



الكلية : كلية طب العام

الفرع : طب السرة والمجتمع

المرحلة : الرابعة

أستاذ المادة : د بديعه ثامر يحيى

اسم المادة باللغة العربية: وبائيات

اسم المادة باللغة الانكليزية : epidemiology

اسم المحاضرة الر ابعه باللغة العربيه : الغربله

اسم المحاضرة الرابعه باللغة الانكليزية :

Screening tests (Validity: sensitivity & specificity):

4- Screening tests (Validity: sensitivity & specificity):

Q17- The prevalence of undetected diabetes in a population to be screened is approximately 1.5 % and it is assumed that 10,000 persons will be screened . The screening test will measure blood serum sugar content. A value of 180 mg % or higher is considered positive . The sensitivity and specificity associated with this screening are 22.9 % and 99.8% , respectively .

a- set up 2x2 table .

b- calculate the following values .

1- percentage of false positive .

2- percentage of false negative .

3- positive predictive value .

4- negative predictive value .

1- how many false positive and false negative will occur if 100000 people are screened ?

sol:

1.5% X10000= 150 disease

10000 – 150 = 9850 non disease

	Diabetic	Non	Total
Blood sugar higher 180	34	20	54
Blood sugar lower 180	116	9830	9946
Total	150	9850	10000

1- percentage of false +ve

100 - specificity =

100 – 99.8=

20

----- X100 = 0.2 %

9850

2- percentage of false -ve

100 – sensitivity =

$$3- \text{ ppv} = \frac{\text{T+ve}}{\text{all +ve}} = \frac{34}{54} \times 100 = 63\%$$

$$4- \text{ npv} = \frac{\text{T-ve}}{\text{all - ve}} = \frac{9830}{9946} \times 100 = 98.8\%$$

5- f+ve 200 persons

6- f-ve 1160 persons

Q18- To observe the effect of increasing sensitivity , assume a blood sugar screening level of 130 mg % , with a sensitivity of 44.3 % and specificity of 99% . Calculate the following values when the number of persons screened is 10000 and the prevalence of undetected DM is 1.5 %.

- percentage of false positive .
- percentage of false negative .
- positive predictive value .
- negative predictive value .
- how many false positive and false negative will occur if 100000 people are screened ?
- summarize the effects of increasing the sensitivity , observed from your calculation for above and this questions .
- if you were the director for the diabetes screening program would you prefer to screen at 130 mg or 180 mg % ?

sol: 1.5% x10000

$$10000 - 150 = 9850$$

	DISEASE	NON DISEASE	TOTAL
Blood sugar <130	66.5	3196	3262.5
Blood sugar >130	83.5	6654	6737.5
TOTAL	150	9850	10000

$$\text{SENSITIVITY} = \frac{\text{T+ve}}{\text{all disease}}$$

$$44.3\% = \frac{\text{TP}}{150}$$

$$\text{TP} = 66.5$$

$$\text{Specificity} = \frac{\text{T-ve}}{\text{all non disease}}$$

$$99\% = \frac{\text{TN}}{9850}$$

$$\text{TN} = 6654$$

A- percentage of false +ve = $100 - \text{specificity} = 100 - 99 = 1\%$

B- percentage of false -ve = $100 - \text{sensitivity} = 100 - 44.5 = 55.5\%$

$$\text{C- PPV} = \frac{\text{T+ve}}{\text{All +ve}} \times 100$$

$$= \frac{66.5}{3262.5} \times 100 = 2\% \text{ مصداقية الفحص}$$

$$\text{D- NPV} = \frac{\text{T-ve}}{\text{All -ve}} \times 100 =$$

$$= \frac{6654}{6737.5} = 98.8\%$$

E- False+ve = 31960

False -ve = 835

F- $\uparrow \text{sensitivity} \rightarrow \uparrow \text{NPV} \downarrow \text{F-ve}$
 $\uparrow \text{specificity} \rightarrow \uparrow \text{PPV} \downarrow \text{F +ve}$

$$\text{G- Overall misclassification rate} = \frac{f\text{-ve} + f\text{+ve}}{\text{Total population}} = \frac{83.5 + 3196}{10000} \times 100$$

$$= 32.8\% \downarrow \text{مهم يكون قليل}$$

Q19- In a population of 4000, it is known that 20% of them are hypertensive. An investigator was asked to check the blood pressure of all individuals in the population and he was able to correctly identify 20% of the hypertensive. Assume that false -ve are equal to false +ve.

- Display the data in a 2 x 2 table.
- Calculate the sensitivity, specificity and over all misclassification rates according to the investigator findings. What is the observed prevalence rate of hypertension?

SOL:

$$20\% \times 4000 = 800 \text{ disease}$$

$$4000 - 800 = 3200 \text{ non disease}$$

$$20\% \times 800 = 160 \text{ TP}$$

	Disease HT	Non HT	total
B.pre ↑	160	640	800
B.pre ↓	640	2560	3200
total	800	3200	4000

T+ve

$$\text{Sensitivity} = \frac{\text{TP}}{\text{TP} + \text{FN}}$$

All disease

160

$$= \frac{160}{800} \times 100 = 20\%$$

800

T-ve

2560

$$\text{Specificity} = \frac{\text{TN}}{\text{TN} + \text{FP}} \times 100 = \frac{2560}{3200} \times 100 = 80\%$$

All non disease

3200

$$\text{over all misclassification rate} = \frac{f\text{-ve} + f\text{+ve}}{\text{Total population}} = \frac{640 + 640}{4000} \times 100$$

$$= 32\%$$

$$\text{Prevalence rate} = \frac{a}{a+c} = \frac{160}{800} \times 100 = 20\%$$

20- If a screening test misses 15 of every 200 TB cases, what is the sensitivity of this test?

SOL:

$$\text{Sensitivity} = 1 - \text{false -ve} = 1 - 15 = 0.85$$

$$\text{OR} = 100 - \text{false -ve} = 100 - 15 = 85\%$$

Q21- To assess the validity of a screening test in detecting cases of disease X, the test was performed on 100 patients with the disease X and on 800 normal persons. positive results were obtained in 95 out of the 100 diseased and in 70 out of the 800 normal persons.

Calculate the sensitivity, specificity and over all misclassification rate of this test. Is this test useful in screening of fatal disease? Explain.

Sol:

	Dis	non	Total
+ve	95	70	165
-ve	5	730	735
	100	800	900

$$\text{Sensitivity} = \frac{\text{T+ve}}{\text{All disease}} \times 100$$

$$= \frac{95}{100} \times 100 = 95\%$$

$$\text{Specificity} = \frac{\text{T-ve}}{\text{All non disease}} \times 100 = \frac{730}{800} \times 100 = 91.3\%$$

$$\text{over all misclassification rate} = \frac{f_{-ve} + f_{+ve}}{\text{Total population}} = \frac{70 + 5}{900} \times 100$$

$$= 8.3$$

If this test useful inb screening of fatal disease ? yes

↑ sensitivity ↑ specificity ↓ misclassification

Q22/ If the screening criterion to detect glaucoma shown in figure in lecture 9 is set at 22 mm Hg , what happens to the sensitivity and specificity of the test ?

If the screening criterion is then set at 26 mm Hg , how do the sensitivity and specificity change ?

Q23- In a study carried out in city X to evaluate the ability of doctors in charge of prenatal care to identify high risk pregnancy among users of the services. The validating test is the opinion of a team of specialists in Obstetrics and gynecology. The study was carried out on 800 pregnant women and the results were as follows:

Of these 800 pregnant women, 440 were considered high risk by the team of specialists. Of this high risk group, doctors in charge were able to identify 230. In addition, they labeled 55 of the non risky as risky. How accurate (valid) was the judgment of doctors in charge of prenatal care on the risk status of pregnant women?

- 1- Set a 2 x 2 table.
- 2- Calculate validity of screening test.
- 3- positive predictive value .
- 4- negative predictive value .

Q24-Anemia prevalence in country X is 1.5 % , and that 10000 persons will be screened . The screening test will measure blood hemoglobin concentration . A value of 11.5 mg/dl or less is considered positive . The sensitivity and specificity associated with the screening test are 22.9% and 99.8% respectively.

- a- Set up 2x 2 table with appropriate numbers in each cell.
- b- Calculate false positive percent, false negative percent.
- c- Predictive value of a positive test, predictive value for negative test.
- d- How many false positive and false negative will occur if 100000 people are screened?
- e- What is the relationship between sensitivity and specificity in relation to increase in or decrease in prevalence rate?

Q25- A Hypothetical example of application of a screening test with 99 % sensitivity and 99% specificity on 1000000 population with a prevalence of disease 1/ 10000. Find positive predictive value and negative predictive value.

Q26- Two tests, test –A and test –B are available to diagnose a certain disease, these tests have the following characteristic:

Test-A positive in 25% of patients who are disease free, negative in 2% of patients who are diseased.

Test-B positive in 2% of patients who are disease free , negative in 25% of patients who are disease .

What are the sensitivity and specificity of each test? Which one do you prefer for the screening of a relatively severe disease?

Q27- To assess the validity of a screening test in detecting cases of disease (X), the test was performed on 100 patients with the disease (X) and on 800 normal persons. Positive results were obtained in 95 out of the 100 diseased and in 70 out of the 800 normal persons.

Calculate the sensitivity, specificity and overall misclassification rate of this test. Is this test useful in screening of fatal disease? Explain.

