

SENSITIVITY & SPECIFICITY

1. Definition

- Sensitivity
 - Proportion of subject with a target condition who are identified by a positive test finding.
 - Test's ability to correctly identify individuals with the condition
 - Test's capacity to detect the condition when it is truly present
 - Probability of a test being positive given that the condition is present
 - Also called true positive rate or hit rate
 - The test will actually classify a person (with the condition) as likely to have the condition

- Specificity
 - Proportion of subjects free of the condition who are correctly identified by a negative test result
 - Test's ability to correctly identify individuals without the condition
 - Test's capacity to exclude condition when it is truly absent
 - Also called true negative rate or correct rejection rate
 - The test will actually classify a person (without the condition) as unlikely to have the condition

Respondents	With the condition	Without the condition	Total
With the condition	a 36	b 96	132
Without the condition	c 4	d 864	868
Total	40	960	1000

Sensitivity = $a/(a+c) = .90 \rightarrow \text{true positive}$

Specificity = $d/(b+d) = .90 \rightarrow \text{true negative}$

Positive Predictive Power (PPP) = $a/(a+b) = .27 \rightarrow \text{false positive}$

Negative Predictive Power (NPP) = $d/(c+d) = .99 \rightarrow \text{false negative}$

2. Validity of the Test

		<u>True status (population)</u>	
		positive	negative
<u>Result of test</u>	positive	a	b
	negative	c	d

Sensitivity: the probability of testing positive if the condition is truly present = $a/(a+c)$

Specificity: the probability of screening negative if the condition is truly absent = $d/(b+d)$

Example: Screening breast cancer by Physical Exam & Mammography

Respondents	With the condition	Without the condition	Total
With the condition	a 36	b 96	132
Without the condition	c 4	d 864	868
Total	40	960	1000

Sensitivity: $a/(a+c)$

= $36/(36+4)$

= $0.90 = 90\%$

Interpretation \rightarrow screening by physical exam and mammography will identify 90% of all true breast cancer cases

Specificity: $d/(b+d)$

$$= 864/(96+864)$$

$$= 0.90 = 90\%$$

Interpretation → screening by physical exam and mammography will correctly classify 90% of all non-breast cancer patient as being free disease.

$$PPP = a/(a+b)$$

$$= 36/(36/96)$$

$$= 0.27 = 27\%$$

$$NPP = d/(c+d)$$

$$= 864/(864 + 4)$$

$$= 0.99 = 99\%$$

Validity – the extend to which the test distinguishes between persons with and without the condition

High validity require

- High sensitivity
- High specificity