Stanford CASE (Clinical Assessment Simulation Engine): Assessment Tool for Clinical Critical Thinking

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Pollev.com/microid
Text MICROID to 37607
Learning Objectives

Recognize the challenges in effectively assessing students’ ability to justify their clinical reasoning

Describe how Stanford CASE is addressing this problem

Inspire instructors to emphasize clinical critical thinking and assess students’ ability to justify their clinical decisions about patients.
How do people learn?
What does this have to do with medical education?

Patients are more complex

Healthcare is more complex and ever-changing

The medical education approach has not changed
Knowledge is King

Quiz: What is a JAG-1 mutation?
AND organization of knowledge is a must

• Alagille syndrome – narrowed or missing bile ducts, heart defects, distinctive facial features (broad forehead, small pointy chin).

• Digestible table of congenital heart defects: Tetralogy of Fallot associated with Alagille syndrome, Down syndrome, DiGeorge syndrome

• Illness scripts for cyanotic heart diseases

• Exemplars from experience
Routine experts

Adaptive experts
Routine vs. Adaptive Expert

Routine expert – stable recurrent tasks, premium on efficient completion

Adaptive expert – high degree of variability and change

Adaptive experts possess flexibility and evolution in their thinking to create new solutions
Routine Experts

• You are a proficient routine expert
Very itchy
Heuristics

Mental shortcuts

Automatic and unconscious

You build these from repeated experiences, overlearned associations, stimuli triggers.
Bat & Ball

A bat and ball cost $1.10
The bat costs one dollar more than the ball.
How much does the ball cost?
Bat & Ball

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

• $.10 - total cost would be $1.20

• Answer is $.05.

Fast thinking doesn’t always work
Question 5

What advice did you receive to get the best score on multiple choice tests?

A. Trust your intuition
B. At the end of the test, go back and reconsider the questions you weren’t sure about
Should you trust your first answer or reconsider it?

<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>YEAR</th>
<th>SETTING</th>
<th>Total Questions</th>
<th>% Changed</th>
<th>Right to Wrong</th>
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Daniel Kahneman won the 2002 Nobel Prize in Economics for prospect theory. (and Amos Tversky)

The premise: standard economic models assumed economic rationality and did not take into account human behavioral biases.

People do not always make decisions based on rational thought.

Foundation for behavioral economics
Dual Process theory – Decision making

• Type 1
  • Fast. unconscious.

• Type 2
  • Slow. conscious.
Does Reflection improve Diagnostic Performance?

Accuracy Score

Immediate Reflection

Simple Cases Complex Cases

Conscious thought beats deliberation without attention in diagnostic decision making – at least when you are an expert.  S Mamede et al.  
Psychol Research 2010: 74: 586-592
## Claims for High-severity Harm

Newman-Toker DE, et al.  
*Diagnosis* 2019, 6(3):227

<table>
<thead>
<tr>
<th>Category</th>
<th>All claims cases distribution</th>
<th>Big Three distribution</th>
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<td>Myocardial infarction</td>
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<td>Venous thromboembolism</td>
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<td>Aortic aneurysm and dissection</td>
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<td>Other vascular</td>
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<td>Other vascular</td>
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<table>
<thead>
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<th>Category</th>
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<td>Meningitis and encephalitis</td>
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<td>Spinal abscess</td>
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<td>Pneumonia</td>
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<td></td>
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<tr>
<td>Endocarditis</td>
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<td>Other infection</td>
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<table>
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<th>Category</th>
<th>All cancer distribution</th>
<th>Lung cancer</th>
<th>Breast cancer</th>
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<td>Cancer</td>
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<td>Lung cancer</td>
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<td>Breast cancer</td>
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<tr>
<td>Colorectal cancer</td>
<td></td>
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<tr>
<td>Prostate cancer</td>
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<td></td>
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<tr>
<td>Melanoma</td>
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<td></td>
<td></td>
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<tr>
<td>Other cancer</td>
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<table>
<thead>
<tr>
<th>Distribution of harm severity using the NAIC scale</th>
<th>Low</th>
<th>Medium</th>
<th>Disability</th>
<th>Death</th>
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<tr>
<td>0%</td>
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<td></td>
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<tr>
<td>20%</td>
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<td>40%</td>
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<tr>
<td>60%</td>
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<tr>
<td>80%</td>
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</tr>
<tr>
<td>100%</td>
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</table>
Contributing Causal Factors

Newman-Toker DE, et al.
Diagnosis 2019, 6(3):227

6165/7193 = 85.7%
Routine Expertise is not enough

Adaptive experts are what we need
“Explain why” is missing

• **Why** do Alagille patients have bile duct problems, heart defects and dysmorphic facies?

• What caused it?
Senior medical students are deficient at diagnostic justification

Mean Thought Process Score

<table>
<thead>
<tr>
<th>Year</th>
<th>Mean</th>
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<tbody>
<tr>
<td>2011</td>
<td>1.72</td>
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<tr>
<td>2012</td>
<td>2.05</td>
</tr>
<tr>
<td>2013</td>
<td>1.73</td>
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</table>

Williams RG. Academic Medicine 2014, 89:790
More complex patients and ever changing health-care system

Adaptive Experts

Preparation for future learning (PFL)

Branford JD, Schwartz DL. Rethinking Transfer 1999
Preparation for future learning (PFL)

Understanding rather than performance
Emphasize struggle, risk taking
Support meaningful variation

Cognitive link:

Biological characteristics can be linked to clinical characteristics of a patient

Quiz:

Why do we need a new influenza vaccine every year?
Genetic Shift & Drift

- Reassortment → Shift → Pandemics & Epidemics
- Mutations → Drift → Epidemics
Reassortment

Proof-reading problems

Different subtypes of Influenza A

Antigenic shift (Genetic shuffling)

New Influenza A subtype

Antigenic drift (Random mutation)

Different Influenza A strains
Breakout Room – Cognitive Links

Create a cognitive link in your field
2 people in each breakout room
5 minutes
Put your answer into PolLEV

Cognitive link:
Biological characteristics can be linked to clinical characteristics of a patient
Create a cognitive link. Cognitive link: Biological characteristics can be linked to clinical characteristics.
Adaptive experts

Emphasize understanding, not performance

Encourage learners to make cognitive links and ask “why”
Ask “Why”
“Why” Not?

What we do - What is the DDX of cough.

What we don’t do - Explain why ACE inhibitors cause cough?
Breakout rooms

What prevents you from asking learners to “Explain Why”
• 2 people in each breakout room
• 5 minutes
• Put your answer into PolLEV
What prevents you from asking learners to "Explain Why"?
Adaptive experts

Emphasize understanding, not performance

Encourage learners to make cognitive links and ask “why”
Did they learn?
What kind of assessment?
  Teaching is about explaining why. Assessment is about explaining why

What do we measure?
  Start backwards. What does an adaptive expert look like?
  Dr. Carl Weiman (Professor of physics and Graduate School of Education) – what decisions do experts make when problem-solving?
Stanford CASE

1. An assessment tool for skills of adaptive expertise.

2. How you might use it.
CASE can capture growth in learning

Mean CASE Score

CASE Total Score
## Grading Rubric Sample

<table>
<thead>
<tr>
<th>Grade</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Element</td>
<td>MS1</td>
<td>MS3/4</td>
<td>ID Expert</td>
</tr>
<tr>
<td>General appearance</td>
<td>to get sense of how sick he is.</td>
<td>Need to be in ICU or on wards</td>
<td>to get sense of how sick he is.</td>
</tr>
<tr>
<td>Extremities - Left knee</td>
<td>look for swelling, redness, pain</td>
<td>look for swelling, redness, location of pain.</td>
<td>look for swelling, redness, location of pain. make sure patella is in place and not dislocated and ligament integrity if possible – these may be source of pain from knee injury that wasn’t recalled and knee injury may be inciting event, potentially with then a subsequent infection; assess for effusion not just overall swelling. Note angle of flexion and extension.</td>
</tr>
<tr>
<td>Extremities – right knee</td>
<td>Compare swelling to right knee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremities - left hip and left ankle (joint above and below)</td>
<td></td>
<td>Compare all assessments to right knee.</td>
<td>to get sense of other joint problems and if knee swelling is separate from pain (i.e knee pain is a referred pain).</td>
</tr>
<tr>
<td>Skin</td>
<td>Make sure no lesions, no breaks in skin, no overlying skin changes over other joints.</td>
<td></td>
<td>Make sure no lesions, no breaks in skin, no overlying skin changes over other joints. Skin breaks anywhere along both lower extremities, especially where skin would be exposed with baseball uniform. Get sense of introduction of commensal bacteria</td>
</tr>
<tr>
<td>Eyes</td>
<td></td>
<td>make sure no injected conjunctiva – seen with Leptospira infection. May also see with toxin-mediated process</td>
<td></td>
</tr>
<tr>
<td>Neck</td>
<td></td>
<td>Look for enlarged lymph nodes as hint of cancer or of primary infection (with post reactive arthritis). Can also see with systemic Histoplasma infection.</td>
<td></td>
</tr>
<tr>
<td>CV</td>
<td></td>
<td>listen for murmur – make sure no hint of infective endocarditis – can see immune-complex deposition in joint and subsequent swelling (maybe pain).</td>
<td></td>
</tr>
<tr>
<td>Abdomen</td>
<td></td>
<td>look for hepatosplenomegaly seen with systemic Histoplasma infection.</td>
<td></td>
</tr>
<tr>
<td>GU</td>
<td></td>
<td>look for rectal tags or significant fissures – consider inflammatory bowel disease such as Crohn’s disease presenting with extra-intestinal manifestation.</td>
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</table>

Although you would conduct a full physical exam, what parts of the physical exam are you going to emphasize in your presentation to the attending physician?
H&P “Thinking” questions capture growth in learning

**Question 1:** Identify key clinical signs and symptoms in the patient’s history and explain why you believe those are key (e.g. relevant to a potential clinical diagnosis?)

**Question 3:** Although you would conduct a full physical exam, what parts of the physical exam are you going to emphasize in your presentation to the attending physician?

**Question 1 Mean CASE Score**

MS1: 1.40, MS3/MS4: 2.25

**Question 3 Mean CASE Score**

MS1: 1.40, MS3/MS4: 2.13

$p=0.007$, $p=0.01$
Growth in learning

Identify key features

- MS1
- MS3
- Resident
- Fellow/Attending
Does the overall story about this patient “fit” (make sense)?

Confidence level

Residents/Fellows  22%

Attending Physicians  75%
Problems
How would you use Stanford CASE?
Inspire