

Epidemiology Statistics

How good is your test?

Is your test 'better' sometimes more than other times? If so, why?

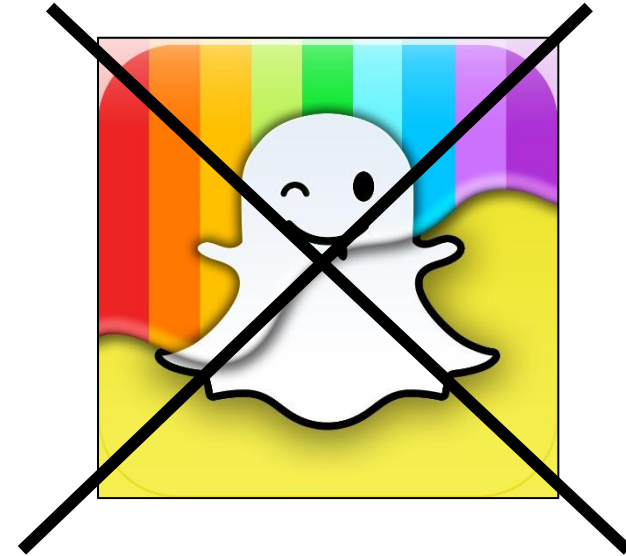
Epidemiology Statistics: Sensitivity

- **Sensitivity** = **True Positive Rate** = the % of positive cases that correctly test positive. What is the probability that my test can correctly identify someone as having X?
 - Test = You're a high school student TODAY
 - X = You're on Snapchat
 - What is the probability that I know that you're on Snapchat ("positive case") if I know that you're a high school student NOW ("test positive")?



Epidemiology Statistics: Specificity

- **Specificity** = **True Negative Rate** = the % of negative cases that correctly test negative. What is the probability that my test can correctly identify someone as not X (disease-free)?
 - Test = You were a high school student 20 years ago, not today
 - X = You're **NOT** on Snapchat
 - What is the probability that I know that you're **NOT** on Snapchat ("negative case") if I know that you went to high school 20 years ago, not today ("test negative")?



No Test is Perfect...

- With any diagnostic test, there are TRUE positive results and FALSE positive results.
- With any diagnostic test, there are also TRUE negative results and FALSE negative results.
- The questions are:
 - How many of each?
 - And how bad is it to be wrong?

Why Are False Positives Bad?

- What is the probability that I know that you're on Snapchat ("positive case") if I know that you're a high school student NOW ("test positive")?
- My test is wrong. You're a high school student and you're not on Snapchat – so what?
- But what if you tested **positive** for HIV but you **are NOT infected**?

Why Are False Positives Bad?

- When testing patients being for HIV, the tests are often run twice. Why do you think that is?
- What would happen if the patient had a **false positive** test?



Why Are False Negatives Bad?

- What is the probability that I know that you're not on Snapchat ("negative case") if I know that you were a high school student 20 years ago ("test negative")?
- My test is wrong. You were a high school student 20 years ago and you ARE on Snapchat – so what?
- But what if you tested **negative** for HIV but you **are infected**?

Why Are False Negatives Bad?

- As noted before, when testing patients for HIV, the tests are often run twice.
- What would happen if the patient had a **false negative** test?



What is a “Gold Standard”?

- How do you really know if your result is a “true positive” or a “true negative”?
- Example: Look on Snapchat
- **IDEAL**: A test previously shown to highly accurate, though that test may be more expensive or invasive
- **Alternative**: Follow the subjects for long periods of time to determine if they get sick

2 x 2 Tables: Sensitivity and Specificity

	Diseased	Not Diseased	TOTALs
Test Positive	A	B	A + B
Test Negative	C	D	C + D
Column Totals	A + C	B + D	Grand Total

- **Sensitivity** = **True Positive Rate** = the percentage of positive cases that correctly test positive
$$= A / A + C * 100$$
- **Specificity** = **True Negative Rate** = the percentage of negative cases that correctly test negative
$$= D / B + D * 100$$

2 x 2 Tables: Sensitivity and Specificity: Breast Cancer Screening Test

	Diseased	Not Diseased	TOTALs
Test Positive	132	983	1,115
Test Negative	45	63,650	63,695
Column Totals	177	64,633	64,810

- **Sensitivity = True Positive Rate** = the percentage of positive cases that correctly test positive
$$= (132 / 177) * 100 = 74.6\%$$
- **Specificity = True Negative Rate** = the percentage of negative cases that correctly test negative
$$= (63,650 / 64,633) * 100 = 98.5\%$$

Epidemiology Terms: Prevalence

- **Prevalence** = percentage of people have a disease or condition ***at a given time***
 - On April 1, 38 students were absent from Any City High School due to the flu. Any City High School has 1450 students.
 - What is the **prevalence** of flu at Any City High School on April 1? Put another way, how common is the condition or disease?
 - Can we conclude from prevalence whether the number of cases of flu are increasing or decreasing?

Epidemiology Terms: Incidence

- **Incidence** = the *rate* at which a *new* disease or condition occurs (i.e., new cases)
 - From April 1-5, 109 students were absent from Any City High School due to the flu. 24 of these students had been home sick with the flu the week before. Remember that there are 1450 student at Any City High School.
 - What is the **incidence** of flu per 1,000 students during the April 1-5 time period?
- The principal of Any City High School looked at the number of students absent from school due the following week, April 8-12, and saw that 119 students were absent from school due to flu, 57 of which were also absent the week before.
- What is the **incidence** of flu per 1,000 students during the April 1-5 time period?
- The principal is worried that the rate of new flu cases is increasing each week. In other words, she is worried that more students are getting infected each week than were getting infected the week before. Based on your calculations, what would you tell her?