Mathematics and Biostatistics

Sensitivity and Specificity

1st Semester 2022

Lecture 6

Review

- Probability
  1. Probability can be defined as a measure of how likely an event was to occur.
  2. Values between 0 and 1 indicated occurrence somewhere in between the extremes.
  3. P(A), read as the probability of A.
  4. P(A) + P(Not A) = 1.
- Types of Events
  1. mutually exclusive $\longrightarrow$ P(A and B) = 0.
  2. joint event $\longrightarrow$ P(A and B) = P(A) x P(B).
  3. Conditional events $\longrightarrow$ $P(B|A) = P(A \text{ and } B)/P(A)$
  4. Independent $\longrightarrow$ P(A and B) = P(A)xP(B)

Disease▶ Test ▼	Yes	NO
Yes	TP	FP
No	TN	FN

Sensitivity and Specificity

- Sensitivity and specificity are mathematical terms that refer to the precision with which a test can indicate the presence or absence of a disease.
- Individuals who have the condition are referred to as 'positive', while those who do not have it are referred to as 'negative'.

Disease ▶ Test ▼	Yes	NO
Yes	TP	FP
No	TN	FN

Sensitivity and Specificity

- SENSITIVITY (True Positive Rate) measures the proportion of positives that are correctly identified
- is the probability of a test to indicate the presence of the disease when the person is truly diseased.
- a correct behavior for a diagnostic test, and a conditional probability.
- True Positive Rate = TP/P

Disease ▶ Test ▼	Yes	NO
Yes	TP	FP
No	TN	FN

Sensitivity and Specificity

- SPECIFICITY (True Negative Rate) measures the proportion of negatives that are correctly identified

- is the probability of the test to be negative when the person does not have the disease.

- Again, this is a correct behavior for the test.

- True Negative Rate = TN/N

Disease ▶ Test ▼	Yes	NO
Yes	TP	FP
No	FN	TN

Sensitivity and Specificity

- There are two errors that can occur:
- A false positive-- The probability that the test is positive when in fact the person is truly negative for the disease. (FP)
- A false negative– The probability that the test is negative when in fact the person does in fact have the disease. (FN)

Disease ▶ Test ▼	Yes	NO
Yes	TP	FP
No	FN	TN

Sensitivity and Specificity

- Sensitivity = TP/(TP+FN) x 100%
- Specificity = TN/(FP+TN) x 100%
- **SENSITIVITY** =(10/13) x 100% = 77%, The test correctly found 77% of the diseased individuals.

- **SPECIFICITY** = (47/87) x 100% = 54%, the test correctly identified 54% of those without disease.

Disease ▶ Exposure ▼	Yes	NO	Total
Yes	10	40	50
No	3	47	50
Total	13	87	100

The end of lecture