Lecture 38
Case Study: Health

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Announcements
Decisions: Review
"We asked 20 house officers, 20 fourth-year medical students and 20 attending physicians, selected in 67 consecutive hallway encounters at four Harvard Medical School teaching hospitals, the following question:

"If a test to detect a disease whose prevalence is 1/1000 has a false positive rate of 5%, what is the chance that a person found to have a positive result actually has the disease, assuming that you know nothing about the person's symptoms or signs?"
Example: Doctors & Clinical Tests

Problem did not give the true positive rate.

That’s the chance the test says “positive” if the person has the disease.

It was assumed to be 100%.
Data and Calculation

\[
P(\text{Disease given Test +}) = \frac{0.001 \times 1}{0.001 \times 1 + (0.999 \times 0.05)} = 0.0196270…
\]
Decisions
Subjective Probabilities

A probability of an outcome is…
- The frequency with which it will occur in repeated trials, or
- The subjective degree of belief that it will (or has) occurred

Why use subjective priors?
- In order to quantify a belief that is relevant to a decision
- When the subject of your prediction was not selected randomly from the population
A Subjective Opinion

prior probability that the person has the disease

(Demo)
A Different Subjective Opinion

prior probability that the person has the disease

(Demo)
Introduction
Malcolm Gladwell

- Author (Blink, The Tipping Point) & journalist (New Yorker)
- "Revisionist History will go back and reinterpret something from the past: an event, a person, an idea. Something overlooked. Something misunderstood."
- You should listen to the whole episode: Season 2, Episode 10

http://revisionisthistory.com/episodes/20-the-basement-tapes
The Diet-Heart Hypothesis
Atherosclerosis narrows arteries due to plaque buildup.

#1 cause of death and disability in the developed world.

Cardiovascular disease (CVD) is the leading global cause of death: 17.3 million deaths per year.

The causes are not known, but there are associations with high blood pressure, diabetes, smoking, obesity, family history, age, inactivity, and an unhealthy diet.

https://www.nhlbi.nih.gov/health/health-topics/topics/atherosclerosis/atrisk
Diet & Cardiovascular Disease

- 1.7M deaths worldwide are attributed to low fruit and vegetable consumption by the WHO (2011).
- High intake of salt is linked to high blood pressure.
- High intake of processed foods is linked to obesity.
- Eliminating trans fats is widely recommended.
- Added sugar is linked to high blood pressure & obesity.
- High intake of alcohol is associated with CVD risk.

The Diet-Heart Hypothesis

Hypothesis:
- Replacing saturated fat (e.g. dairy) with polyunsaturated fat (e.g. plant-based oil) reduces risk of heart disease.

Justification:
- This replacement reduces serum cholesterol.
- Serum cholesterol is associated with heart disease.
- "Clinical trials that used polyunsaturated fat to replace saturated fat reduced the incidence of CVD." (AHA, 2017)

http://circ.ahajournals.org/content/early/2017/06/15/CIR.00000000000000510
Hypothesis Testing
Designing an Experiment

Hypothesis:

● Replacing saturated fat (e.g. dairy) with polyunsaturated fat (e.g. plant-based oil) reduces risk of heart disease.

What evidence would support this hypothesis?
Minnesota Coronary Experiment
(1968-1973)
Study Design

- Double blind randomized controlled experiment
- Subjects were patients in institutions, so diet was under the control of the researchers
- Control group had standard diet of the time, including saturated fats
- Treatment group got less saturated fats; more unsaturated fats such as vegetable oil
- Over 9,000 patients
- About three to five years
The Researchers

- Christopher Ramsden, NIH, 2011
- Robert Frantz, professor and physician, Mayo Clinic
- Ivan Frantz, principal scientist (died 2009)
- Ancel Keys: “author of the Seven Countries Study, Time cover subject, and the most prominent advocate of replacing saturated fat with vegetable fat.”
Rediscovering the Data

Records Found in Dusty Basement Undermine Decades of Dietary Advice

Raw data from a 40-year-old study raises new questions about fats

By Sharon Begley, STAT on April 19, 2017

Number of Deaths by Age and Randomization Group

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<th>Age</th>
<th>Diet</th>
<th>Control</th>
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<td>Died</td>
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</table>

(Demo)

Conclusion

- Malcolm Gladwell and Robert Frantz
- Revisionist History: The Basement Tapes
- 00:24:30 to 00:27:47