

24th lecture:

Tutorial- Demography & Screening

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Crude Birth Rate

- In a certain Country in Year 2000, live births: 750,000; population: 30,000,000

$$CBR = \frac{\text{Total number of live births in a certain year and locality}}{\text{Estimated midyear population (same year and locality)}} \times 1000$$

Crude birthrate = $750,000 / 30,000,000 \times 1000$
 = 25 live births per 1000 population per year

Crude Death Rate

- In a certain Country in Year 2000, Total population: 30,000,000; deaths: 150,000

$$CDR = \frac{\text{Total number of deaths in a certain year and locality}}{\text{Estimated midyear population (same year and locality)}} \times 1000$$

Crude Death Rate = $150,000 / 30,000,000 \times 1000 = 5$ deaths per 1000 per year

Rate of Natural Increase (to assess whether the number of population is increasing or decreasing)

- In a certain Country in Year 2000, live births: 750,000; population: 30,000,000 deaths: 150,000
- Calculate RNI?

Crude birth rate = 25 live births per 1000 per year

Crude death rate = 5 deaths per 1000 per year

$$RNI = \frac{CBR - CDR}{10}$$

RNI = $25 - 5 = 20$ per 1000 per year

RNI% = $20 / 10 = 2\%$ per year

Or = $\frac{750,000 - 150,000}{30,000,000} = 2\%$ per year

Population Doubling Time

- For the same country (population: 30,000,000); if the population growth continue to be constant at 2% per year
- When this population would be doubled (become 60,000,000)
 - Calculated by the law of 70
- It would be doubled in $70 / 2 = 35$ years

General Fertility Rate

- In a certain Country in Year 2000,
- Number of live births: 7,500,000;
- number of women ages 15-49: 35,000,000
- Calculate General fertility rate

$$GFR = \frac{\text{Total number of live birth in a certain year and locality}}{\text{mid-year reproductive female population (aged 15-49)}} \times 1000$$

General fertility rate= 7,500,000/35,000,000 x 1000= 214.3 live births per 1000 women ages 15-49 per year

- We don't include aborted fetuses

Age specific mortality rate

In a certain Country in Year 2000,

For age group: 25-34 yrs; population: 5,000,000; and deaths: 200,000 within same age group



Age-specific death rate= 200,000/5,000,000 x 1000
= 40 deaths per 1000 population per year for age group 25-34

Cause-specific death rate

- In a certain Country in Year 2000,
- Total population: 5,000,000;
- Deaths due to (cause) accidents: 4,000

$$= \frac{\text{Deaths of a specific cause in a given year and locality}}{\text{Estimated mid-year population in same year and locality}} \times 100,000$$

Cause-specific death rate= 4,000/5,000,000 x 100,000= 80 accidental deaths per 100,000 population per year

Proportional mortality ratio

- In a certain Country in Year 2000,
- total deaths from all causes: 1,500,000;
- deaths from cancer: 675,000

$$\text{Proportionate mortality} = \frac{\text{Deaths due to a particular cause}}{\text{Deaths from all causes}} \times 100$$

Proportional mortality ratio= $675,000/1,500,000 \times 100$
 = 45% of total deaths per year from cancer

Infant Mortality Rate

- In a certain Country in Year 2000,
- Number of live births: 325,000;
- infant deaths: 1,750

$$\text{Infant mortality rate} = \frac{\text{Total infant deaths}}{\text{Total live births}} \times 1000$$

Infant Mortality Rate = $1,750/325,000 \times 1000$
 = 5.4 infant deaths per 1000 live births per year

Still Births Ratio

- In a certain Country in Year 2000,
- Still births: 2,450;
- live births: 525,000

$$\text{Still Births Ratio} = \frac{\text{Number of stillbirths}}{\text{Number of live births}} \times 1000$$

Still births ratio = $2,450/525,000 \times 1000 = 4.7$ fetal deaths per 1000 live births

Still Births Rate

- In a certain Country in Year 2000,
- Still births: 2,450;
- live births: 525,000

$$\text{Still Births Rate} = \frac{\text{Number of stillbirths}}{\text{Total births (live + still)}} \times 1000$$

Still births rate = $2,450/(525,000+2,450) \times 1000 = 4.64$ fetal deaths per 1000 total births

Perinatal Mortality Rate

- In a certain Country in Year 2000,
- Still birth (Fetal deaths): 3,250;
- early neonatal deaths: 5,750;
- live births: 475,000

$$\text{Perinatal Mortality Rate} = \frac{\text{Stillbirths} + \text{Early Neonatal Deaths}}{\text{Total Births}} \times 1000$$

Perinatal mortality rate= (3,250+5,750)/(475,000+3,250) x 1000= 18.8 perinatal deaths per 1000 Total births

Neonatal Mortality Rate

- In a certain Country in Year 2000,
- Number of deaths at <28 days:2,750;
- number of live births: 325,000
- Calculate Neonatal mortality rate?

$$\text{Neonatal Mortality Rate} = \frac{\text{Neonatal Deaths}}{\text{Total Live Births}} \times 1000$$

Neonatal mortality rate= 2,750/325,000x1000
= 8.5 neonatal deaths per 1000 live births

Maternal Mortality Ratio

- In a certain Country in Year 2000,
- number of deaths due to maternal causes: 275,
- Number of live births: 1,750,000.
- Calculate Maternal mortality ratio

$$\text{Maternal Mortality Ratio} = \frac{\text{Maternal Deaths}}{\text{Total Live Births}} \times 100,000$$

Maternal mortality ratio= 275/1,750,000 x 100,000= 15.71 maternal deaths per 100,000 live births per year

Summary

- Rates whose denominators are total population:

- Crude mortality rate (crude death rate)
- Crude Birth rate (crude Birth rate)
- Cause-specific mortality rate

- Rates whose denominators are live births:

- Infant mortality rate
- Neonatal mortality rate
- Postneonatal mortality rate
- Maternal mortality rate
- Still birth ratio

Dependency Ratio

• A measure of the portion of a population which is composed of dependents (people who are too young or too old to work). The dependency ratio is equal to the number of individuals aged below 15 or above 64 divided by the number of individuals aged 15 to 64, expressed as a percentage. A rising dependency ratio is a concern in many countries that are facing an aging population, since it becomes difficult for pension and social security systems to provide for a significantly older, non-working population.

Use the figures below calculate the dependency ratio for Community (X) in year 2000.

- age 0 - 14 = 22.04 million
- age 15 - 64 = 32.66 million
- age 65 + = 1.99 million
- Young dep = 0.67 "Calculation is done by dividing the young age group by the adults"
- Old dep = 0.06 "Calculation is done by dividing the young age group by the adults"
- Total dep = 0.73 "the sum of the previous 2"

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

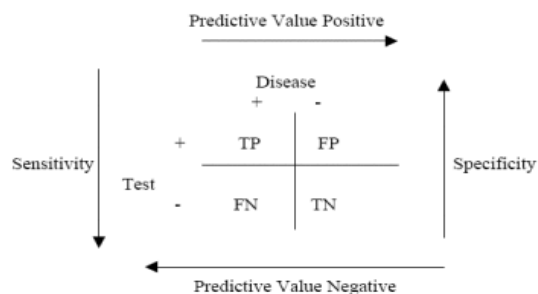
Formula& Definition

- **Sensitivity** = $TP / [TP + FN]$
- The probability that the individual will test positive.
- **Specificity** = $TN / [TN + FP]$
- The probability that the individual will test negative.
- **PV+** = $TP / [TP + FP]$
- The probability that the individual actually has the disease
- **PV (-)** = $TN / [TN + FN]$
- the probability that the individual does not have the disease

Calculations:

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

Following is a diagram that may help you to remember how to calculate sensitivity, specificity and the predictive values.



*most of this tutorial is a repetition of the health indicators and screening tutorial