Cognitive biases in clinical decision-making

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Clinical decision-making

The process by which physicians:

- collect information on symptoms, signs, past history
- synthesise and interpret that information to understand the patient's medical situation or problem
- formulate and verify provisional diagnosis
- plan and implement appropriate management
- monitor and evaluate outcomes
- learn from this entire process
Burden of low value care

Overall 60% of care is effective; 30% ineffective/unnecessary; 10% harmful

Braithwaite et al BMC Med 2020
Burden of low value care

2,106 US physicians; 58% primary care, 42% specialists; 70% response rate

Median of 21% of overall medical care was unnecessary:

- 22% of prescription medications
- 25% of tests
- 11% of procedures

Lyu et al. PLoS One 2017
Poll

• In the last week, how many instances can you recall of interventions (tests, treatments, procedures) that *YOU* requested/provided that, on reflection, you thought were probably not indicated or warranted

1. None – I do no wrong!
2. One or two
3. Three or four
4. Five or six
5. Lost count!
Poll

• In the last week, how many instances can you recall of interventions (tests, treatments, procedures) that YOUR COLLEAGUES requested/provided that, on reflection, you thought were probably not indicated or warranted

  1. None – They do no wrong!
  2. One or two
  3. Three or four
  4. Five or six
  5. Lost count!
Reducing low value care

Knowledge translation approach - ‘rational decision-maker’

Colla et al Med Care Res Rev 2016

Lau et al BMJ Open 2015
Reducing low value care

Cognitive bias - the ‘irrational decision-maker’

Systematic error in thinking that occurs when people are processing and interpreting information in the world around them and affects the decisions and judgments that they make.

Decisions that are often correct and adaptive become maladaptive in certain circumstances because of cognitive bias.

Cognitive bias can predispose to the continuation of ineffective or harmful practices through ingrained beliefs, habits or rituals (Clinical inertia, group norms).
Missed, wrong or delayed diagnosis

Occurs in 8% to 15% of admissions and clinic reviews
Accounts for 60%-70% of all medical errors causing harm in clinical practice
Harmful Dx errors affect about 0.5% to 1.0% of hospital admissions or GP visits
Accounts for 10% of deaths and serious adverse events in hospital
140,000 cases of Dx error annually; 21,000 cases serious harm; 2000 - 4000 deaths
About 80% of diagnostic errors are preventable

- Missed: no Dx ever made
- Wrong: another Dx made before the correct one
- Delayed: sufficient information available for earlier Dx
- Miscommunicated: Dx was not well explained to patients or other clinicians

About 80% of diagnostic errors are preventable

Primary or contributory cause in 75%
Type 1 Intuitive or non-analytical
Efficient, usually effective, fast,
Prone to failure
Intuitive, unconscious
Errors unlikely to be corrected

Type 2 Analytical
Reliable, safe, effective, slow,
Resource intensive

Diagnostic error

Daniel et al 2017
J Teach Learn Resources
## Diagnostic errors

<table>
<thead>
<tr>
<th>Bias</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchoring/ premature closure</td>
<td>Narrow focus on a few features to support a diagnostic hypothesis, despite other features refuting this hypothesis – accepting a diagnosis before it is fully verified</td>
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<tr>
<td>Confirmation bias</td>
<td>Tendency to selectively search for information that confirms one’s initial diagnostic hypothesis</td>
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<tr>
<td>Availability bias</td>
<td>Tendency to think of diagnoses that come immediately to mind; often recent and vivid; evoked emotion</td>
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<tr>
<td>Representativeness bias (Base rate neglect)</td>
<td>Tendency to significantly overestimate likelihood of a diagnosis because the presentation has some features suggestive (representative) of that diagnosis</td>
</tr>
<tr>
<td>Framing effects</td>
<td>Disproportionately influenced by how a problem is described, by whom, the setting, what has been previously accepted as a diagnosis (diagnostic momentum)</td>
</tr>
<tr>
<td>Affective bias</td>
<td>Effects of emotional influences on thinking, including feelings towards their patients, both positive and negative</td>
</tr>
<tr>
<td>Overconfidence</td>
<td>Tendency to think one knows more than one does, especially if placing faith in opinions without gathering necessary supporting evidence</td>
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Strategies to mitigate cognitive biases

Optimise the clinical interview
Adequate history, including obtaining collateral information from relatives, other health professionals
Adequate physical examination
- Yield the diagnosis in more than 80% of cases
  - Paley et al Arch Intern Med 2011
- Failure to enact them contributes to 40% of missed diagnoses

Always consider a differential diagnosis
Among 190 cases of diagnostic error, no DDx documented in 80%
- Singh et al. JAMA Internal Medicine 2013

Knowledge deficits are infrequent (<5%) causes of diagnostic error
- Schiff et al. JAMA Intern Med 2013
  - ‘It is not that clinicians are unfamiliar with a diagnosis, they simply fail to consider it’

Failure to use Bayesian reasoning
- Rottman et al Mem Cognit 2017

Failure to over-ride initial ideas in response to new information
- Bilali et al Cognition 2008

‘Listen to the patient; he is telling you the diagnosis’

Sir William Osler 1925
Strategies to mitigate cognitive biases

Become familiar with specific scenarios commonly associated with diagnostic error

Educational interventions to increase overall knowledge do not necessarily improve diagnostic performance

Tuition focused on scenarios involving frequently missed or wrongly diagnosed conditions
- Big 4: vascular events, infections, cancer, neurological disorders
  - Diagnostic error – median rate 13.6%; range 2.2% (MI) to 62.1% (spinal abscess)
  - Serious misdiagnosis harm – median rate 5.5%; range 1.2% (MI) to 35.6% (spinal abscess)
    - Newman-Toker et al. Diagnosis 2019, 2020
Strategies to mitigate cognitive biases

Develop meta-cognitive skills

Simply seeing more cases does not improve diagnostic accuracy
- Schmidt et al. Med Educ 2015

Deliberate reflection

Cognitive forcing strategies
- Consciously slow your thinking; adopt a more analytical and less intuitive approach
- Systematically evaluate all potential alternatives and mimics before finalising a diagnosis
  - What’s for or against this diagnosis? Are there other diagnoses that may better fit?
- Improves diagnostic accuracy compared with first-impression diagnoses

‘Think out loud’ exercises
- Verbalise your reasoning as a case unfolds and compare it with others who have worked through same case
  - Pinnock et al. J Grad Med Educ 2015
  - No studies to show this improves diagnostic accuracy
Strategies to mitigate cognitive biases

Seek a second opinion

Reviewing diagnoses with peers can increase diagnostic accuracy by as much as 33% – Barnett et al JAMA Netw Open 2019

- ‘Clinical conundrums’

- But beware of ‘groupthink’ and framing effects

Seeking the opinion of patients, families and other members of the healthcare team can also help detect and prevent errors – Commonwealth of Massachusetts Board of Registration in Medicine, Quality and Safety Division. Advisory: Diagnostic process in inpatient and emergency department settings. March 2016.
Establish feedback loops

Self-assessment of diagnostic accuracy very unreliable
Level of diagnostic confidence can be insensitive to both accuracy and case difficulty
- Meyer et al. JAMA Intern Med 2013

Follow-up patients over time
- <5% of hand-off cases (evening/night regs to day teams) are followed up by admitting regs
- Shenvi et al Diagnosis 2018

Ask patients and colleagues to report errors

Implement protocols for identifying errors
- Trigger tools applied to EHRs in identifying unexpected adverse events or unplanned readmissions
- Systematic identification of past errors within mortality and morbidity meetings

Undertake cognitive autopsies which reflect on identified errors

LOOP study

- Handover from night medical regs to day regs in US medical centre
- Structured feedback form within EMR secure messaging system
- Analysis of 544 forms
- 43.7% change in primary diagnoses
  - 29% major changes (12.7% of cases)
- Improvements in:
  - comfort with sharing feedback
  - self-efficacy in identifying and mitigating cognitive biases
  - educational value

Payne et al J Hosp Med 2019
Strategies to mitigate cognitive biases

Beware high risk environments

- Rushed clinical handovers
- Heavy caseloads
- Distractions and interruptions
- Caring for critically ill or complex multi-morbid patients
- Interactions with unco-operative or non-communicative patients
- Fatigue or personal stressors

Exercise greater vigilance of your reasoning before committing to a diagnosis
Use diagnostic checklists

• General checklists that prompt clinicians to optimize their cognitive approach

• Differential diagnosis checklist prompting clinicians to consider the correct diagnosis as a possibility
  • Syndromic schema
    • 5 types of shock
    • 3 types of renal failure
    • 3 types of anaemia
  

• Computer-assisted diagnosis and machine learning

Outcomes

• The worst case scenario is ruled out
• Atypical or rare presentations are identified
• There is a high suspicion for repeat presentations
• Diagnosis is re-evaluated when things aren’t quite right
• The patient and carers’ concerns are heard and acknowledged
• Locally identified high-risk patient groups are recognised
• There is an environment that enables discussion around diagnosis
• There is appropriate referral and escalation for diagnostic dilemmas
• There is effective communication when transferring care
Of the strategies we have discussed to minimize cognitive bias in diagnosis, which one do you feel is, or likely to be, the **MOST EFFECTIVE**?

1. Always considering a differential diagnosis
2. Being familiar with common misdiagnoses
3. Developing meta-cognitive skills
4. Seeking a second opinion
5. Establishing feedback loops
6. Situational awareness
7. Using diagnostic checklists
Overuse (inappropriate care)
Between 10% and 60% of tests and treatments are inappropriate
Too much ‘routine’ or ‘monitoring’ or duplicate investigations
Protocol-driven test requests
- Braithwaite et al BMJ 2018; Scott Intern Med J 2019

More care does not necessarily translate into better patient outcomes

Underuse (appropriate care not given)
About 40% of clinical encounters
- Runciman et al Med J Aust 2012; Braithwaite et al JAMA 2018; Borsky et al Health Aff 2018

Misuse (poor execution of appropriate care)
Less than full benefit from an intervention (underdosing of an antibiotic in septicaemia), or overt harm (eg administration of drug patient allergic to)
Management error

“Overdiagnosis”

Overdetection  Overdefinition

Over-testing  Over-interpretation  Over-treatment

More testing  Screening tests
Greater sensitivity

Broad disease definitions  Broad thresholds
Mild silent disease, pre-disease, genetic or proteomic risk factors

Courtesy
Paul Glasziou
Management error

- Application of an unwarranted diagnostic label that leads to needless or inappropriate intervention (emphasis on drugs)
- Due to more sensitive tests and widened disease definitions

<table>
<thead>
<tr>
<th>Disease</th>
<th>Percentage</th>
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<tr>
<td>Asthma</td>
<td>30%</td>
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<tr>
<td>Mild hypertension</td>
<td>60%</td>
</tr>
<tr>
<td>Lung cancer</td>
<td>25%</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>2%</td>
</tr>
<tr>
<td>Gestational diabetes</td>
<td>20%</td>
</tr>
<tr>
<td>Breast cancer</td>
<td>4%</td>
</tr>
<tr>
<td>PTE</td>
<td>2%</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>50%*</td>
</tr>
</tbody>
</table>

Moynihan et al BMJ 2012
*Coll et al J Am Board Fam Pract 2000

Low testosterone
ADHD
Irritable bowel syndrome
Sinusitis

Doust et al JAMA Intern Med 2017
### Management error

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<td><strong>Commission bias</strong></td>
<td>Tendency to do something (or seen to be doing something) even if intended actions are not supported by robust evidence and may in fact do harm</td>
</tr>
<tr>
<td>‘Omission regret’</td>
<td></td>
</tr>
<tr>
<td><strong>Impact bias</strong></td>
<td>Tendency to over-estimate benefits and under-estimate harms of interventions</td>
</tr>
<tr>
<td><strong>Extrapolation bias</strong></td>
<td>Tendency to extrapolate intervention benefit seen in a circumscribed sample of patients to similar effects among a wider spectrum of patients who share similar disease traits</td>
</tr>
<tr>
<td>‘Indication creep’</td>
<td></td>
</tr>
<tr>
<td><strong>Pro-innovation bias</strong></td>
<td>Tendency to view newer (and more costly) tests and treatments as necessarily better in improving patient outcomes than existing ones.</td>
</tr>
<tr>
<td>‘Novelty bias’</td>
<td></td>
</tr>
<tr>
<td><strong>Contextual error</strong></td>
<td>Tendency to ignore or fail to elicit patient attributes or concerns that may complicate management and lessen chances of favourable outcomes</td>
</tr>
<tr>
<td><strong>Framing effect</strong></td>
<td>Tendency for benefits and risks to be perceived differently if expressed in relative versus absolute terms, or death versus survival</td>
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Scott BMJ 2008; Scott et al Med J Aust 2017
Strategies to mitigate cognitive bias

- How confident are you in the diagnosis?
- Do the guidelines and protocols apply to this patient? – individualise the care
- What are the possible worst case outcomes if you do, or not do, a particular action?
- Weigh up the likely benefits and harms of this action in this patient
  - and how important are they from the patient’s perspective?
- Is there evidence that this action has been evaluated in patients like yours?
- Are you treating yourself or the patient? Are you engaging in wishful thinking?
- Are you feeling pushed into doing, or not doing, something on the basis of emotions, peer pressure, external constraints?
- Can you reframe what appears to be doing nothing into doing something?
  - Symptom management
  - Clinical observation


Education about natural course of the condition
Managing expectations (in context of patient values and concerns)
Strategies to mitigate cognitive bias

- Narratives of patient harm (‘teachable moments’)
- Outcome analyses (follow-up)
- Benchmarking against better performing peers (HRT)
- Second opinion (‘clinical conundrums’)
- Unlearning low value practices and substituting alternative forms of high value care
  - New research renders 7% of ‘best practice’ obsolete each year
- Shared decision-making
  - Value of care considerations in clinical assessments
  - Advance care planning
  - Deprescribing
- Questioning status quo (normalisation of deviance)
- Nudge strategies and default options

Croskerry et al BMJ Qual Saf 2013
Scott et al Med J Aust 2017
Stammen et al JAMA 2015
Korenstein & Smith JAMA Intern Med 2014
Scott et al Aust Health Rev 2021
Key messages

• Diagnostic and management errors are common
• Need to confront the 60-30-10 challenge
• Cognitive biases are a major driver of low value care
• Sole focus on knowledge enhancement and translation won’t be sufficient
• Deploy practical strategies to debias and recalibrate our decision-making
• Every diagnosis and management decision should have an outcome feedback loop
• Openness to the opinions of others and willingness to be corrected (and learn)
• Errors are not personal failings and should not invoke reprimands or sanctions
  • unless clearly reckless or negligent
Future directions

**Behavioural approach**
- Patient demographic, personal and clinical data
- Past clinical decisions and outcomes
- Genomics data
- Patient preferences
- Cost information

**AI/ML approach**
1. Exploit digital knowledge base
2. Conduct artificial intelligence analyses
3. Provide clinical decision support

- Data harmonisation and pre-processing
- Computer-aided diagnosis and treatment selection
- Synthesise results for recommendation

**LHS approach**

- Satterfield et al. Learning Health Syst 2020
Useful resources

Statewide General Medicine Clinical Network
Reducing Low Benefit Care


National Safety and Quality Health Service Standards
User Guide for the Review of Clinical Variation in Health Care
August 2020
Useful resources

Websites providing podcasts, videos, powerpoint presentations, patient toolkits
- Society to Improve Diagnosis in Medicine: https://improvediagnosis.org
- Diagnostic Excellence: http://www.med-u.org
- IMreasoning: https://imreasoning.com
- Differential diagnosis checklists: www.youtube.com/watch?v=uHpleuyP1w0
- Society to Improve Diagnosis in Medicine: https://improvediagnosis.org
- Dx: Diagnostic Excellence: http://www.med-u.org

Seminal texts and articles

Series of diagnostic reasoning exercises
- Exercises in Clinical Reasoning – in JGIM: https://www.sgim.org/web-only/clinical-reasoning-exercises
As part of a global movement, Evolve is a flagship initiative led by physicians, specialties and the Royal Australasian College of Physicians (RACP) to drive high-value, high-quality care in Australia and New Zealand. Evolve aims to reduce low-value care by supporting physicians to:

- be leaders in changing clinical behaviour for better patient care
- make better decisions, and
- make better use of resources.

Find out more:
www.evolve.edu.au

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