td>
<td>Middle aged</td>
</tr>
</tbody>
</table>
Patient’s story: My knee hurt me so much last night, I woke up from sleep. It was fine when I went to bed. Now it’s swollen. It’s the worst pain I’ve ever had. I’ve had problems like this before in the same knee, once 9 months ago and once 2 years ago. It doesn’t bother me between times.

Problem Representation: The acute onset of a recurrent, painful, monoarticular process in middle-aged man with excessive daily alcohol intake.
Pattern Recognition = Illness Script Matching

My knee hurts

Problem representation

- Osteoarthritis
- Gout
- Patellofemoral syndrome
- Meniscal injury
A 52 yo WM with PMH HIV CD4 count 4 presents with fever, pancytopenia, headache, odynophagia, & diarrhea

Differential:

17 x 24 =
System 2/ Analytical Reasoning

• Generate problem list
• Form a differential diagnosis for each problem

• Hypothetico-deductive reasoning
• Bayesian reasoning

Trowbridge et al. Teaching Clinical Reasoning. ACP Teaching Medicine Series. 2015, p. 37, 83.
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System 1

• Heuristics: mental shortcuts that allow a rapid response to information

• When heuristics fail us = cognitive biases

Cognitive biases

Cognitive pills for cognitive ills

Trowbridge et al. Teaching Clinical Reasoning. ACP Teaching Medicine Series. 2015, p. 54.
Heuristics & Cognitive biases

>100 in general literature

>38 in medical literature

Premature closure

- Making a diagnosis before it has been fully verified
- Usually due to another cognitive bias

- 63 yo with DM II who stopped metformin 6 mo ago, presents with confusion, polyuria, polydipsia, blurry vision, BS of 698

If it turned out that the diagnosis wasn’t ____, what else could it be?
Anchoring

- Narrow focus on one aspect of the patient’s presentation or one test to base the entire clinical impression (“fall in love” with a diagnosis).

- Causes us to ignore contradictory information

- 63 yo’s “confusion” = episodes, word-finding difficulty, intermittent

Not better with BS of 165

What doesn’t fit here?
Confirmation Bias

• Searching for evidence that supports the initial impression

• 36 yo with cough ... you’re thinking GERD
  • Is it worse after meals: “yes”
  • Do you sometimes have heartburn: “yes”

• Not asking: about allergic rhinitis, asthma, smoking, etc

What else might this be? ... additional questions?
Availability Bias

The tendency to think that things that come to mind immediately are more likely or more common

- Recently seen or read about
- Frequently seen
- Dramatic cases
- Diagnoses that have been missed in the past
- Those cases associated with a memorable outcome (good or bad)

Am I thinking of this diagnosis because I just read about it or saw a case of it?

Slide courtesy Amanda Clark
Affective Bias

• The emotional influences (both positive and negative feelings) that can induce cognitive errors

Problem representation
Framing Effect/ Diagnostic Momentum

• **Framing Effect:** Susceptibility to be influenced by how a problem is described
  42 yo with hx of drug abuse found down
  42 yo with prev hx of drug abuse (clean x2 years) felt palpitations, then LOC. FH of sudden death.

• **Diagnostic Momentum:** The tendency for diagnostic labels to stick and not be questioned

  Take your own history from the beginning
Roadmap

• How we (humans) think
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Dual Process Reasoning

• System 1: Fast, efficient, but prone to error

• System 2: More accurate, but too slow and inefficient for making routine decisions

You need both the rabbit and the turtle!

Trowbridge et al. Teaching Clinical Reasoning. ACP Teaching Medicine Series. 2015, pp. 54.
Dual Process Reasoning

• System 1: Fast, efficient, but prone to error

• System 2: More accurate, but too slow and inefficient for making routine decisions

Slow down when we should
When should we slow down?

- High stakes symptoms
- Patient doesn’t respond to treatment
- Patient symptom continues or condition worsens
- Complex patient
- You don’t like the patient
- When we are:
  - Tired & hungry
  - Distracted
Cognitive Forcing Strategies

• What else could this be?
• What doesn’t fit with my diagnosis?
• Could the patient have multiple problems?
• Is there any reason I need to slow down?
• How does this patient make me feel?
• What is the worst thing this could be?
• Am I missing something?
• Am I being framed or victim of diagnostic momentum?
Complex cases/High cognitive load

• Make a problem list

• Write a problem representation

• Check your differential

- Pulmonary
- Endocrine
- GI
- Renal
- ID
- Cardiac
- Hematology/Oncology
- Musculoskeletal
- Alimentary
- Neurological
Other Diagnostic Pearls

• When a diagnosis doesn’t fit, retake the history

• **Be Skeptical** – do not believe the “label” the patient carries

• Be systematic, especially with complex or high stakes cases

Courtesy of Gustavo Heudebert, MD
Roadmap

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• Development of expertise
Practice > Ability


Attaining Expertise

• Deliberate Practice:
  • A task is completed
  • Immediate feedback given
  • The task is repeated
  • The difficulty of the task is increased

• Guided by a teacher, effortful

Metacognition

- Thinking about our own thinking
- Get feedback on your diagnoses

Important
Form schemas for signs/symptoms

- Schema: mental structure to organize information

- **Dizziness**

<table>
<thead>
<tr>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertigo</td>
</tr>
<tr>
<td>Disequilibrium</td>
</tr>
<tr>
<td>Presyncope</td>
</tr>
<tr>
<td>Lightheadedness</td>
</tr>
</tbody>
</table>
Form schemas for signs/symptoms

- **Schema:** mental structure to organize information

### Dizziness

<table>
<thead>
<tr>
<th>Category</th>
<th>Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertigo</td>
<td>BPPV</td>
</tr>
<tr>
<td></td>
<td>Vestibular Neuritis</td>
</tr>
<tr>
<td></td>
<td>Posterior Circulation Stroke</td>
</tr>
<tr>
<td></td>
<td>Migrainous Vertigo</td>
</tr>
<tr>
<td></td>
<td>Meniere disease</td>
</tr>
<tr>
<td>Disequilibrium</td>
<td>Poor Vision</td>
</tr>
<tr>
<td></td>
<td>Peripheral Neuropathy</td>
</tr>
<tr>
<td></td>
<td>Medications</td>
</tr>
<tr>
<td></td>
<td>MSK disorders</td>
</tr>
<tr>
<td>Presyncope</td>
<td>Dehydration</td>
</tr>
<tr>
<td></td>
<td>Orthostatic Hypotension</td>
</tr>
<tr>
<td></td>
<td>Arrhythmias</td>
</tr>
<tr>
<td></td>
<td>Valvular Disease</td>
</tr>
<tr>
<td>Lightheadedness</td>
<td>Anxiety</td>
</tr>
</tbody>
</table>
### Adrenal Insufficiency

**Symptom** | **Frequency,** | **Sign** | **Frequency**
---|---|---|---
Weakness, tiredness, fatigue | 100 | Weight loss | 100
Anorexia | 100 | Hyperpigmentation | 94
Gastrointestinal symptoms | 92 | Hypotension (systolic BP <110 mmHg) | 88-94
Nausea | 86 | Vitiligo | 10-20
Vomiting | 75 | Auricular calcification | 5
Constipation | 33 | Electrolyte disturbances | 92
Abdominal pain | 31 | Hyponatremia | 88
Diarrhea | 16 | Hyperkalemia | 64
Salt craving | 16 | Hypercalcemia | 6
Postural dizziness | 12 | Azotemia | 55
Muscle or joint pains | 6-13 | Anemia | 40
| | | Eosinophilia | 17
Learn New Illness Scripts

- ACP Conferences

- MKSAP

Persistent postural-perceptual dizziness (PPPD)

Nonasthmatic eosinophilic bronchitis (NAEB)
A 55yo comes in with several months of intermittent hand tingling ... How do I confirm or refute carpal tunnel syndrome?

<table>
<thead>
<tr>
<th>Finding</th>
<th>+ LR</th>
<th>-LR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tinel's sign</td>
<td>1.4</td>
<td>NS</td>
</tr>
<tr>
<td>Phalen's sign</td>
<td>1.3</td>
<td>0.7</td>
</tr>
<tr>
<td>+ Hand Diagram</td>
<td>2.4</td>
<td>0.5</td>
</tr>
</tbody>
</table>
Calibrate your system 1

The Rational Clinical Examination
Explore JAMA's groundbreaking series on evidence-based use of the medical history, physical examination, and testing to diagnosis disease.

Will Neuroimaging Reveal a Severe Intracranial Injury in This Adult With Minor Head Trauma? The Rational Clinical Examination Systematic Review

JAMA | Review | December 22, 2015 |

Does This Patient With Chest Pain Have Acute Coronary Syndrome? The Rational Clinical Examination Systematic Review

JAMA | Review | November 10, 2015 |
Diagnostic Experts

• Illness scripts with greater granularity

• More attention to “red flags”

• Understand when to switch to system 2

Deliberate Practice
Summary

• To make diagnoses utilize:
  • System 1, intuitive, pattern recognition
  • System 2, analytical, slow & effortful

• We can improve our diagnoses by:
  • Learning when/how to slow down
  • Deliberate practice → feedback on cases
  • Developing schemas, illness scripts, PE skills
Resources for clinical reasoning

- Getting it Right: Cases to Improve Diagnosis (3 CME/MOC)
- Clinical Reasoning Toolkit
- https://www.improvediagnosis.org/page/ClinicalReasoning
Evidence for Slowing Down

- 34 internal medicine residents completed 12 cases (6 complex and 6 simple)
- Immediate answer vs forced analytical thinking answer
  - Simple cases: no difference
  - Complex cases: diagnostic accuracy improved 50%

Mamede S. Conscious thought beats deliberation without attention in diagnostic decision-making: at least when you are an expert. *Psychol Res.* 2010 Nov;74(6):586-92