From EBM to Medical Decision Making: Taking the Next Step

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Diagnostic tests: The decision making viewpoint

- Assume there's the possibility that a patient has a disease, and we have a treatment that is:
  - Effective (if they are sick), but
  - Dangerous (undesirable if they're healthy)
- Using decision analysis of the possible outcomes (treat sick, treat healthy, ignore sick, ignore healthy), we can determine the probability of disease above which the treatment is a good idea

A Contrived Example

- A four year old child presents to the hospital with a high fever and a stiff neck.
- The lab technicians are on strike and have taken all the microscopes with them.
- What will you do?

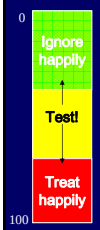
Diagnostic tests, continued

- When the probability is neither high enough to comfortably treat nor low enough to comfortably forgo treatment…
- The goal of a diagnostic test is to move the probability/belief higher or lower, ideally enough to cross a threshold
- Implications:
  - A better test is one that leads to greater belief revision
  - If management will be the same no matter the test result, don't bother with the test

Test characteristics (EBM refresher)

- Independent of disease prevalence:
  - Sensitivity: *Given a group of sick patients*, what proportion does the test pick up?
  - Specificity: *Given a group of well patients*, what proportion does the test agree?
  - Positive likelihood ratio: *Given a positive test*, probability that patient is sick / probability that patient is well
  - Negative likelihood ratio: *Given a negative test*, probability that patient is sick / probability that patient is well
- Confounded with prevalence:
  - Positive predictive value: *Given a positive test*, what is the probability the patient is sick?
  - Negative predictive value: *Given a negative test*, what is the probability the patient is well?

Diagnostic tests, completed



- So if you know what test you have available, and how strong it is, you now have two thresholds:
  - No treat vs. test
  - Test vs. treat
- And, ideally, your zone of discomfort is much smaller!

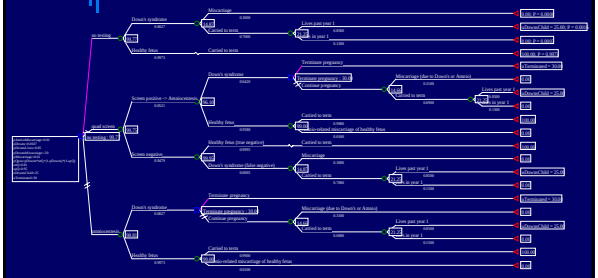
Case: Pat and Sam

Your group's job, in writing, is:

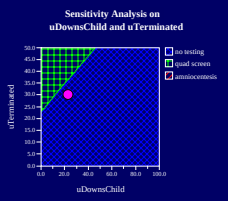
- To decide what information you require
- To provide a suggestion to Pat and Sam, along with the basis for your suggestion

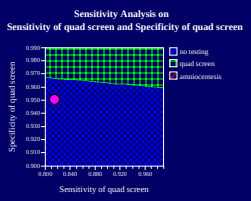
To get additional information that you think may be relevant to this decision, a member of your group should approach Dr. Schwartz privately and request the specific information you would like.

A decision tree



Sensitivity analyses





Making probability judgments

- Differential diagnosis involves making a set of probability judgments
  - Initial probabilities of different explanations
  - Revised probabilities after learning test results
- Although there are formal methods for both initial and revised judgments, they are often made informally, based on experience and the features of the case at hand.
- Usually, this works well. However…

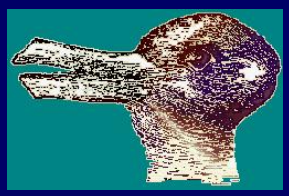
Heuristic: Availability

- Which is a more likely cause of death in the United States:
  - Being killed by falling airplane parts
  - Being killed by shark attack

Availability

- Answer: The chances of dying from falling airplane parts are 30 times greater ("Death Odds" (1990, Sept 24). Newsweek page 10)
- Heuristic: The easier something comes to mind, the most likely it is
- Adaptive: "When you hear hoof beats, don't think of zebras."
- Non-adaptive: probability is overestimated because of recent, salient events
  - Grand rounds
  - Recent personal experience
  - The missed case (and other fears)

Heuristic: Representativeness



What am I?

Heuristic: Representativeness

- Judge probability by how closely it fits the pattern we expect
  ("If it walks like a duck and quacks like a duck, it must be a duck.")
- Adaptive: Fast way to classify
- Non-adaptive: Uncommon presentations of common diseases are more likely than classical presentations of rare diseases

Gambler's Fallacy

Dawson and Arkes, JGIM 1987;2:183-187

- "We average five cases of myocardial infarction per weekend. It is Sunday night and so far we've only seen one.
- The next patient with chest pain is likely to have an MI. We're due!"

Heuristic: Anchoring and Adjustment

Step 1
A. Did Mahatma Gandhi die before or after the age of 140 years?
B. Did Mahatma Gandhi die before or after the age of 9?

Step 2
How old was Gandhi when he died?
Group A estimates 67 years
Group B estimates 50 years

Heuristic: Anchoring and Adjustment

- After setting the anchor you adjust by taking into account other factors
- Adaptive: Easy to use cognitive short cut
- Non-adaptive: Adjustment is often inadequate, anchors are often inappropriate

Closing Thoughts

- Medicine involves uncertainty
  - We don't know what's wrong with the patient
  - We don't know how well a treatment will work
  - We don't know how the patient will experience their future health
- Uncertainty is scary, but we have tools to help manage it
- People are good at some kinds of decisions, but often need help thinking through complex problems in ways that will further their goals
- Physicians can help their patients elaborate their values, understand the clinical uncertainties, and arrive at good decisions
- Copy of lecture notes available at: http://araw.mede.uic.edu/~alansz/courses/ecpp