Community Medicine

19th lecture:

Screening - tutorial

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Calculating sensitivity and specificity of a screening test

		Disease		
		D	no D	
Test	+	57	2	59
	−	3	38	41
		60	40	100

In this example:

- True positive= 57 (a)
- False positive = 2 (b)
- False negative = 3 (c)
- True negative= 38 (d)

Reminder:

- Sensitivity: Proportion of individuals who have the disease who test positive (a.k.a. true positive rate)
- Specificity: Proportion of individuals who don't have the disease who test negative (a.k.a. true negative rate)

Calculate:

- Sensitivity = $\frac{a}{a+c} = \frac{57}{57+3}$ x 100 = 95 %
- Specificity = $\frac{d}{b+d} = \frac{38}{38+2}$ x 100 = 95%

Calculating sensitivity and specificity of a screening test

		Disease		
		D	no D	
Test	+	19	99	118
	−	1	1881	
		20	1980	2000

In this example:

- True positive= 19 (a)
- False positive = 99(b)
- False negative = 1 (c)
- True negative= 1881 (d)

Calculate:

- Sensitivity = $\frac{a}{a+c} = \frac{19}{19+1}$ x 100 = 95 %
- Specificity = $\frac{d}{b+d} = \frac{1881}{99+1881}$ x 100 = 95%

Calculating the PPV/NPV of a screening test

Test		Disease D	Disease no D	
	+	19	99	118
	–	1	1881	
		20	1980	2000

Reminder:

- Positive predictive value: Proportion of individuals who test positive who actually have the disease
- Negative predictive value: Proportion of individuals who test negative who don't have the disease

In this example:

- True positive= 19 (a)
- False positive = 99(b)
- False negative = 1 (c)
- True negative= 1881 (d)

Calculate:

P.P.V. = $\frac{a}{a+b} = \frac{19}{118} x100 =$16% Among persons who screen *positive*, 16% are found to have the disease.

N.P.V. = $\frac{d}{c+d} = \frac{1881}{1882} x100 =$ 99.99% Among persons who screen *negative*, 99.9% are found to be disease free.

Calculating the PPV/NPV of a screening test

Test		Disease D	Disease no D	
	+	57	2	59
	–	3	38	41
		60	40	100

In this example:

- True positive= 57 (a)
- False positive = 2(b)
- False negative = 3 (c)
- True negative= 38 (d)

Calculate:

- P.P.V. = $\frac{a}{a+b} = \frac{57}{59} x100 =$96.6%
- N.P.V. = $\frac{d}{c+d} = \frac{38}{41} x100=$93%

Factors affecting the PPV/NPV of a screening test

Prevalence (%)	Sensitivity	Specificity	PPV
0.1	90%	95%	1.8%
1.0	90%	95%	15.4%
5.0	90%	95%	48.6%
50.0	90%	95%	94.7%

Factors affecting the PPV/NPV of a screening test

- Sensitivity
- Specificity
- Prevalence
- PPV is maximized when used in "high risk" populations since the prevalence of pre-clinical disease is higher than in the general population.
- screening a total population for a relatively infrequent disease can be very wasteful of resources and may yield few previously undetected cases.
- In other words, screening is useful with diseasses that have high prevelence in a certain community. Otherwise it'll be just a waste of resources.
- E.g. screening for diabetes in our community should be conducted among general population rather than risk groups. (we don't use high risk strategy)

The coming example is just a repition, practice then compare with the answers below:

Comparison of mammography results with findings from surgical excisional biopsies in women without palpable breast masses

Screening test (Mammography)	Gold standard (Surgical biopsy)		Total
	Cancer	No cancer	
Positive	16	49	65
Negative	4	931	935
Total	20	980	1000

Comparison of mammography results with findings from surgical excisional biopsies in women without palpable breast masses

Screening test (Mammography)	Gold standard (Surgical biopsy)		Total
	Cancer	No cancer	
Positive	TP 16	FP 49	TP+FP 65
Negative	FN 4	TN 931	FN+TN 935
Total	TP+FN 20	FP+TN 980	1000

Calculate:

- **Sensitivity**
- **Specificity**
- **Positive Predictive Value**
- **Negative Predictive Value**
- **False Positive rate**
- **False Negative rate**
- **Disease prevalence**

Answers:

- Sensitivity: 16/20*100 = 80%
- Specificity: 931/980*100 = 95%
- PPV: 16/65*100 = 24.6%
- PNV: 931/935*100 = 99.6%
- False Positive rate = 49/980*100 = 5%
- False Negative rate = 4/20*100=20%
- Disease prevalence 20/1000*100=2%