

TUTORIAL: SCREENING

PERFORMANCE OBJECTIVES

Compute and interpret

- Sensitivity
- Specificity
- Predictive value positive
- Predictive value negative
- False positive rate
- False negative rate

“Screening is defined as the search for unrecognized disease or defect by means of rapidly applied tools in apparently healthy individuals not seeking medical care”

Screening test results	Gold standard		Total
	Diseased	Not diseased	
Positive	a True positive	b False positive	a+b
Negative	c False negative	d True negative	c+d
Total	a+c	b+d	a+b+c+d

Sensitivity is ability of the test to detect correctly those who truly have the condition

(true positive) $= \frac{a}{a+c}$

Specificity is ability of the test to detect correctly those who truly don't have the

condition (true negative) $= \frac{d}{b+d}$

Screening test results	Gold standard		Total
	Diseased	Not diseased	
Positive	a True positive	b False positive	a+b
Negative	c False negative	d True negative	c+d
Total	a+c	b+d	a+b+c+d



False negative rate = $\frac{c}{a+c}$



False positive rate = $\frac{b}{b+d}$

Screening test results	Gold standard		Total
	Diseased	Not diseased	
Positive	a True positive	b False positive	a+b
Negative	c False negative	d True negative	c+d
Total	a+c	b+d	a+b+c+d

Predictive value positive (Pv_{+ve}) is the probability that a person positive by the test truly have the condition $= \frac{a}{a+b}$

Predictive value negative (Pv_{-ve}) is the probability that a person negative by the test truly don't have the condition $= \frac{d}{c+d}$

A total of 100 barbers were screened for hepatitis C using ELISA followed by confirmation of the diagnosis using RIBA. Results shows that 57 out of the 59 positive by the ELISA were as well positive by the RIBA and 38 out of the 41 negative by the test were as well negative by the RIBA.

Present the data in a suitable table

Compute and interpret the sensitivity, specificity, predictive values and errors of the test

Test (ELISA)	Hepatitis C (RIBA)		Total
	Positive	Negative	
Positive	57 (TP)	2 (FP)	59
Negative	3 (FN)	38 (TN)	41
Total	60	40	100

Sensitivity $(57/60) \times 100 = 95\%$

Specificity $(38/40) \times 100 = 95\%$

False positive $(2/40) \times 100 = 5\%$

False negative $(3/60) \times 100 = 5\%$

Pv+ve $(57/59) \times 100 = 98.3\%$

Pv-ve $(38/41) \times 100 = 92.7\%$

EXERCISE - 1

Sensitivity:

The test was able to identify correctly 95% of those who have anti-bodies (indicate previous exposure) against hepatitis C virus

Specificity:

The test was able to identify correctly 95% of those who don't have anti-bodies (indicate no previous exposure) against hepatitis C virus

Both sensitivity and specificity of the ELISA are high

False positive rate

It is the complementary of the specificity

The test misclassified 5% of the subjects as positive; they are in fact negative

False negative rate

It is the complementary of the sensitivity

The test misclassified 5% of the subjects as negative; they are in fact positive

EXERCISE -1

Predictive value positive

Out of those who were positive by the ELISA, 98.3% were positive by the confirmatory test

Predictive value negative

Out of those who were negative by the ELISA, 92.7% were negative by the confirmatory test

The test has a high yield

Ck results	Myocardial infarction		Total
	Positive	Negative	
Positive \geq 80 IU	215	16	231
Negative $<$ 80 IU	15	114	129
Total	230	130	360

Sensitivity $(215/230) \times 100 = 93.5\%$

Specificity $(114/130) \times 100 = 87.7\%$

False positive $(16/130) \times 100 = 12.3\%$

False negative $(15/230) \times 100 = 6.5\%$

Pv+ve $(215/231) \times 100 = 93.1\%$

Pv-ve $(114/129) \times 100 = 88.4\%$

A study was conducted to evaluate the role of serum creatine kinase (CK) in the identification of acute myocardial infarction (MI) among 360 patients admitted to the ICU with suggestive symptoms. Results are presented in the opposite table.

Compute and interpret the sensitivity, specificity, predictive values and false rates obtained by the test.

EXERCISE -2

- The test is suitable for screening because its high sensitivity and predictive value positive
- The test is capable to identify correctly 93.5% of those with MI and 93.1% of those positive by the test have MI.
- Its specificity and predictive value negative are still good but lower than sensitivity and predictive value positive as CK may be elevated in association with other conditions.
- Those who receive false reassurance are only 6.5% of those tested negative by the test

EXERCISE -2

Bleeding	Uterine cancer		Total
	Positive	Negative	
Positive	10	40	50
Negative	5	45	50
Total	15	85	100

Sensitivity $(10/15) \times 100 = 66.7\%$

Specificity $(45/85) \times 100 = 77.5\%$

False positive $(40/85) \times 100 = 47.1\%$

False negative $(5/15) \times 100 = 33.3\%$

Pv+ve $(10/50) \times 100 = 20\%$

Pv-ve $(45/50) \times 100 = 90\%$

The opposite table portrays the results of confirmation of the diagnosis of uterine cancer among 50 women who presented with bleeding and 50% who did not report bleeding.

Compute and interpret the sensitivity, specificity, predictive values and false rates obtained by the test.

EXERCISE -3

- Bleeding has a low specificity and much lower sensitivity in indicating the presence of uterine cancer.
- Its false positive rate means that nearly 50% of the women will be subjected to a series of investigation at high cost and they will be negative
- Like wise, 33.3% of the women who are not presenting with bleeding will receive a false reassurance that they are free
- On the contrary, the absence of bleeding means a high probability (0.90) that they are free from uterine cancer

EXERCISE -3