Understanding Cognitive Errors in Medicine

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UT Southwestern
Medical Center
Disclosures

• Nothing to disclose.....
Acknowledgements...
What you need for this workshop:

• Pen

• Handout

• Cellphone to text in your responses
Social Contract

• Adult Learners—Promise to keep you entertained.

• Dialogue, not a lecture—Your Participation is key.

• Three Learning Objectives:
  • To introduce you to Dual Process Theory of Cognition.
  • To illustrate to you what Cognitive Errors are.
  • To enable you to reflect on your own Cognitive errors & demonstrate some Strategies and Tools to avoid common pitfalls.
Why Should I Care About This?

WARNING
TO AVOID INJURY
DON'T TELL ME HOW TO DO MY JOB

Baby Image
In The Literature....

BJA 2011

NEJM 2013

Anesthesiology 2014
Textbooks on the subject...
The Public is Paying Attention...

Surgeon’s ‘cognitive bias’ responsible for deadly medical error

A recent case involving a preventable medical error that resulted in the death of a patient was found to be the cause of the deadly hospital error.

After a surgeon administered a dye that resulted in the death of a patient, cognitive bias was found to be the cause of the deadly hospital error.

In the case at issue, reported by the New York Times, a surgical error at Beth Israel Deaconess Hospital is alleged to have led to the death of a patient undergoing a procedure to remove a brain tumor.

The physician was ordered to inject the dye into the patient’s brain in order to identify the location of a tumor, which had already invaded the brain.

However, the physician did not follow the dye that the physician had ordered, and injected a different one. Unfortunately, the dye had been correctly injected into the same area.

The surgery was successful due to a nurse and a physician’s erroneous judgment. Instead of the proper dye, an incorrect dye was injected into the brain.

According to the surgeon’s account, a pharmacist had the nurse that the operating room nurse had injected the dye that the physician had ordered, and instead of the proper dye, injected the dye that was used for a different dye.

The nurse proceeded to inject the dye, telling them “this is what we have.” The surgeon claims that the nurse injected the dye that was used for a different dye.

Patient Essays MR. P, a resident in cognitive bias...The patient claims “The surgeon told me that the nurse had injected the dye. You need to...be careful. What you are doing will happen because most of the time it actually does.”

Unfortunately, in this case it did not. Hospital executives were reportedly to believe the surgeon did not follow the dye that he had ordered. The patient was treated with dye that was used for a different dye, rather than the correct dye that was to be injected into the brain.

The patient was treated with dye that was used for a different dye, rather than the correct dye that was to be injected into the brain.

"Must reading for every physician who cares for patients and every patient who wishes to get the best care." – Tina

“NEW YORK TIMES BESTSELLER

How Doctors Think

JEROME GROOPMAN, M.D.

THINKING, FAST AND SLOW

DANIEL KAHNEMAN

WINNER OF THE NOBEL PRIZE IN ECONOMICS

UT Southwestern Medical Center
The Joint Commission is All Over This...

- **Assessment**
  - Adequacy, timing, or scope of assessment: pediatric, psychiatric, alcohol/drug, and/or abuse/neglect assessments; patient observation; clinical laboratory testing; care decisions

- **Human Factors**
  - Staffing levels, staffing skill mix, staff orientation, in-service education, competency assessment, staff supervision, resident supervision, medical staff credentialing/privileging, medical staff peer review, other (e.g., rushing, fatigue, distraction, complacency, bias)
The Lawyers are paying attention...
Closed Claims Payouts

MEDICAL Closed Claims

Cognitive Error as the Most Frequent Contributory Factor in Cases of Medical Injury

Table III. Factors contributing to injuries attributable to surgical errors

SURGICAL Closed Claims

Atul Gawande et al Surgery 2006; 140: 25-33
Closed Claims Data from 4 Liability Insurers
Our Mind...

The mind is like an iceberg, it floats with one-seventh of its bulk above water.
-Sigmund Freud
Dual Process Theory of Cognition

System 1—Fast Thinking
Intuitive, Pattern Match, Shortcut...

FAST Brain

System 2—Slow Thinking
Conscious, Algorithmic thoughtful

SLOW Brain

Originally named by Keith Stanovich and Richard West
Yell out first word that comes to mind...

Ready?
Which Line is Bigger...
97 people get on a bus on the corner of 5th and Broadway. 14 more come on at 6th, 3 leave. At 7th and Madison, another 16 get come on the bus and 7 leave. At 8th and Lexington, 32 get off and another 4 come on.....

Who’s got it.....
Trivia...
Trivia Answer....
Fill In The Blank...

WASH

EAT

SOAP

SO__P
Fire is dangerous.

Impossible Not to Understand this....
System 1 Fast Brain—The Unconscious Brain

• Operates Automatically
• Effortless (lazy)
• Pattern Seeking
• Difficult to Over-ride
• Examples:
  • Detect that one object is farther than another
  • Detect the location of a sound
  • Detect Hostility in a voice
  • Read Simple Words or Sentences on a Billboard
  • Add 3+3 = 6
Let’s Do Some Simple Math...

• $19 \times 26 = 494$

• $17 \times 15 = 255$

• $112 \times 197 = 22,064$

Getting A Drop Harder I imagine, Yes?

Requiring More Attention Perhaps...
Find Waldo....
Read This Sentence...
Play Ball....

A Ball and a Bat Cost $1.10. The Bat Costs $1 more than the Ball...

**FAST Brain**

Bat = $1.00
Ball = 10¢

**SLOW Brain**

Bat = $1.05
Ball = 5¢
System 2 Slow Brain—Conscious Brain

- Voluntary
- Analytical
- Requires Attention and Effort
- Sympathetic Release when activated (Pupils Dilate, HR increases)
- Experienced as Stress → We may avoid this type of thinking because of an aversion to the experience of stress

Examples:
- Comparing two Cars Value
- Filling out a Tax Return
- Searching your Memory Actively for anything
- Reading something with intention
Dual Process Theory

FAST Brain

No Clear Pattern... My Gut tells me A not B...

Type I Intuitive
- Pattern recognition
- Repetition

Yes → Pattern recognized?

Type II Analytical

No → Decision

Yes → Back to Algorithmic Discrimination

Yes, I see “pattern A”, but not all the data fits A... so Back to Algorithmic Discrimination

SLOW Brain

Croskerry P. Academic Med 2009; 84; 1022e8

Stiegler et al. Anesthesiology 01 2014, Vol.120, 204-217.
Falling Down The Rabbit Hole...
The mind is like an iceberg, it floats with one-seventh of its bulk above water.
-Sigmund Freud
A
Bird In
The
The Bush.
“Pay Attention....”
Multi-Tasking is a Myth...

Instructions:
1.) Count # times hear the word “Magic”
2.) Count # times “David Copperfield” Picture or Name on screen
Distracted by Technology...

- Human Factors Issue
- Slower reaction time
- Significant Medical Legal Risk
- Increase in Surgical Errors
Distraction is Dangerous...
Take Home--Attention is a Limited Resource

Fixation Error

Multi-Tasking

Distracted

Inattention Blindness

Loss of Situational Awareness

-Poor Medical Judgment-
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-Sigmund Freud
Please Read This...

**Bookending**
Testing your Short Term Memory....

- How many words did you recall?
- Most people can remember 7+/- 2 things in their short term memory.¹
- How many of you recalled the word “Sleep”? If you did, then like 50% of people, you are subject to a "Retrieval Distortion Error".²

Instrucions:
I am going to briefly flash a list of words. First read the list. Then, once I remove the list, write down as many of the words as you can recall.

Everyone ready?

Current Theory on Accessing Memory

- Memory is very fluid
- Data lost, changed
- Affected by
  - Simply Recalling
  - Social influences
  - Other memories
  - Anxiety, Stress....

Piaget’s Theory of Schema

Learning Memory. August 2015 22: 360-363
Bridge et al. J Neuroscience. 2012 Aug 29; 32 (36) 12, 144-51
Take Home—Avoid Reliance on Memory

Common Pitfalls Using CVA-Decision Support:

- Team Leaders should not be the ones focused on Manuals/CVA—loose GA.
  - Instead, designate a “Reader”

- Be Careful of Diagnosis Momentum & Anchoring into first Diagnosis-sheet on the Manual
  - Re-assess Data
  - Speak Out loud

- Avoid “Frequency Gambling” c CVA’s:
  - Use Algorithmic Discrimination
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### Hazardous Attitudes

<table>
<thead>
<tr>
<th>Hazardous Attitudes</th>
<th>Antidotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-Authority</td>
<td>Follow the rules. They are usually right.</td>
</tr>
<tr>
<td>Impulsivity</td>
<td>Not so fast. Think first.</td>
</tr>
<tr>
<td>Invulnerability</td>
<td>It could happen to me.</td>
</tr>
<tr>
<td>Macho</td>
<td>Taking chances is foolish.</td>
</tr>
<tr>
<td>Resignation</td>
<td>I’m not helpless. I can make a difference.</td>
</tr>
</tbody>
</table>

Figure 9-1 — Antidotes for Hazardous Attitudes.
Best Guess Please…

Instructions:
Please put an upper and lower bound around your estimate such that you are 90% confident the correct answer falls within this "confidence range".

Answers
1. 9.0 ounces
2. 2.3 million
3. 10,800
4. 67,900 sq mi
5. 1,000 mph
6. 3%
7. 68.5 inches
8. 35,000
9. 92.1 million
10. 31,677

How many of you got 2 or more questions wrong? (wrong = answer is not within your range)

If so, then like 79% of the world, you are subject to an Over-Confidence bias.
Over-Confidence

Tendency of an individual to believe they are more knowledgeable than they are.

Leads to Diagnostic Error:

- Accept Intuition
- Act on incomplete information
- Premature Closure of Case
- Denial of Facts, even when presented with clear evidence to contrary.

Machismo—Another Hazardous Attitude
Take Home Point—4 Tools to Counter Over-Confidence...

- “Rule of 3”
  - Re-assess after 3 failed interventions (Stiegler)

- Use Algorithmic Discrimination
  - Prove it wrong, not right

- Slow Down...Reflect
  - Do I have all the facts?

- Learn to Tolerate Uncertainty

Croskerry et al. Am J Med. 2008 May;121(Suppl)
The mind is like an iceberg, it floats with one-seventh of its bulk above water.
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Our Mind...
Get Out your Cell Phones and Text this Number--22333

Please enter this code in your phone
Practice Poll Question

Your poll will show here

1. Install the app from pollev.com/app
2. Make sure you are in Slide Show mode

Still not working? Get help at pollev.com/app/help or Open poll in your web browser
Get Out your Cell Phones and Text this Number--22333
You are in major debt...

Heads....
You win $10,000
Cash now

Tails....
You pay me
$2,000 Cash now

You have only two choices—you either play or pay $100 cash now to get out of the situation....
Your poll will show here

1. Install the app from pollev.com/app
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Loss Aversion--Preference for Certainty

“A Bird in the Hand is better than 2 in the Bush”....

Expected Value = Probability x Pay-off

Scenario 1—Play the Game:
- Heads EV = 0.5 x $10,000 = $5,000
- Tails EV = 0.5 x -$2,000 = -$1,000
  - TOTAL EV = $4,000.

Scenario 2—Don’t Play the Game:
- Total EV = 1 x $100 = $100.

It hurts more to loose than it does to win.....
Loss Aversion—The problem behind Paralysis by Analysis

Steve Jobs
1955-2011
Framing—The Effect on our Preferences...

Study reported in NEMJ Vol. 306 #21, 1982

“This study asked 167 subjects to imagine they had lung cancer, half were told:

"of 100 people having surgery, 10 will die during surgery, 32 will have died by one year, and 66 will have died by five years."

"of 100 people having radiation therapy, none will have died during treatment, 23 will die by one year, and 78 will die by five years."

Which treatment would you prefer?
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Which treatment would you prefer?

Physicians

90 will survive the

68 will survive past

34 will survive past

all will survive the

77 will survive past

22 will survive past

84% Surgery

16% Radiation
The mind is like an iceberg, it floats with one-seventh of its bulk above water.
-Sigmund Freud
Feedback—Why it’s so hard to make happen...

Because of Loss Aversion:

- “No News is (assumed interpreted as) Good News”
- Talking may lead to worse consequences
- We need competency and Credentialing.

Interrogated...

Punished...

Shamed...

Retaliated against Later...
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-Sigmund Freud
Bias...

• Subconscious Process...

• You are At Risk Biased Reasoning when:
  • Tired
  • Cognitively Overloaded (too much on your plate)
  • Distracted during evaluation
  • Interrupted during evaluation
  • Came from a Hand-off, not the first set of eyes on the patient
  • Pt that is difficult or you just don’t like
Blind Spot Bias

This is someone else’s issue, not mine....

The more cognitively sophisticated we are, the more subject we are to this bias....
Visceral Bias...

• When our emotions affect how we care for pts...
• We might want to limit our interactions with “difficult pts”
• We might feel extra pressure with “VIP pts”
• Even our Empathy can get in the way of care:
A 37 yo G3P1011 at 32 weeks presented with moderate abdominal pain and no noted fetal movement for >2 days. Intra Uterine Fetal Demise was confirmed, and induction of labor was planned. The patient had significant grief, and was given some time alone. Lethargy was mistaken for grief. 12 hours later, a delay in diagnosis of placental abruption and DIC was made, leading to urgent cesarean delivery, massive transfusion (20 unites) and bilateral uterine artery ligation in order to control the hemorrhage.
“You only Hear what you want to hear honey...”
Confirmation Bias...

“Surgical Error at Tufts prompts widespread changes, Aug 2014, The Boston Globe

- Spine Surgeon wanted to do a myelogram, inject dye into the intrathecal space

- Pharmacist handed surgeon 2 different dye’s—unsafe for intrathecal injection—because the dye asked for was unavailable

- The OR RN hands the Dye to the surgeon and states “This is all we have”

- KEY PART: The surgeon then looks at the bottles....

- Clearly labeled, “Not for injection into spine”, and

- Injects the Dye into the Patient anyways...

- Pt died 24 hrs later....

Selectively Ignoring Certain Information and Accepting only the pieces that confirm our preconceived notions or mental constructs of reality....
Confirmation Bias

- Tendency to Confirm pre-conceived notions/conclusions.
  - Ignore evidence that refutes your mental model
  - Search Satisfying—stopping a search once a first positive result comes

Mr. W is a 51-year-old diabetic male who presents to the emergency department (ED) with a seven-day history of lumbar lower back pain that occurred immediately after lifting a heavy box at work. He reports radiation of pain down the front of his leg and denies trauma, and bowel or bladder abnormalities. He has been using high-dose Motrin (600 mg every 6 hours) to relieve the pain. He reports a pain severity of 10/10.

He has no other medical problems, smokes marijuana occasionally, and has a distant history of IV drug abuse. Triage vitals are as follows: blood pressure, 150/91; heart rate, 105 beats per minute; temperature, 100.5ºF; and respiratory rate, 16 respirations per minute. He took 600 mg of Motrin 1 hour before ED arrival. He reports that he has been unable to work all week and needs a written excuse for his boss.

The nurse approaches the emergency physician (EP) and states, “Mr. W is here again. He is here all the time requesting pain medicine and work excuses for lower back pain. He was even here yesterday and was seen by your colleague, Dr. S, [was] diagnosed as having a muscle strain or a herniated disk, [was] given two Percocet orally, and [was] told to follow up with his primary physician. Let’s get him out of here.”
Back examination reveals diffuse lumbar bony and paraspinous tenderness. He is unable to tolerate a straight-leg raise because of pain. The neurological examination is grossly non-focal, and he has no major deficits in sensation or motor ability. No rectal or perineal examinations are performed because he is in the hall.

On further questioning, he admits using IV heroin 3 weeks before onset of the pain. Complete blood count, chemistries, erythrocyte sedimentation rate (ESR), a chest radiograph, and lumbar plain films are ordered. His white blood cell count (WBC) is 11.8 3 103/mm3, his ESR is 47 mm/h, and the rest of his labs are unremarkable. Chest radiograph shows no acute disease. Lumbar films show vertebral endplate and disk destruction.

Emergency magnetic resonance imaging with gadolinium enhancement is ordered and reveals findings consistent with epidural abscess. The neurosurgery consultant is immediately notified of the results and decides to take Mr. W to the operating room for emergent drainage.
Take Home Point—Don’t sell the Facts, state them...

When calling for more eyes to look at a problem...

Don’t sell a story, try to state the facts...
Availability Bias...

Estimating the likelihood of something based on how memorable something is.
Availability Bias...

- Stories and anecdotes are more impactful on us than Evidence.
  - We remember stories more than we remember data.

- What is vivid, powerful, recent comes to mind easiest.

- But just because something is more memorable does not make it more likely.
When assessing a Patient...

Don’t let your emotions pre-determine the results of your inquiry

Title: Take Home Point—Head Before Heart...
Omission Bias

- Tendency towards inaction—Keep the Status Quo.
- Linked to Loss Aversion
- It’s The “Do No Harm” principle exaggerated...Fear we will hurt pts.
- “Not Killing the patient seems better than we could not save them...”—Dr. M Stiegler, ASA Lecture on Cognitive Errors. 2015.

During Airway management in a low risk patient, in a low risk facility, AMBU surg, having to do a surgical airway.

Needing to put in a chest tube a case where no bleeding is expected....
Outcome Bias

• We have always done it this way....“All is well that ends well.”

• Judging decisions by the outcome alone is not a correct way to assess decision quality

• Outcome bias leads to what is called a Normalization of Deviance
Texting during driving...

- Most of the Texting done while driving does not lead to injury or death (good outcome)... 
- In 2013, of the 32,719 fatal car injuries, 3154 of them were due to being a distracted driver, or 9.6%.

www.distraction.gov
http://www.textinganddrivingsafety.com/texting-and-driving-stats
Clinical Examples of Outcome Bias...

• Physician Assistant Phyllis takes a sickle cell patient with a known positive antibody screen to the operating room for a surgery with a low risk of blood loss without knowing blood is available.

• Anesthesiologist Ariela continues to fold to pressure from High RVU producing surgeons to clear sicker and sicker patients at Outpatient Surgery Centers, with disease processes that could need more intense post operative monitoring (OSA, AICD Patients)

• Surgeon Sam touches his plastic face mask and whips the sweat off his brow, and continues to operate. When told to change his gloves, he says “oh, that is no big deal...we will just load the pt with antibiotics and he will do fine.”

• NICU Nurse Judy shares her pyxis password with a Nurse Eleanor, to help Eleanor be more efficient at wasting narcotic drugs.

• Phlebotomist Sam tears off the index finger glove tip in order to “feel for the vein” in his difficult to stick Burn Patients because he does not want to subject the patient to “multiple sticks”.
Normalization of Deviance

• When it becomes the norm to see people Cutting Corners, Bypassing safety checks, Turning off alarms

• Space Shuttle Challenger Disaster
  • Rocket Booster O Rings- Designed to function with launch pad not colder than 59 degrees
  • Only 4/21 flights showed minor damage with progressively lower temps with no bad outcome
  • Until on the day in question, launch pad was 29 degrees
Culture of Low Expectations...

Caregivers come to expect and tolerate a norm of faulty and incomplete information exchange, where people come to believe what they do is “good enough”...

Our Mind...

The mind is like an iceberg, it floats with one-seventh of its bulk above water.
-Sigmund Freud
Heuristic Thinking...

Imagine Life if we had to work every little issue up, had no intuition, no judgment....

• Never get anything done.....totally inefficient.

• Pattern Matching is an incredibly powerful human skill
• The ability to Ignore some information is vital to decision making
• Intuitive, automatic, primed
• Might have word associations
• Subconscious process

Croskerry P. Academic Medicine 2009; 84: 1022e8,
What’s the Diagnosis?

A gravida 5, para 4 postpartum woman gets out of bed on postoperative day 1 after her third cesarean section and becomes acutely hypotensive with shortness of breath. She is morbidly obese, has 1+ pitting edema, and has refused her last three doses of subcutaneous heparin (including that morning). She rapidly loses consciousness and progresses to pulseless electrical activity. What’s her most likely diagnosis?

Hemorrhage
Pulmonary Embolism

Bleeding is a 100x more likely than PE in a postpartum female.

Heparin RR=40%
Obesity OR=2.8
Obesity OR=2.2

What’s more likely?

• Perception of data
• Processing of data

Mary is 24 y/o Female who enjoys burning incense and work. She loves to clean beaches, volunteers at homeless animal shelters, wears tie-dye shirts, and reads her horoscope daily. When she has free time, she goes to hotbox yoga classes.

Mary is most likely a…?

School Teacher?  
Spiritual Healer?

1000x more teachers than there are spiritual healers.
Which statement is more Likely?

A. Mr. F has had one or more heart attacks.

B. Mr. F is over 55 years old, and has had one or more heart attacks.

B is clearly just a subset of A.
Representative Heuristic

when faced with a diagnostic challenge, we construct a mental model based not on statistical probability, but rather patterns and “buzz words"
Take Home Point—Think Horses before Zebra’s
Give me your best guess--Factorial

Most people who start with 1, 2, 3..., usually guess a smaller answer number than those who started with 8, 7, 6.....

WHY?

ANCHORING Bias

Split the room into two sides.....
Consider The Following Case....

A 20 y/o male arrives in the Trauma bay with multiple stab wounds to the arms, chest, and head. His fast scan is negative and primary ATLS exam in is notable for mild to moderate respiratory distress. His secondary exam in unremarkable. After a long discussion with between the Faculty Trauma Surgeon and his Chief, they elect to avoid a CT Scan of the patient’s chest, instead opting for non-operative management. All of his wounds are sutured closed by the intern, and the patient is sent home the next am after 23 hours of observation in the ED with stable vital signs.
Case Continues...

4 days after the initial stabbing event, the patient returns to the Emergency room with blurry vision, vomiting, and an inability to concentrate.

A head CT reveals 1 4 centimeter laceration of the brain frontal temporal lobe.
ANCHORING BIAS

Occam’s Razor...

When we initially estimate a value or a state, our subsequent estimates in response to new information are affected by our starting point, they are “anchored” to that point.

"We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances."
Take Home Point—Re-Assess Data....

Especially after 3 failed assessments or interventions...
The mind is like an iceberg, it floats with one-seventh of its bulk above water.
-Sigmund Freud
Cognitive Distortions...

**All or nothing thinking**
- Sometimes called 'black and white thinking'.
- If I’m not perfect I have failed.
- Either I do it right or not at all.

**Over-generalising**
- Seeing a pattern based upon a single event, or being overly broad in the conclusions we draw.
- "Everything is always rubbish.
- "Nothing good ever happens."

**Jumping to conclusions**
- There are two key types of jumping to conclusions:
  - Mind reading (imagining we know what others are thinking).
  - Fortune telling (predicting the future).
- \(2 + 2 = 5\)

**Magnification (catastrophising) & minimisation**
- Blowing things out of proportion (catastrophising), or inappropriate shrinking something to make it seem less important.

**Mental filter**
- Only paying attention to certain types of evidence.
- Noticing our failures but not seeing our successes.

**Disqualifying the positive**
- Discounting the good things that have happened or that you have done for some reason or another.
- That doesn’t count.

**Emotional reasoning**
- Assuming that because we feel a certain way what we think must be true.
- I feel embarrassed so I must be an idiot.

**Should must**
- Using critical words like ‘should’, ‘must’ or ‘ought’ can make us feel guilty or like we have already failed.
- If we apply ‘shoulds’ to other people the result is often frustration.

www.pinterest.com “cognitive Behavioral Therapy”
Thank you

Oren Guttman, MD, MBA, CHSE
UTSW Culture of Safety Officer
Co-Direc. Pt Safety Simulation Team
Master Trainer, AHRQ TeamSTEPPS
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