

# Teaching Students to Think About Complexity and Subtlety

Occam's razor, Hickam's Dictum,  
Cognitive Traps, and the Perils of Clinical  
Guidelines and Evidence B(i)ased Medicine

# Objective

- To understand the title of this talk

# How I came to this topic

- “Thinking about thinking”
- Geriatric Medicine
  - “Experts in complexity and subtlety”
- How do I teach this????
- How do we take novices and turn them into experts?
- How do we teach students to think?
- What mistakes do trainees make in thinking?

"A unique, insightful, and wonderful book... You'll never look at your own doctor in the same way again!"  
—David D. Lewis and Stephen J. Tobias, authors of *Prescription*

# How Doctors Think



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# Goals of Today's Session

- Discuss some of the challenges of taking novice learners to the next step of expertise
- Understand how evidence based medicine teaching and clinical guidelines can be misused by novice learners
- Discuss common cognitive errors made by trainees
- Discuss some ways we might begin to teach trainees about thinking to avoid these errors and develop expertise

# The Old Way of Becoming An Expert



# Levels of Cognitive Behavior

- Skills Based
  - After learned, need only visual/motor input with minimal cognitive input
- Rule Based
  - Following a clinical guideline or protocol
- Knowledge Based
  - Clinical decision making
  - Management decisions
  - Diagnostic reasoning

# Mismatch between teaching and practice

## Taught

- Step-by-step approaches
- Book knowledge
- EBM and Bayesian Analysis
- Hypothesis testing
- Thoroughness / Luxury of Time

## What they see

- Quick, snap judgments
- “Wisdom” “Experience”
- “Fast and Frugal” or “Flesh and Blood” (real world)
- Pattern recognition and seemingly automatic retrieval from the subconscious
- Shortcuts



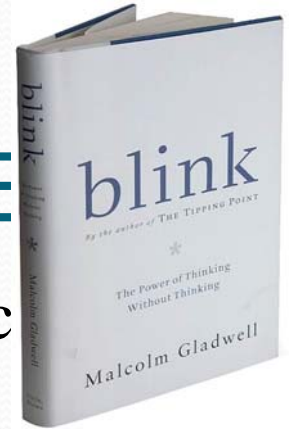
# “Flesh and Blood Decision Making”

How Doctors think in real life:

- Pattern Recognition
- “Mind as Magnet”
- Non-linear
- Thinking and acting are connected
  - Not data collection followed by analysis
  - “Thought in action”
- Usually 2-3 diagnoses initially
- Heuristics (shortcuts)

# Decisions Made in the Blink of an Eye

- “Fast and Frugal” decisions are often amazingly accurate when made in the right hands
- *Blink* by Malcolm Gladwell
- Trainees are busy looking at every piece of information; the expert goes to the data that will be most helpful or hones in on things that are abnormal (don't fit the expected pattern)
- Leaves trainees very confused and feeling inadequate



# Evidenced Based Medicine

- Evidenced Based Medicine
  - Big advance in medical education
  - Moved medicine from the days of “apprenticeship” (following what an expert did and copying that behavior)
  - Gives trainees a way to evaluate the enormous amount of new information
- Often abused and a cause of much “lazy thinking”
  - Evidenced B(i)ased Medicine

# Evidence B(i)ased Medicine

- “But the  $p$  was less than 0.05”
- Statistically significant is not the same as clinically meaningful

# Evidence B(i)ased Medicine

- Does the study apply to my patient?
  - Inclusion criteria
  - Exclusion criteria
- Spectacular examples of adverse effects to patients when this is not done
  - Example: Hyperkalemia after the RALES trial
- An alternative: the N of 1 randomized, clinical trial

# Evidence B(i)ased Medicine

- Inability to place evidence in the proper context
- Not taking into account patient preferences

# Evidence B(i)ased Medicine

- Manipulation of data and use of data for marketing by pharmaceutical industry and device marketers
- Example: Relative risk versus absolute risks

# Clinical guidelines and cookbook medicine

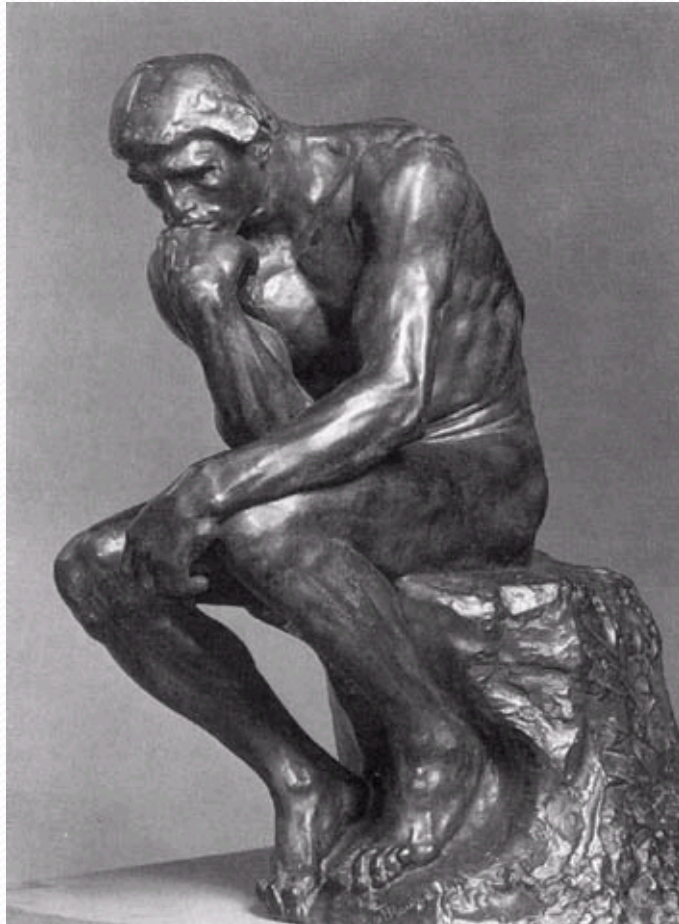
- Great for the simple, straightforward, typical patient
- Help reduce variability in clinical practice
- Speed rate that new knowledge is applied

Why trainees love them:

- Clear answer of “what to do next”
- Clear targets / goals of treatment
- Simplify things / “take away the uncertainty”



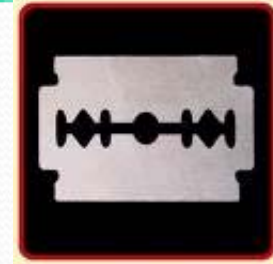
# Teaching trainees to think



# Early Trainees

- Spent years taking tests, sitting in classrooms
- Used to multiple choice questions and “one right answer”
- Uncomfortable with uncertainty
- “There must be a right answer”
- In the end, this leads to a search for THE diagnosis

# Occam's Razor



- *A principle attributed to the 14th-century English logician and Franciscan friar William of Ockham.*
- *Numquam ponenda est pluralitas sine necessitate*
  - Plurality ought never be posited without necessity
- Diagnostic Parsimony (unifying diagnosis)
- Take all the patient's symptoms and try to find a single underlying cause
- Emphasized in Sir William Osler's teachings and writings

# Hickam's Dictum



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- Former chairman of Medicine at Indiana University
- “Patients can have as many diseases as they damn well please”
- Statistically more likely that a patient has several common diseases, rather than having a single rarer disease which explains multiple symptoms.

# Saint's Triad



- South African Physician
  - Hiatal hernia
  - Gallbladder disease
  - Diverticulosis
- 
- No patho-physiological basis for the coexistence of these three diseases; but are often found in the same patient

# Thinking errors

- I discovered there were many other errors other than “the search for the unifying diagnosis”
- Cognitive Psychology and research into “How Doctors Think”
- Cognitive Errors

# How do cognitive errors occur?

- Not in isolation typically
- Cascade of sequential cognitive mistakes
- They are common
  - Up to 10% of autopsies reveal a diagnosis that was clinically relevant that was missed
  - Misdiagnosis occurs 15-20% of the time and about 80% of these are due to cognitive errors
- Technology is not a solution
  - Increased technology can increase mi

# Types of Cognitive Errors

- Over 30-40 types of cognitive errors have been described in the literature
- A few are very common
  - Anchoring
  - Availability
  - Attribution
  - Premature Closure
  - Confirmation Bias



# Anchoring

- Snap judgment
- Locking onto salient features in the initial presentation
- Get “anchored” to this initial hypothesis and then hard to detach from this diagnosis

# Confirmation Bias

- “Pertinent Negatives” (or positives) which all make one less likely to consider alternate diagnoses
- Mind’s tendency to “cherry pick” data that fits with our assumptions and rationalize away contradictory data
- Can often compound an anchoring error

# Premature Closure or “Freezing”

- Once you have something that “fits” you stop thinking
- Also has been called “satisficing error”
  - Satisfy + suffice
- “The fracture most commonly missed is the second”

# Framing or Diagnosis Momentum

Once several doctors/specialists agree on a diagnosis it is easier to perpetuate it rather than take the time to question its accuracy

# Availability Errors

- Choosing the most likely or most memorable diagnosis
- Over-estimation of frequency vivid or easily recalled events
- Under-estimation of frequency of ordinary or hard to recall events
- The “New England Journal Effect” at morning report

# The Zebra Retreat

- “When you hear hoofbeats, think horses”
- But... if you never think of Zebras you will never diagnose one
- Not considering a disease because of its unfamiliarity or rareness

# Representativeness

- Deleting a disease from the differential diagnosis list because it does not match the standard variant/ usual presentation
- A large problem in diagnosis of patients in whom “atypical presentations” are quite common

# Attribution Errors

- Stereotyping
- Judgemental
- Gender Bias
- Racial Bias



# Commission Bias

- The urge to act rather than do nothing even when nothing is preferable.
- Rooted in beneficence/active intervention

# Omission Bias

- The tendency towards inaction
- Events that are attributed to the natural events of a disease better than those related to a physician's intervention
- Rooted in non-malificence

# Outcome Bias

- Opting for diagnostic decisions that will lead to good outcomes rather than bad ones
- Stronger likelihood in decision making towards what one hopes will happen than for what one really believe might happen
- Results in minimization of potential serious diagnoses

# Aggregate Bias / Aggregate Fallacy

- Belief that aggregated data / practice guidelines do not apply to your patient— that your patient is exceptional, atypical, or special
- For example, prescribing antibiotics when not indicated for sinusitis

# Playing the Odds

- Opt for the more common or more benign diagnosis because it is more likely

# Rule out the Worst-Case Scenario

- Also called “Base-rate neglect”
- Often used in Emergency Room Medicine
- Often used to avoid litigation

# Gambler's Fallacy

- Belief that if a coin is tossed 5 times and is heads each time, then surely the 6<sup>th</sup> toss has a greater chance of being tails
- (Adjusting the pre-test probability based on outcomes of preceding independent events)

# Some other cognitive errors:

- Ying-Yang-Out
- Psych-out Error
- Sutton's Slip
- Sunk Costs
- Triage Cuing

# How do we teach avoidance of these cognitive errors?

- Make thinking explicit – think outloud!
- Feedback
  - Challenges with fragmented system and hand-offs of care
  - Decreased use of autopsies
  - M&M conferences
- Reflective Practice
- Become comfortable with uncertainty
- Acknowledgement that we get it wrong up at least 10% and up to 20% of the time

# Thinking about Thinking

- Metacognition: “Cognitive Pills for Cognitive Ills”
- Features of Metacognition
  - Awareness of the requirements of the learning process
  - Recognition of limitations of memory
    - Willing to “look it up”
  - Appreciation of perspective (de-anchoring)
    - Willing to step back and look at the big picture
  - Capacity for self-critique
  - Ability to select and switch between different strategies to deal with each situation



# Cognitive Debiasing Strategies

- Develop insight/awareness
- Consider alternatives
- Metacognition / Reflective approach
- Decrease reliance on memory
- Simulations
- Cognitive Forcing Strategies
- Make tasks easier
- Minimize time pressures
- Establish accountability
- Feedback

# Summary

- It is possible to get our students to “think”
- We must teach trainees to avoid the simple route of blindly following clinical guidelines and practicing cookbook medicine
- Development of better thinking strategies is what separates a novice from an expert
- We must start with thinking about thinking ourselves and make our thinking explicit to our trainees
- We must teach trainees to think about thinking
- Why? Various cognitive errors are very common and lead to misdiagnosis, and this has significant implications for patient safety

# References

- Elstein AS, Schwarz A. Clinical problem solving and diagnostic decision making: selective review of the cognitive literature. *BMJ*. 2002;324:729-732.
- Gladwell M. *Blink: The Power of Thinking Without Thinking*. New York, NY: Little, Brown and Company; 2005.
- Groopman, Jerome E. *How Doctors Think*. Houghton Mifflin, 2007
- Graber ML, Franklin N, Gordon RR. Diagnostic error in internal medicine. *Arch Intern Med*. 2005;165:1493-1499.
- Croskerry P. The importance of cognitive errors in diagnosis and strategies to minimize them. *Acad Med*. 2003;78:775-780.
- Croskerry P. Cognitive forcing strategies in clinical decision making. *Ann Emerg Med*. 2003;41:110-120.
- Redelmeier DA. Improving patient care. The cognitive psychology of missed diagnoses. *Ann Intern Med*. 2005;142:115-120.