DATA 8

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Lecture 38

Case Study: Health

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Announcements

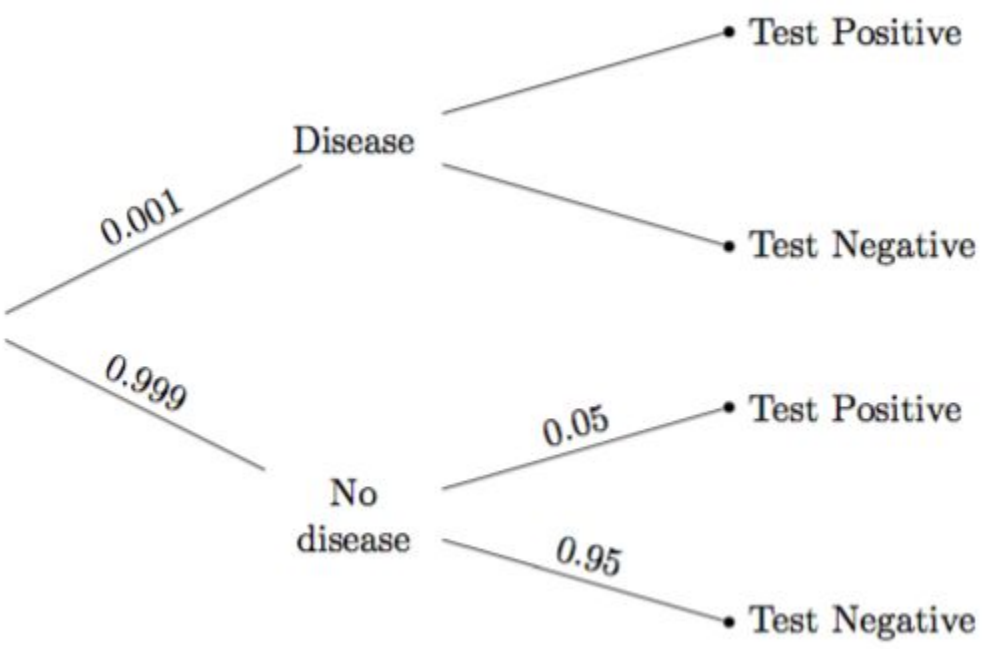
Decisions: Review

Decisions Under Uncertainty

Interpretation by Physicians of Clinical Laboratory Results (1978)

> "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

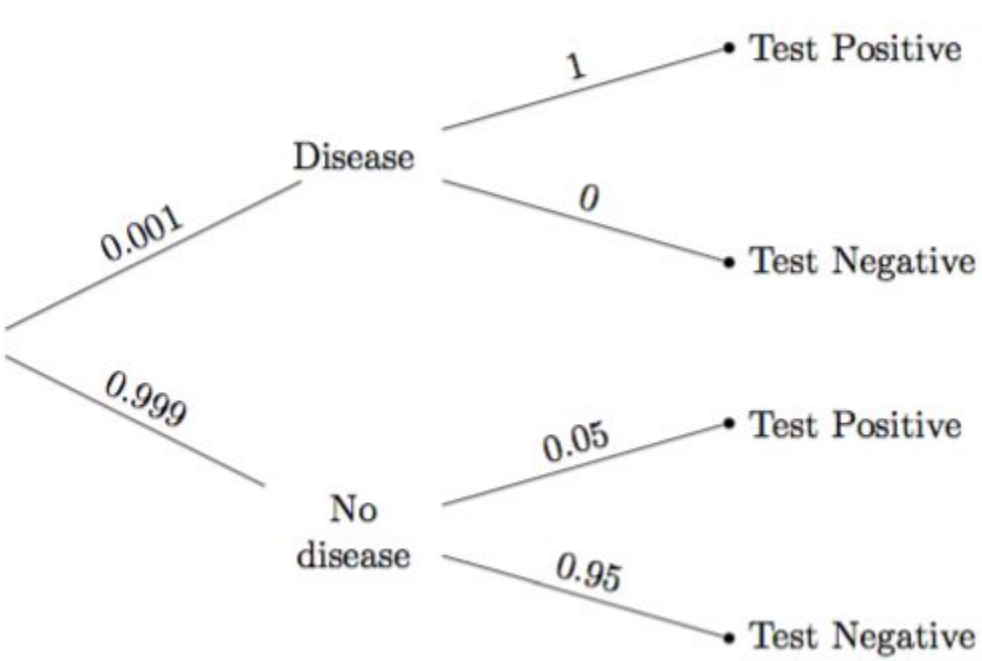


Problem did not give the *true positive* rate.

That's the chance the test says "positive" if the person has the disease.

It was assumed to be 100%.

Data and Calculation



P(Disease given Test +)

=

$$\frac{0.001 * 1}{(0.001 * 1) + (0.999 * 0.05)}$$

= 0.0196270…

Decisions

Subjective Probabilities

A probability of an outcome is…

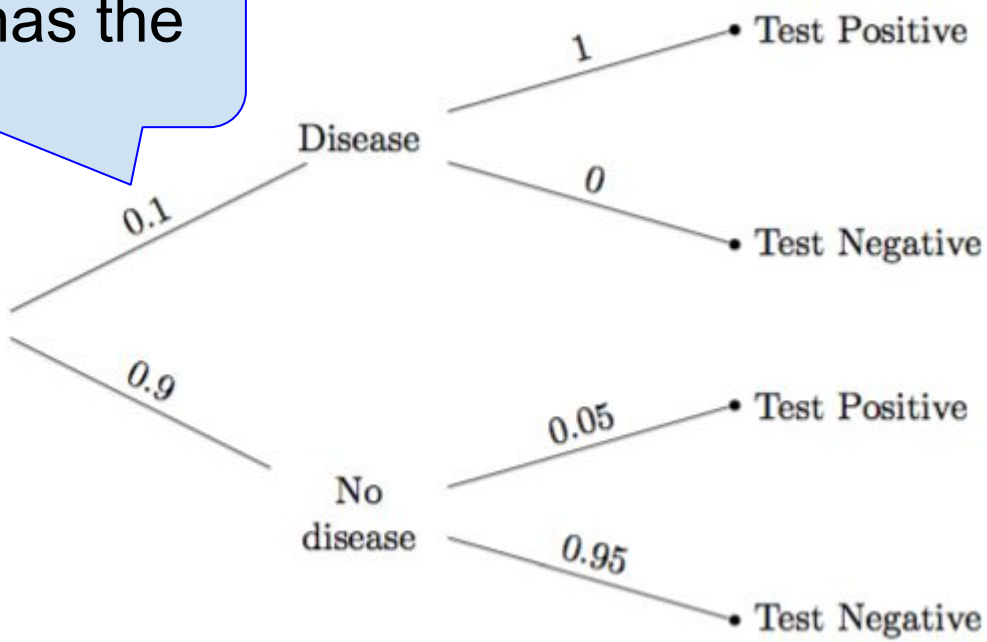
- The frequency with which it will occur in repeated trials, *or*
- The subjective degree of belief that it will (or has) occurred

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

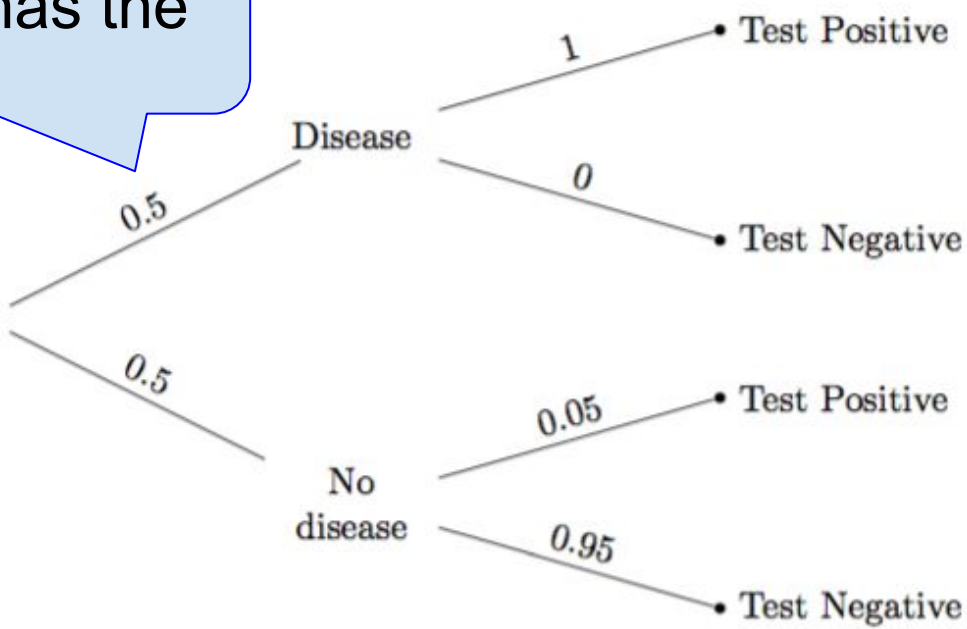
prior probability that the person has the disease



(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

Cardiovascular Disease

- *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.

http://www.who.int/cardiovascular_diseases/publications/atlas_cvd/en/

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.0000000000000510

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
- Steven K. Broste, biostatistician: Master's thesis, 1981
- 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

https://www.scientificamerican.com/article/records-found-in-dusty-basement-undermine-decades-of-dietary-advice/

Broste Thesis Figure 6

Number of Deaths by Age and Randomization Group

	Diet			Control		
Age	Randomized	Died	%	Randomized	Died	%
LT 35	1367	3	0.2	1337	7	0.5
35-44	728	3	0.4	731	4	0.5
45-54	767	14	1.8	816	16	2.0
55-64	870	35	4.0	896	33	3.7
GE 65	953	190	19.9	958	162	16.9
TOTAL	4685	245	5.2	4738	222	4.7

(Demo)

http://www.psych.uic.edu/download/Broste_thesis_1981.pdf

Conclusion

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

- http://revisionisthistory.com/episodes/20-the-basement-tapes