What Was I Thinking?
Challenges in Clinical Reasoning

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Please do not look ahead in the slides if you want to play the brain games!
Objectives

- Overview of clinical reasoning with focus on diagnosis/diagnostic errors
- Discuss some examples of cognitive errors
- Reflect on how to reduce cognitive errors
- Provide some references in medical/lay press
- See if we can recognize our own cognitive errors using cases

Solve this Quickly

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

[From Kahneman]
Diagnostic Errors

- Diagnostic Error
  - Systems Error (e.g., lab report lost)
  - Cognitive Error (e.g., wrong diagnosis)

Clinical Reasoning

How clinicians make patient care decisions
What is This?

GGE
EGG
GEG

Scrambled EGGs

From www.brainbashers.com

Clinical Reasoning Cycle

From Newcastle (AU) website: www.newcastle.edu.au
Why Do We Care About Clinical Reasoning?

- Understanding reasoning process helps us understand how things go wrong
- Diagnostic errors
  - Wrong diagnosis → wrong treatment
  - Delays in care
  - Bad outcomes
  - Increased costs and other resources
  - Patient and family dissatisfaction
  - Higher rate of malpractice

Diagnostic Errors and Malpractice


Ali S Saber Tehrani,1 HeeWon Lee,2 Simon C Mathews,2 Andrew Shore,7 Martin A Makary,9 Peter J Pronovost,9 David E Newman-Toker1

ABSTRACT
Background: We sought to characterise the frequency, health outcomes and economic consequences of diagnostic errors in the USA.

Conclusions: Among malpractice claims, diagnostic errors appear to be the most common, most costly and most dangerous of medical mistakes. We found roughly equal
Results: Errors and Malpractice


<table>
<thead>
<tr>
<th>Malpractice allegation group</th>
<th>n (%)</th>
<th>Mean, US$</th>
<th>Median, US$</th>
<th>Malpractice payments in US$ millions (%)</th>
<th>SD in US$ millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis related</td>
<td>100249 (23.6)</td>
<td>386849</td>
<td>213250</td>
<td>38781 (35.2)</td>
<td>0.56</td>
</tr>
<tr>
<td>Treatment related</td>
<td>95675 (21.7)</td>
<td>196960</td>
<td>58805</td>
<td>18836 (11.5)</td>
<td>0.42</td>
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<tr>
<td>Surgery related</td>
<td>84880 (24.2)</td>
<td>280257</td>
<td>135935</td>
<td>23816 (21.7)</td>
<td>0.47</td>
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<tr>
<td>Obstetrics related</td>
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<td>651670</td>
<td>343245</td>
<td>14956 (13.6)</td>
<td>1.10</td>
</tr>
<tr>
<td>Medication related</td>
<td>18697 (5.3)</td>
<td>257333</td>
<td>92085</td>
<td>4811 (4.4)</td>
<td>0.63</td>
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<tr>
<td>Anesthesia related</td>
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<td>419126</td>
<td>168705</td>
<td>4411 (4.0)</td>
<td>0.86</td>
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<tr>
<td>Monitoring related</td>
<td>7101 (2)</td>
<td>354131</td>
<td>149663</td>
<td>2514 (2.3)</td>
<td>0.77</td>
</tr>
<tr>
<td>Other miscellaneous</td>
<td>6929 (2)</td>
<td>176781</td>
<td>44708</td>
<td>1224 (1.1)</td>
<td>0.45</td>
</tr>
<tr>
<td>Equipment/product related</td>
<td>1872 (0.5)</td>
<td>128204</td>
<td>35718</td>
<td>239 (0.2)</td>
<td>0.28</td>
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<tr>
<td>Intravenous and blood-products related</td>
<td>1080 (0.3)</td>
<td>294011</td>
<td>127165</td>
<td>317 (0.2)</td>
<td>0.55</td>
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<tr>
<td>Behavioural health related</td>
<td>887 (0.1)</td>
<td>212494</td>
<td>65550</td>
<td>145 (0.1)</td>
<td>0.45</td>
</tr>
<tr>
<td>Total</td>
<td>350706 (100)</td>
<td>313813</td>
<td>133250</td>
<td>110055 (100)</td>
<td>0.59</td>
</tr>
</tbody>
</table>

How About These?

- sdraw backwards
- ehca backache
- hijklmno water

From www.brainbashers.com
We were very excited to go on our first camping trip. We first packed up the car so that we would have all the stuff we needed: food, camping materials, clothes, and games to play. We finally reached the campground and it was just as we pictured: beautiful scenery, gorgeous views, and wildlife all around. We started to pitch the tent and could not wait to start our vacation.
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How Good is Our Clinical Reasoning?

Discrepancies Between Clinical and Autopsy Diagnoses
A Comparison of University, Community, and Private Autopsy Practices
Fabio Tavora, MD; Clinton D. Crowder, MD; Chen-Chi Su, MD; and Allen P. Burke, MD

Abstract
Although it is known that autopsies often disclose unexpected findings, few studies have been published that address the effect of institutional setting, selection bias, and length of hospitalization. Records of medical

Hospital-based medical autopsies are a well-established tool for education and quality assurance. However, several studies have documented a decrease in the autopsy rate and in the importance given to autopsy by clinicians. The causes for the decreasing autopsy rate are diverse and include...
Not Good Enough

- Relatively small study (291 patients) done in 2008
- Overall 50/291 (17.2%) had a major discrepancy
- Found community setting and shorter hospital stay associated with higher rate of discrepancy
- This rate does not seem to be significantly different from older studies

Confidence vs. Accuracy

Do Physicians Know When Their Diagnoses Are Correct?

Implications for Decision Support and Error Reduction

Charles P. Friedman, PhD,1 Guido G. Gatti, MS,1 Timothy M. Franz, PhD,2 Gwendolyn C. Murphy, PhD,3 Fredric M. Wolf, PhD,4 Paul S. Heckerling, MD,5 Paul L. Fine, MD,7 Thomas M. Miller, MD,8 Arthur S. Elstein, PhD6

1Center for Biomedical Informatics, University of Pittsburgh, Pittsburgh, PA, USA; 2Department of Psychology, St. John Fisher College, Rochester, NY, USA; 3Division of Community Health, Duke University, Durham, NC, USA; 4Department of Medical Education and Informatics, University of Washington, Seattle, WA, USA; Departments of 5Medicine and 6Medical Education, University of Illinois at Chicago, Chicago, IL, USA; 7Department of Medicine, University of Michigan, Ann Arbor, MI, USA; 8Department of Medicine, University of North Carolina, Chapel Hill, NC, USA.

OBJECTIVE: This study explores the alignment between physicians’ confidence in their diagnoses and the “correctness” of those diagnoses, as a function of clinical experience, and whether subjects were prone to over- or under-confidence.

DESIGN: Prospective, counterbalanced experimental design.

SETTING: Laboratory study conducted under controlled conditions at...
Confidence vs. Accuracy

- Friedman (2005) studied students, residents, and faculty about their differential diagnoses and confidence

Why Are We Wrong so Often?

- Lack of knowledge: uncommon
  - A condition we have never seen or learned about
- Problem with data analysis: more common
  - Failure to obtain appropriate data
  - Failure to differentiate relevant from irrelevant/conflicting
- Problem with data synthesis: most common
  - Failure to “put everything together”
To Consider…

• Is the diagnosis:

  THE answer, and the goal of thinking?
  
  or
  
  “a way of making meaning of the situation in order to better understand and manage a problem”?  

  Ilgen, J Gen Int Med. 2016

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On Diagnostic Certainty

“Our task is not to attain certainty, but rather to reduce the level of diagnostic uncertainty enough to make optimal therapeutic decisions.”

  Kassirer, 1989
The Case of Linda

Linda is a 31-year-old woman, single and bright. When she was a student, in high school and in college too, she was deeply involved in social justice issues, and also participated in environmental protests. Which is most probable about Linda’s occupation today?

A. Linda works as a TV reporter;
B. Linda is a bank teller;
C. Linda is a bank teller, and she’s very active in the environmental movement.


The Case of Linda

• There are about 50,000 TV reporters in the US
• There are about 500,000 bank tellers in the US
  [Bureau of Labor Statistics]

• It is impossible for answer C to be correct (the group described in C is a subset of B)
Distributed Cognition

• Proposes that cognition and knowledge are not confined to an individual; rather, it is distributed across objects, individuals, artifacts, and tools in the environment.

• In medicine, diagnosis may require inputs from others who:
  – May see different aspects of the patient
  – May not directly communicate
  – May have different biases

Blind Men and the Elephant
What Affects Our Decision Making?

- Patient and family factors
  - Appearance, language, cultural factors
  - How they interact with you as the provider
- Encounter factors
  - Time pressures
  - Perceived requirements of encounter (well visit, fill out form, etc)
- Provider factors
  - Your emotional state
  - Your degree of fatigue, hunger, stress
  - Your feelings about the patient
  - Your recent experience
  - How you think (i.e., cognitive processes)

What is This?

AmUous

Ambiguous

From www.brainbashers.com
Heuristic Methods

- **Heuristics/heuristic methods**: “methods that are not guaranteed to be perfect, but sufficient for immediate goals”
- May be mental shortcuts, educated guesses, rules of thumb, stereotypes, intuition, or common sense
- Often work, but need to be aware that we are using them
- Benefits: increased efficiency, rule out conditions with significant morbidity, reduced waste, “anchor and adjust”
- Risks: use by inexperienced providers, availability bias, missing rare diagnoses

Heuristics vs Biases

“Heuristics — cognitive strategies or mental shortcuts that are automatically and unconsciously employed — are particularly important for decision making. Heuristics can facilitate decision making but can also lead to errors. When a heuristic fails, it is referred to as a cognitive bias.” [IOM 2015]
Thinking About Thinking

• **System 1**: Intuitive, heuristic
• **System 2**: Methodical, systematic

Example: What do you recall about your last drive to work?


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Croskerry’s Dual Process Theory

<table>
<thead>
<tr>
<th></th>
<th><strong>System 1</strong></th>
<th><strong>System 2</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive Style</td>
<td>Intuitive</td>
<td>Analytical</td>
</tr>
<tr>
<td>Speed</td>
<td>Fast</td>
<td>Slow</td>
</tr>
<tr>
<td>Effort</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Awareness</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Reliability</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Potential for bias</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>

More experience leads to more use of System 1.
Cognitive Processes Over Time

Novice

Deliberate, structured following of templates

Expert

More automatic pattern recognition based on experience (heuristic)

But which system is more accurate?

Another Example

S P L O Y O C H Y G
Another Example

Ideal Approach: A Blend?

• Thoroughly gather all data
• Generate complete differential diagnosis
  – Dedicated time to weighing likelihood of alternative diagnoses
  – Direct communication with other providers
• Rank diagnoses by likelihood
• More System 2, but used by experts in difficult cases
Types of Cognitive Errors: Many Ways to Go Wrong

One may go wrong in many different ways, but right only in one, which is why it is easy to fail and difficult to succeed.

~ Aristotle

Types of Cognitive Errors

From Business Insider
Anchoring Bias

- Anchoring bias
  - Comparing based on limited or specific information

Scenario 1: Large vs small
Scenario 2: Large, medium, small

Anchoring Bias: Clinical Examples

From Seifter, Medscape, 2015.

The Power of First Impressions
Our first clinical encounters can have surprisingly long-lasting effects. During a general surgery rotation as a student, I admitted a 20-year-old man with severe LLQ pain, an acute abdomen requiring abdominal exploration. The finding was acute appendicitis with situs inversus. Is it fair that my first experience with appendicitis occurred in a patient with a L-sided appendix?

The Right Diagnosis?
A 3 month old presents with fever and fussiness. He has some URI symptoms and mild dehydration. He tests positive for rhinovirus. He remains febrile for another 24 hours. A few hours later, he becomes less responsive. An LP shows bacterial meningitis. This was initially considered but the ED was reassured by the positive rhinovirus test.
Diagnosis Momentum

• Similar to anchoring bias
• Diagnosis becomes more sticky
• EMRs make this worse? More signouts?

Premature Closure

• Failure to consider alternative diagnosis even if new important information is available
• When we see the first fracture but not the second
• Perhaps the most common error
Bias of Illusory Causality

A 3 yr old girl has abdominal pain. Her trusted physician does a urinalysis which shows 10-25 WBCs, +leukocyte esterase. The culture is pending. In the meantime, she is prescribed Bactrim. In 2-3 days, the patient feels better. The culture is negative. Her physician decides to finish the course of antibiotics since there was clearly some bacterial component.

– Does this affect the approach next time she has abdominal pain?
• This is so strong that even marked placebos may work!

Availability Bias

• Bias based on how easily examples come to mind
• Example: air travel vs car travel after Sept 11
  – More dangerous even than baseline!
• A physician sees three cases of melanoma this month, orders more skin biopsies as a result
• Why people buy lottery tickets
Gambler’s Fallacy

• If an ED doctor typically sees 5 cases of MI each weekend, but this weekend has not seen any, so the next patient with chest pain...

• 1930s tonsillectomy study of 389 NYC children
  – Initial recommendation was tonsillectomy in 45%
  – Other 55% then evaluated again → 46% of this group!
  – Group excluded first two times → 44% of this group!

Study Repeated in 1990s

Do Physicians Have a Bias toward Action?
A Classic Study Revisited

JOHN Z. AYANIAN, MD, MPP, DONALD M. BERWICK, MD, MPP

In an attempt to replicate the findings of a classic study of medical decision making, the authors studied decision making in modern pediatrics practice. They performed case simulations and surveyed pediatricians for their common clinical decision. Temporarily fully blinded, pediatricians were presented with case scenarios and asked to select the best initial management plan. The study found that pediatricians’ decisions were biased in favor of treatment, and the bias was greatest when patients had multiple chronic conditions. This study highlights the importance of recognizing and addressing bias in medical decision making. 

Physician decision making has come under increasing scrutiny in recent years as medical costs and outcomes have become a focus of substantial public concern. Financial incentives, organizational structures, and local culture have all been identified as factors that influence the decisions of doctors.” In this study, we tested a hypothesis set forth over 50 years ago that at least in some clinical situations, physicians are biased toward action in the use of diagnostic evaluations and therapeutic procedures.

The results were striking. Contrary to the findings of the 1970s study, pediatricians were more likely to perform tonsillectomy on children whose parents were more eager to undergo surgery. This bias was especially pronounced in cases where the child had a history of recurrent tonsillitis. The findings suggest that physicians’ decisions are influenced by factors beyond the evidence-based guidelines and may be affected by patient preferences and social pressures.
Bias of Multiple Alternatives: Scenario 1

You plan to spend the evening in the library working on a short paper due the following day. As you walk across campus, you discover that an author you have always admired is about to give a public lecture. Do you proceed to the library anyway or go to the lecture instead?

From Redelmeier and Shafir. JAMA, 2015.

Bias of Multiple Alternatives: Scenario 2

You plan to spend the evening in the library working on a short paper due the following day. As you walk across campus, you discover that an author you have always admired is about to give a public lecture and that—in another hall—they are about to screen a foreign movie that you have been wanting to see. Do you proceed to the library anyway, go to the lecture instead, or go to the movie?

Results: 21% chose library in first scenario, 40% chose library in second (p < 0.005)
Base Rate Fallacy

You see your primary care doctor who informs you that you have tested positive for a fatal disease. You are asymptomatic. The test is 95% accurate (5% false positive rate). The prevalence of the disease is 1/1000. What is your plan of action?

A. Make no change in your outlook
B. Get a second opinion
C. See how quickly you can get life insurance
D. Plan your funeral

- False positive paradox: when FP > TP with low prevalence
- Chance of having the disease is only about 2%

Reducing Cognitive Errors

- Use metacognition: thinking about thinking
- Try to recognize our own biases when possible
  - Just being able to name a bias is not enough
- Take care of ourselves: appropriate time, rest, etc.
- Try to use a combination of Systems 1 and 2
- Diagnostic time-out
- Use “cognitive forcing” strategies (Crosskerry)
Cognitive Forcing (Crosskerry)

Learn From Our Mistakes

“Different doctors ... achieve competency in remarkably similar ways ... Primarily, they **recognize and remember their mistakes** and misjudgments, and incorporate those memories into their thinking.”

- Jerome Groopman, *How Doctors Think*

...But Don’t Dwell on Them (Wellness Talk)
Suggested Readings: Lay Press

- Brush, The Science of the Art of Medicine, 2015.
- Kahneman, Thinking Fast and Slow, 2011.

References

- **Books**
  - Brush, The Science of the Art of Medicine, 2015.
  - Kahneman, Thinking Fast and Slow, 2011.

- **Journals**
Thank You! Any DEEF?

Now...on to the cases!