Cognitive Errors in Diagnostic Reasoning

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Session Summary

Every medical professional would like to be perfect; none of us would choose to make errors. Unfortunately, we do make errors. The human brain is designed to look for patterns, make conclusions based on pattern recognition, and has built in biases that are used in decision making. This presentation will examine why we make errors, the types of errors we make, how those errors change with experience, and what we can do to try to prevent them.

Session Objectives

Upon completion of this presentation, the participant will be able to:

- discuss incidence and recognition of cognitive and diagnostic errors;
- understand the effect of various individual factors on the incidence and type of errors;
- implement strategies to prevent cognitive and diagnostic errors.

References


Croskerry (2009). Context is everything or how could I have been that stupid? *Healthcare Quarterly*, 12: p e171-e177.
Session Outline

See presentation handout on the following pages.
Cognitive and Diagnostic Errors and the Neonatal Nurse Practitioner

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Objectives/Main Points

- I don't make cognitive errors, Do you?
- Diagnostic errors.
- Cognitive errors and frequent types of errors.
- Does experience change the incidence or types of errors? Do Nurse Practitioners make different types of errors?
- Strategies to prevent cognitive errors.

I don't make errors....do you?

- Can you remember making any errors in diagnosis?
- In this era of safety, why aren't we talking about these?

Other specialties

- ½ of all litigation against emergency physicians is due to delayed or missed diagnosis
- Emergency medicine has been called the “natural laboratory of error” (Croskerry, 2003)

Radiologists

- Reading x-rays requires perception and cognition
- 100 radiologists, shown 60 x-rays and asked “Is the film normal”
  - Disagreed between themselves 20% of time
  - When same radiologists reread films....contradicted their own analysis 5-10% of time
- One film missing clavicle (requires noticing what is not there). 60% failed to identify....if asked to look for cancer 83% found it.
  - Potchen et al 2000
By the way....
- Residents and all other subspecialties were more inconsistent reading x-rays than the radiologists....... 
- How many films have you looked at this week?

Neonatology
- Very little information available about our diagnostic accuracy 
- We haven’t looked...

Evidence that we make errors...
- Literature search on autopsies in neonates and concordance with neonatal diagnosis.....eliminated studies from third world countries 
- Autopsy reports:  
  - Two studies remained

Autopsies
- 29 autopsies on very preterm infants  
  - Very preterm infants less likely to have an autopsy  
  - New findings in 79%, significant change in diagnosis 28%  
  - Elder, 2005  
- 10 years of autopsy reports  
  - 74% had complete concordance between clinical cause of death and autopsy.  
  - New information in 26%  
  - Brodlie, 2002

Diagnostic Errors
- There are Three types....  
  - No Fault errors  
  - System errors  
  - Cognitive errors  
  © (Harasym, 2008) (Croskerry, 2003)

No-Fault Errors
- The disease is present, but not detected.  
  - Disease is silent, presents atypically or mimics something more common  
- Case: Not all hoof beats are horses......Sometimes you have to hunt for Zebras
**System Errors**
- Diagnosis is delayed or missed because of imperfections in the health care system.
- Case 1: the official radiology report of xrays is dictated after clinicians have seen films and reacted to them. The reports are not routinely reviewed.

**Cognitive Errors**
- Misdiagnosis from faulty data collection or interpretation, flawed reasoning, or incomplete knowledge.
- Limitations in processing, using heuristics (short cuts/ pattern recognition)
- Memory limitations and excessive cognitive loading
- Bias

**Cognitive Errors**
- The majority of diagnostic failures (75%) are due to cognitive error (Graber, 2005)
- Cognitive dispositions to respond (CDRs)
  - Failure in perception
  - Failed heuristics
  - Biases

  –Croskerry, 2003

**Decision Making**
- Dual process theory
  - Type 1
  - Type 2

**Type 1 Processes**
- Inductive, heuristic, reflexive, skilled, rules of thumb, pattern recognition
- Advantages:
  - Fast !!!!, minimal effort
  - Low cost
- Disadvantages:
  - Vulnerable to bias (some may be hardwired)
  - Errors common
  - Highly dependent on context
  - Low dependence on scientific rigor

**Type 2 Processes**
- Analytical, normative, deductive, abstract
- Advantages:
  - deliberate and rule based,
  - less vulnerable to bias,
  - few errors,
  - context less important
- Disadvantages:
  - slow, deliberate,
  - high cost, learned (not hardwired)
Patterns
- Your brain looks for patterns
  - It then tends to ignore information that does not fit the pattern
- Your brain has a limited ability for attention

Count all letters F
- Finished files are the result of years of scientific study combined with the experience of years......

Inattentional blindness or perceptual blindness
- From aviation: on a flight simulator trained pilots did not notice distractions in the runway, untrained pilots did not anticipate what they would see and noticed the distractions
- Nurse: “I was amazed you got the kid tubed...it is so distracting when the grandmother hits the floor”.....
- http://www.youtube.com/watch?v=INGwGGQjifY

Read the word.............
BLUE RED GREEN RED YELLOW BLACK BLUE GREEN YELLOW RED GREEN BLUE
More than 40 Cognitive Errors Described

Cognitive Failure contributes to accidents and errors

Premature Closure

- Narrowing of the choice of diagnostic possibilities too early in the process...the correct diagnosis is never seriously considered

Availability Bias

- Recent experience with a disease may inflate the likelihood of it's being diagnosed

  • Example: ______ always comes in threes....

Confirmation Bias

- Tendency to seek out data that supports one's original diagnosis, rather than seeking non confirmation data.

Commission Bias

- Tendency toward action rather than inaction.
- It occurs more frequently in those who are overconfident.
- Commission bias is less common than omission bias.

  • Spitzer’s laws: When you don't know what is going on, call a surgeon. They won't know what is going on either, but they will do something about it.
Contextual Errors
• Tendency to characterize a problem in terms of an organ system involved. (Pulm/cardiac)
• Case: 34 week‘er with failure to pink in the delivery room.

Framing Effect
• How diagnosticians see things may be influenced by how the problem is framed.
• Case: it is the middle of the night......

Gender Bias
• The tendency to believe that gender is a determining factor in the probability of diagnosis
• Example: WWB

What other factors affect the occurrence of errors?

Do experienced clinicians make fewer errors?
• Studies are discrepant.........
  • Unable to find any studies on NNP’s, none on neo’s
  • Study of ER Physicians (Berk, et al 2008)
  • 829 cases reviewed, 374 errors identified. Physicians with >1.5 years experience were less likely to make an error.
  • Errors not associated with physician age.

Experience
• Inexperience: analytical skills, deliberate. Most of the time this is slow and inefficient (type 2 thinking)
• Experience: pattern recognition, recalling similar cases. Most of the time this works well....leading to overconfidence.

“Ignorance more frequently begets confidence than does knowledge”. Charles Darwin, 1871
Changes in Cognitive Processing with Age

- Scores on PREP exams (Multiple choice test, encounters with 4 standardized patients, chart stimulated recall)
  Older physicians performed less well.
- Positive correlation between experience and diagnostic accuracy. There is evidence that older physicians are particularly influenced by information encountered early in a case. Older adults have a greater tendency to infuse personal experience into problem representations. (a potential explanation is that nonanalytic diagnostic strategies remain strong, but use of analytic confirmation strategies declines)

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Errors made by experts

- Expert skills develop over years
- The types of errors made by experts are different!

Just in case you don’t think this applies to you...........

- How old is the average NNP?
- If you go to pubmed and search neonate, published in 2013.....over 512, 789 articles (human neonate 889). How many have you read?

What kind of errors do NNP’s make?

- Just some observations...........
- Cognitive error or tool? Framing effect
- Factors that put us at risk
  - We change our behaviors/orders depending on which neo is on
  - Tend to take on a large cognitive load (busy!)
- Fatigue
- Age

What kind of errors are NNP’s at risk for?
**Protective factors?**
- Factors that may offer some protection
  - Experience
  - We tend to work as part of a group
  - Communication patterns

**Error Prevention**

**Diagnostic Error**
- Best estimates 4-15% of time (Berner & Graber 2008)
- Typically have multiple root causes
  - Average of 6 causes per case (Graber et al. 2005)
    - 2/3 system related factors
      - Coordination of care, abnormal result not seen
    - 2/3 cognitive elements
      - Did not gather data appropriately or synthesize appropriately
      - Knowledge deficits rare in mature clinicians (internists)

**Cognitive pills for cognitive ills**

**Croskerry**

**Solutions**
- Any solutions need to include both a system’s approach and a cognitive approach
- On suggested method is to look at Aviation and its use of Situational awareness (Singh, 2006)

**Situational awareness**
- Situational awareness (perception of situation, comprehension, prediction of consequences), decision making and ability to perform are influenced by:
  - Goals and objectives, expectations
  - Abilities, experience, training
  - System capability, stress and workload
  - Complexity, automation
Translation......Remember..........  
- Your brain is always looking for a pattern, once it finds one (real or imaginary) it tends to ignore things that don't fit that pattern  
- There is a limit to the number of things we can attend to  
  - Multi tasking myth  
  - Affected by fatigue, age, distractions...........  
- Our Brain has both hard wired and learned biases  
- Humans tend to overestimate their abilities  
  - 94% of academic doctors rate themselves as performing within the top half of their profession. Doctors have difficulty in recalling errors they make (Norman & Eva, 2010)

Strategies for Preventing Errors  
- Conscious reflective thought  
- Be aware of cognitive dispositions to respond  
- Use a checklist  
  - Complete history, comprehensive exam, systematic approach, pause and reflect, ensure follow up!  
- Feedback loops

Cognitive Debiasing Strategies  
(Crookery, 2009)  
- Develop insight and awareness  
- Consider alternatives  
- Metacognition (reflective approach)  
- Decrease reliance on memory  
- Simulation  
- Cognitive forcing strategies  
- Minimize time pressures  
- Accountability and follow-up  
- Feedback  
- Specific training: distinguishing correlation from causation, Bayesian probability

Multifaceted Approach (Graber, 2009)  
- Development of expertise  
  - Experts perform at highest level of proficiency  
- Speed expertise: Cases, practice and formative feedback (Ericsson, 2008)  

High Risk Situations for Biased Reasoning  
(Modified and referenced from Crookery, Singhel and Manzoni, 2009)  

<table>
<thead>
<tr>
<th>High Risk Situation</th>
<th>Potential Biases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was the patient handed off to me from a previous shift?</td>
<td>Diagnosis momentum, framing</td>
</tr>
<tr>
<td>Was the diagnosis suggested to me by the patient, nurse or another provider?</td>
<td>Premature closure, framing bias</td>
</tr>
<tr>
<td>Did I just accept the first diagnosis that came to mind?</td>
<td>Anchoring, availability, search satisficing, premature closure</td>
</tr>
<tr>
<td>Did I consider other organ systems besides the obvious one?</td>
<td>Anchoring, search satisficing, premature closure</td>
</tr>
<tr>
<td>Did I think this patient I don't like, or like too much, for some reason?</td>
<td>Affective bias</td>
</tr>
<tr>
<td>Have I been interrupted or distracted while evaluating this patient?</td>
<td>All biases</td>
</tr>
<tr>
<td>Am I feeling fatigued right now?</td>
<td>All biases</td>
</tr>
<tr>
<td>Am I cognitively overloaded or overwhelmed right now?</td>
<td>All biases</td>
</tr>
</tbody>
</table>

The Case  
- Called for primary csection at term, report: mom is hepatitis B positive
The Case

• Called at one hour of age, infant’s accucheck 16. The RN has fed the infant, it is 20 min later and the glucose screen is 38.
• Discovered the mother has some history that was left out.

The Case

• Admitted to NICU
• orders
• Infant ate well
• Weaning?
• Loose stools

The Case

• Called by lab.....the lytes are abnormal, should we release them?
• Called attending
  • orders?

The Case

• Day of life three: infant discharged to WBN to be with mom. Follow up gluc and Na ordered
• Sodium on DOL 4 was 130
• Infant discharged on DOL 4

Follow up

• Case report:
  • What do you know about most maternal medications?

Follow up

• An error does not become truth by reason of multiplied propagation, nor does truth become error because nobody sees it.
  Mohandas Gandhi