

Lecture 10: Chapter 3

Section 3E: Deceptive Numbers

September 21, 2005

Better in Each Case, Worse Overall

- Believe it or not numbers can be deceptive.

Consider the following:

Example 1. Researchers wish to know if a new cancer treatment is better than an old one. They separated patients into two class: mild cancer (1) and severe cancer (2) and compiled the following results:

	Cured (1)	Not Cured (1)	Cured (2)	Not Cured (2)
Old Treatment	2	8	40	40
New Treatment	30	60	12	8

Which treatment is better?

Misrepresentation

- The above example is a case of **Simpson's paradox** since in both cases, the New Treatment appears better, but overall it is worse.
- This occurs because the test groups were of different size.

Example 2. John and Sam enjoy ultimate frisbee. They play two games and accumulate the below stats. Who had the highest percentage of catching the Frisbee given the below table? Is the answer reflexive of the table alone?

	Passes (1)	Catches (1)	Passes (2)	Catches (2)
John	4	10	3	4
Sam	1	4	7	10

Solution:

Example 3. A survey concluded the following results.

- Among adults who drank alcohol, 35% died during the 20 years since the beginning of the survey.
- Among adults who did not drink alcohol, 61% died during the 20 years since the beginning of the survey.

Can we conclude drinking alcohol makes you live longer?

Positive Test Results

Example 4. Consider a study in which mammograms were given to 10,000 women with breast tumors. Assume 1% are malignant.

- The mammogram correctly identifies 85% of 100 malignant tumors. We call these cases **true positives**.
- In the other 15 cases, the result is negative, even though the women have malignant tumors. We call these cases **false negatives**.
- The mammogram correctly identifies 85% of 9900 benign tumors. We call these cases **true negatives**.
- In the other 15% (1485) of cases, the result is positive, even though the women have benign tumors. We call these cases **false positives**.

(i) If a woman's mammogram comes back positive, what is the probability of her having cancer?

(ii) If a woman's mammogram comes back negative, what is the probability of her having cancer?

Solution: