Cognitive bias and accurate diagnosis
What are our stumbling blocks?

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Conflicts of interests

- Developer of TREAT, a decision support system for antibiotic treatment
- Hate antibiotic abuse
Cognitive bias: what is it?

- The human brain’s habit of finding what it wants to find

  Nature 526, 163, 8 October 2015

- Systematic pattern of deviation from norm or rationality in judgment, whereby inferences about other people and situations may be drawn in an illogical fashion

Wikipedia
Bandwagon effect, groupthink, herd behavior

The tendency to do (or believe) things because many other people do (or believe) the same
Anthropomorphism

The tendency to characterize animals, objects and abstract concepts as possessing human-like traits, emotions, and intentions.
Stereotyping

Expecting a member of a group to have certain characteristics without having actual information about that individual
Post-purchase rationalization

The tendency to persuade oneself through rational argument that a purchase was good value
IKEA effect

The tendency for people to place a disproportionately high value on objects that they partially assembled, regardless of the quality of the end result.
Google effect

The tendency to forget information that can be found readily online by using Internet search engines
Judgment under Uncertainty: Heuristics and Biases

- People rely on a limited number of heuristic principles which reduce the complex tasks of assessing probabilities.
- Heuristics are quite useful, but sometimes they lead to severe and systematic errors.

Amos Tversky and Daniel Kahneman. Science 1974
Example

- What is the incidence of UTI relative to pneumonia among patients admitted in an acute-care hospital?
- Is it above or below 5 times more common than pneumonia?
Example

• What is the incidence of UTI relative to pneumonia among patients admitted in an acute-care hospital?
• Is it above or below 1.5 times more common than pneumonia?
Cognitive bias and diagnosis

Effect on antibiotic prescription
Confirmation bias

- History taking will direct the patient towards our pre-presumed diagnosis
- The physical examination will confirm our beliefs regarding the patient’s diagnosis
- Finding contradicting it will tend to be ignored
Patient A

- Admitted to your department with chest pain, dyspnea, de-saturation
- Ceftriaxone started in the emergency room for suspected pneumonia

Patient B

- Admitted to your department with chest pain, dyspnea, de-saturation
- No treatment started in the emergency room - for evaluation
Momentum

- 24-years old woman
- Returned from travel to Thailand two weeks ago
- Non-resolving pneumonia for four weeks
- Melioidosis? Other endemic infection
Neglect of probability

- Antibiotic treatment is an art of probabilities
  - Probability of pathogens
  - Probability of resistance to antibiotics
- We totally ignore probabilities in clinical decision making
- We use guidelines, local practice
Identifiable victim effect

• We give a higher priority to the patient in front of us than to future unidentified patients.
• The impact to the individual currently treated might be much smaller than the impact on society.
• We are more concerned with the patient’s immediate outcome than with his/ her future.
Availability heuristic

• Our last failure influences the following patients
• My first attempt to introduce short antibiotic treatment for febrile neutropenia to the hematology ward failed when one of the first patients developed severe sepsis following antibiotic discontinuation
Bizarreness effect

Number of different antibiotic regimens

- Decision support system
- Physicians

Appropriate empirical antibiotic treatment

- Decision support system
- Physicians
Reactance

- Resistance to antibiotic stewardship programs
  - Antibiotic drug approvals
  - Active consultations
- Why are there no computerized decision support systems in medicine?
Self-serving bias

• What percentage of patients with bacteremia in your hospital receive inappropriate empirical antibiotic treatment?
Benchmarking appropriate empirical antibiotic treatment

Kariv et al. Clin Microbiol Infect 2013
Outcome bias

- A patient admitted for fever and cough during the winter season
- Given ceftriaxone
- Fever resolves and patient better
- Discharge diagnosis?
Experimenter's or expectation bias

- Frank bias in clinical trials
- Less obvious manipulation of multivariate analysis
- Discussion and conclusions unrelated to the study results
Confronting cognitive bias

To improve antibiotic stewardship
Behavior modification

- Antibiotic stewardship programs
- “Debiasing” strategies
- Awareness
- Critical thinking
TREAT decision support system

- Neglect of probability
- Confirmation, momentum, availability heuristic, anchoring
- Bizarreness effect
- Identifiable victim

- Causal probabilistic network
- Stupid, no feeling, doesn’t read referral notes
- Boring
- Explicit consideration of the future in a cost-benefit model
TREAT clinical installation

Coverage all pathogens

Before study 2015 H1 Prescribed 2015 H1 Treat 2015 H2 Prescribed 2015 H2 Treat

Coverage bacteremias

Before study 2015 H1 Prescribed 2015 H1 Treat 2015 H2 Prescribed 2015 H2 Treat

Installed at Rabin Medical Center, Beilinson Hospital 2014-2015
Let's debias!
Thank you