



# 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

# 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

# Anchoring and search satisficing

## 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*
- *Meilloidosis? 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

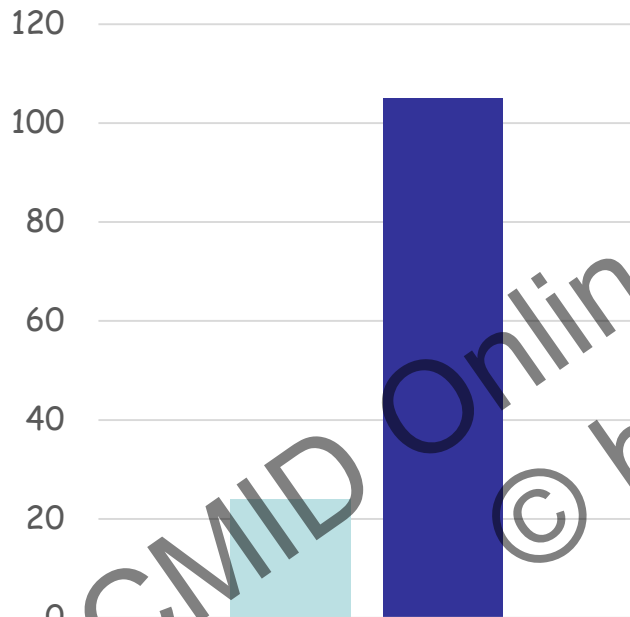
# Identifiable victim effect

- 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

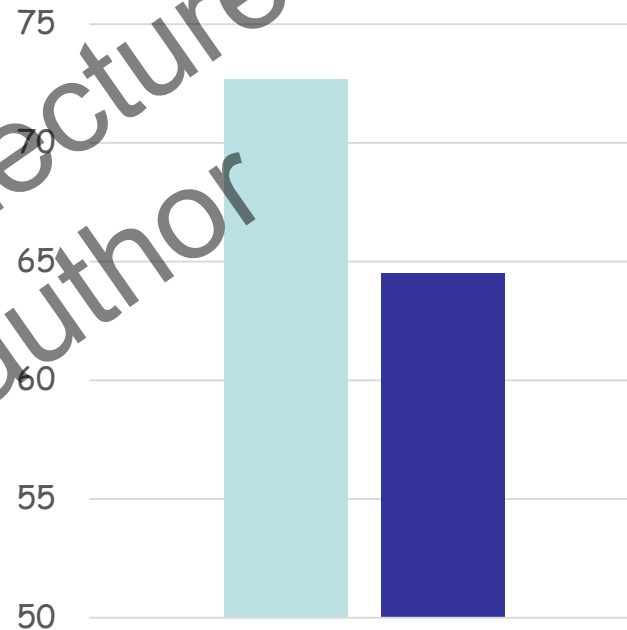
- Our last failure influences the following patients
- My first attempt to introduce short antibiotic treatment for febrile neutropenia to the hematology ward failed when one of the first patients developed severe sepsis following antibiotic discontinuation

# Bizarreness effect



Number of different antibiotic regimens

Decision support system  
Physicians



Appropriate empirical antibiotic treatment

Decision support system  
Physicians

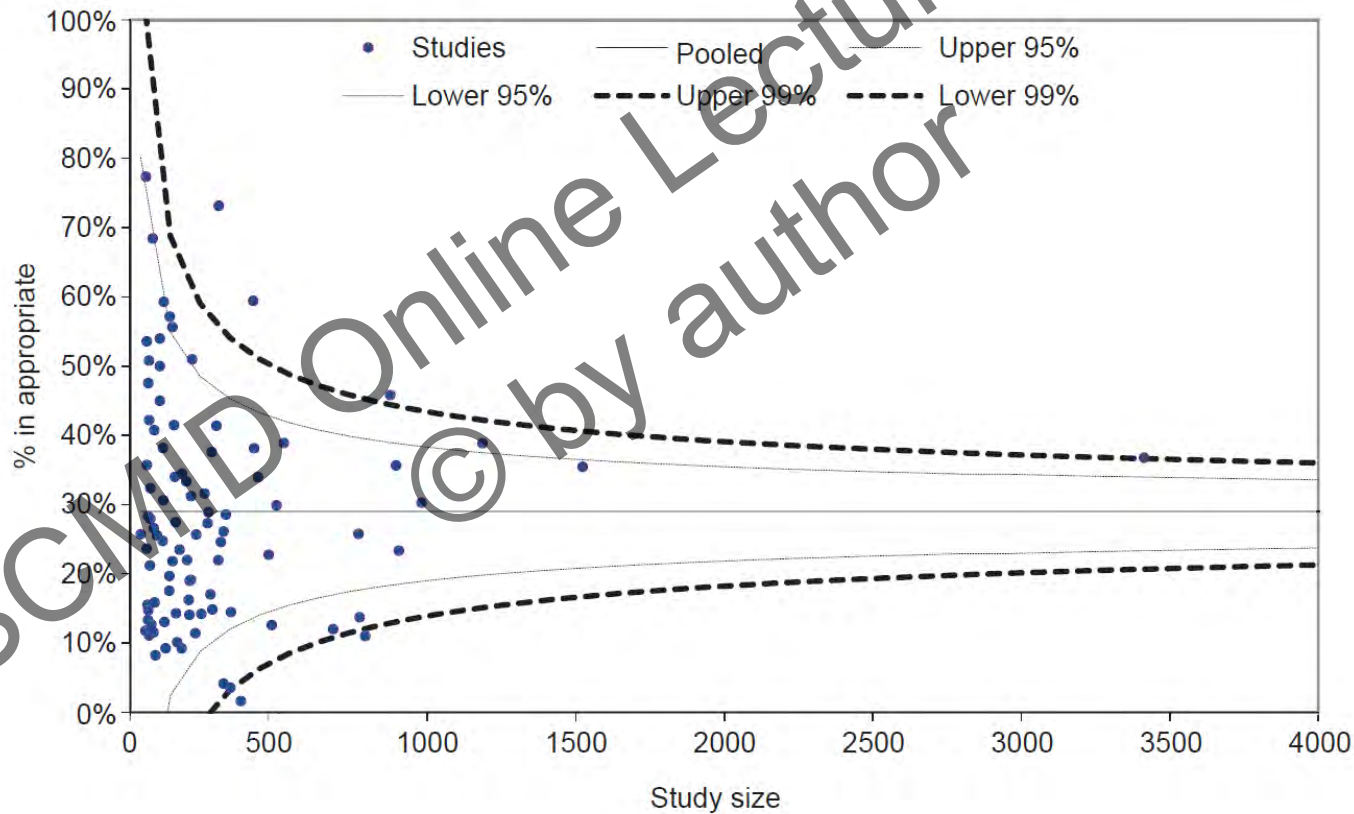
# Reactance

- 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

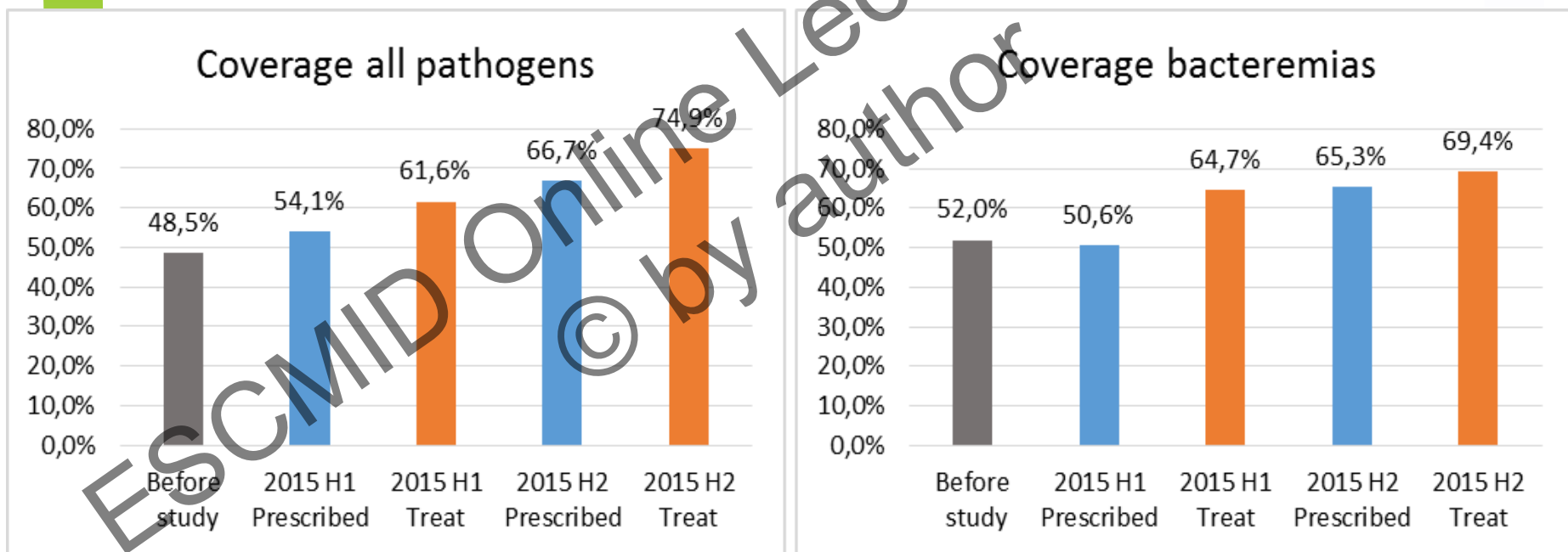
- Antibiotic stewardship programs
- "Debiasing" strategies
- Awareness
- Critical thinking



# 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



Installed at Rabin Medical Center, Beilinson Hospital 2014-2015

**Let's debias!**





Thank you

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