Tutorial 1: Demography

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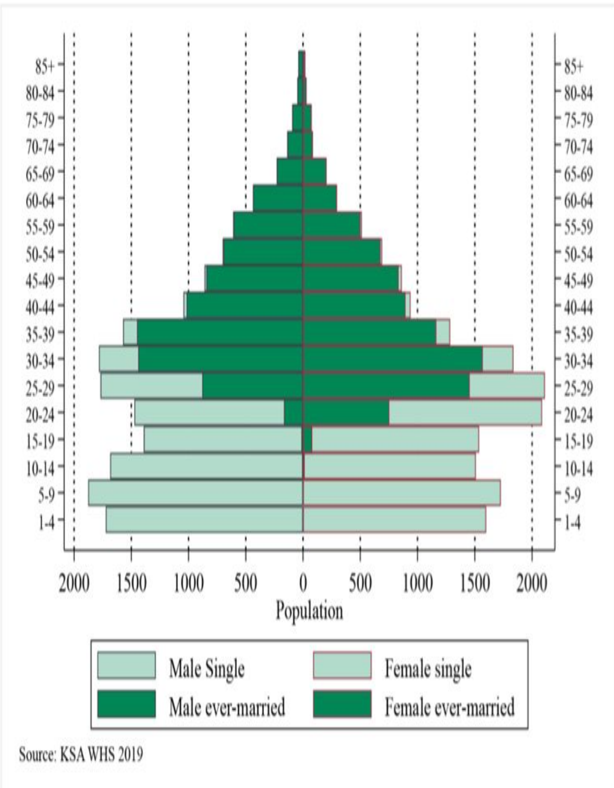
Exercise 1:

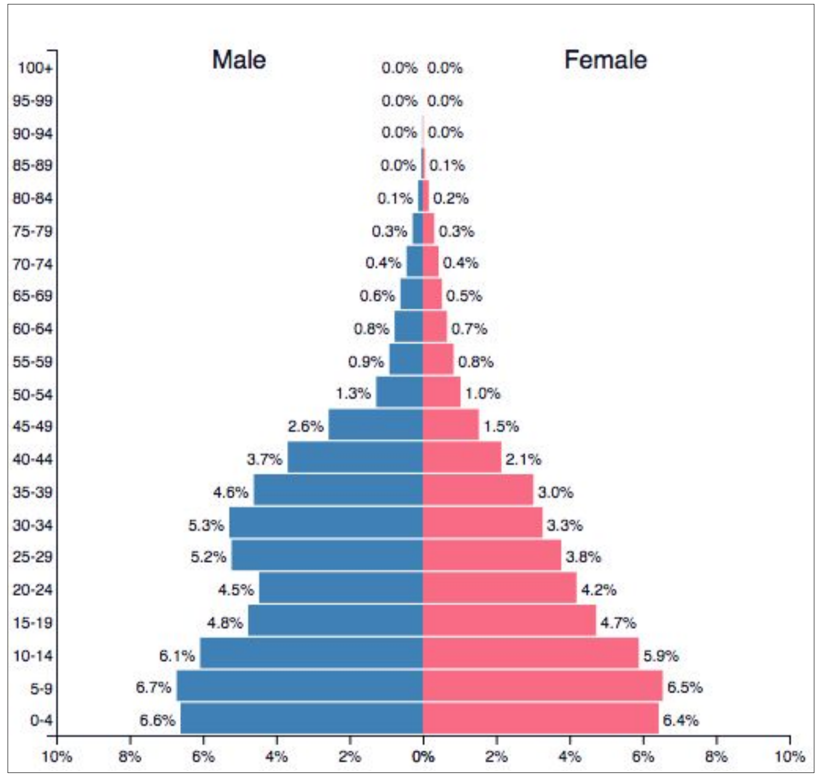
-We interpret the sides of the population pyramid by comparing male and femael ages and ages within the same sex.
-the 2 main factors that caused an increase in life expectancy are:
1-sanitation (الصرف الصحي)
2-vaccination.

Consider the following two population pyramids for Saudi Arabia, in the years 2021 and 2000.

Population pyramid A



Population pyramid B



1. Describe the shape of each of these two pyramids. What are the most striking features in each?**<u>(In terms of: 1-Apex 2-Base 3-Height 4-Side 5-Shape)</u>**

Pyramid A:
1-Apex: wider (=longer life expectancy).
2-Base: narrower (= low fertility rate).
3-Height: higher(lower fertility and mortality)
4-Side:Fairly equally distributed
5-Shape: Stationary

Pyramid B:
1-Apex: narrower(=short life expectancy).
2-Base: Wider (=high fertility rate).
3-Height: lower(higher fertility and mortality)
4-Side:Concave
5-Shape: expansive

2. What are the main differences in population composition between pyramid A and Pyramid B?
Fertility rate, and Mortality rate

Exercise 2:

1-During which stage of demographic transition is population growth the highest? Explain why.
3rd Stage Late expanding (fertility rate > mortality rate).

2-In your own words, please describe the meaning of the term "population equilibrium".
when the birth rate becomes equal to the death rates

3-Which of the following best describes what has been explained in the lecture about population growth?

1- Population growth mathematical projections are always accurate
2- Population growth will be exponential forever
3- Population growth is determined by many interacting factors
4- Population growth is not important for health policy making

Exercise 3:

The following data shows the population distribution of Saudi Arabia in 2000 and 2015.

Age groups (years)	Year 2000	Year 2015
< 15	8000000	7000000
15 - < 65	12000000	19000000
65+	500,000	900,000

1. Calculate the dependency ratio in each of these two years.(if given in the test only "dependency ratio" in the test calculate total dependency ratio unless asked specifically to calculate a specific dependent age group like <65)

$$\text{Dependency ratio} = \frac{\text{children under 15 + persons over 65}}{\text{Pop age 15-64}} \times 100$$

$$\text{Year 2000: } \frac{(8000000+500000)}{12000000} \times 100 = \underline{0.7} \times 100 = 70\%$$

$$\text{Year 2015: } \frac{(7000000+900000)}{19000000} \times 100 = \underline{0.42} \times 100 = 42\%$$

-dependency ratio can be used to compare countries.
-when u calculate dependency ratio of <15 it's called child dependency ratio.
-when u calculate dependency ratio for >65 it's called senior dependency ratio.

2. During which year was it higher? Provide a plausible explanation.

The dependency ratio in 2000 is higher, because population between 15-65 has grown in 2015

Exercise 4:

Consider the following hypothetical data.

Age groups	No. of females (mid-year)	Live births	-------
15-19	100	8	
20-24	250	80	
25-29	200	96	
30-34	300	84	
35-39	200	40	
40-44	150	24	
45 – 49	250	20	
Total	1450	352	

1. Calculate the general fertility rate from this table.

$$\text{General fertility rate} = \frac{\text{Number of live births in a year in a specific locality}}{\text{Mid-year female population age 15-49 (reproductive age) in that same year and same locality}} \times 1000$$

$$\frac{352}{1450} \times 1000 = \text{242 live births per one thousand women}$$

2. Calculate the age-specific fertility rate for women from 20 to 34 years of age.

$$\text{Age-specific fertility rate} = \frac{\text{Number of live births among a specific age group}}{\text{Mid-year female population in that age group in that same year and same locality}} \times 1000$$

$$\frac{80+96+84}{250+200+300} \times 1000 = \text{346 live births per one thousand women}$$

Practice Questions(439)

Q1: The population growth rates are highest during:

A. Ist stage of demographic transition .	B. IInd stage of demographic transition.	C. IIIrd stage of demographic transition.	D. IVth stage of demographic transition.

Q2: Calculating the population doubling time using the standard exponential growth formula assumes:

A. That the population will continue to grow at the current rate B.	B. The population growth rate will slowly decline due to probable decline in fertility over time	C. The population growth rate will increase due to decline in mortality and steady fertility rates.	D. None of the above.

Q3: An age dependency ratio of 120 mean that there are:

A. 120 children under 15 year for every 100 person over 65.	B. 120 young adults in the age group 15-64 for every 100 person over age 65.	C. 120 elderly persons over age 65 in the age group for every 100 persons in the age group 15 to 64 years.	D. 20 children under age 15 and elderly person over age 65 for every 100 persons in the age group 15-64 years in the population.

Q4: A population pyramid with a broad base and a narrowing top is characteristic of:

A. Slowing growing population.	B. Population with zero growth rate.	C. A rapidly growing population.	D. Population with a negative growth rate.

Q5: The denominator for general fertility rate relates to:

A. All women.	B. The total population.	C. Women in the reproductive age group.	D. Women and men in the reproductive age group.

Q6: Use the following data to calculate the CBR (crude birth rate) per 1,000:

Island of Mauritius, 1985

Total Births: 18,247
Total female population: 491,310
Total male population: 493,900

A. 18.5 births per 1,000.	B. 37.1 births per 1,000.	C. 99.4 per 1,000.	D. 29.3 per 1,000.

Answer key:
1 (B) , 2 (A) , 3 (D) , 4 (A) , 5 (C) , 6 (A)

Tutorial 2: Screening

objective:

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Components of Validity

TABLE 3–A

Screening test result by diagnosis

Screening test results	Diagnosis: Diseased	Diagnosis: Not diseased	Total
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

(a) Sensitivity = $a/(a + c) \times 100$

- The ability of the test to identify correctly all those who have the disease, that is "**true-positive**".
- 90% sensitivity means that 90% of the diseased people screened by the test will give a "**true-positive**" result and the remaining 10% a "false-negative" result.

Specificity

(b) Specificity = $d/(b + d) \times 100$

- The ability of a test to identify correctly those who do not have the disease, that is "**true-negatives**"
- 90% specificity means 90% of non-diseased persons will give "true-negative" result, 10% of non-diseased people screened by the test will be wrongly classified as "diseased" when they are not "false-positive".

Diagnosis of brain tumours by EEG

EEG results	Brain tumour: Present	Brain tumour: Absent
Positive	36	54,000
Negative	4	306,000
	40	360,000

Sensitivity = $36/40 \times 100$ = 90 per cent
Specificity = $306{,}000/360{,}000 \times 100$ = 85 per cent

Diagnosis of brain tumours by computer assisted axial tomography

CAT results	Brain tumour: Present	Brain tumour: Absent
Positive	39	18,000
Negative	1	342,000
	40	360,000

Sensitivity = $39/40 \times 100$ = 97.5 per cent
Specificity = $342{,}000/360{,}000 \times 100$ = 95 per cent

Components of Validity

Predictive accuracy

- Reflects the diagnostic power of a test.
- Depends upon sensitivity, specify and disease prevalence
- The probability that a patient with a positive test result has, in fact, the disease in question.
- The more prevalent is a disease in a given population, the more accurate will be the predictive value of a positive screening test.

(c) Predictive value of a positive test = $a/(a + b) \times 100$

(d) Predictive value of a negative test = $d/(c + d) \times 100$

(e) Percentage of false-negatives = $c/(a + c) \times 100$

(f) Percentage of false-positive = $b/(b + d) \times 100$

Predictive value of a positive gram-stained cervical smear test
(with constant sensitivity of 50% and specificity of 90%) at three levels of prevalence

Prevalence 5%					Prevalence 15%					Prevalence 25%				
		Culture					Culture					Culture		
		+	–	Total			+	–	Total			+	–	Total
Smear	+	25	95	120	Smear	+	75	85	160	Smear	+	125	75	200
	–	25	855	880		–	75	765	840		–	125	675	800
Total		50	950	1000	Total		150	850	1000	Total		250	750	1000
Positive predictive value		$\frac{25}{120} \times \frac{100}{1} = 21\%$			Positive predictive value		$\frac{75}{160} \times \frac{100}{1} = 47\%$			Positive predictive value		$\frac{125}{200} \times \frac{100}{1} = 63\%$		

- In the exam you might be given the formula and asked to give the interpretation or vice versa, you might be given the interpretation and asked for the formula. e.g: 90% of the diseased people screened by the test will give a "true-positive" result and the remaining 10% a "false-negative" result what is the formula?. answer: this is sensitivity and the formula is
$a/(a+c) \times 100$.

Questions and answers

Exercise 1:

In a survey, 100 persons were positive to the reference test for disease A and 900 were negative. The screening test identified 200 persons to be positive. Of these 80 were positive to the reference test.

		Diagnostic test		
		Disease	Non Disease	Total
Screening test	+ve	80	120	200
	-ve	20	780	800
	Total	100	900	1000

(a) Sensitivity = a/ (a + c) × 100

= 80/100 X 100 = 80%

➔Among those who are diseased, 80% will show positive with the screening test

(b) Specificity = d/(b + d) × 100

=780/900 X 100 = 86.7%

➔ Among those who doesn't have the disease, 86.7% will show negative in the screening test

(c) Predictive value of a positive test = a/(a + b) × 100

= 80/200 X 100 = 40% **who tested +ve actually they have the disease**

➔ Among those who tested positive, 40% actually have the disease

(d) Predictive value of a negative test = d/(c + d) × 100

= 780/800 X 100 = 97.5% **who tested -ve actually don't have the disease**

➔ Among those who tested negative, 97.5% will not have the disease

(e) Percentage of false-negatives = c/(a + c) × 100

= 20/100 X 100 = 20%

➔ Among those who have the disease ,20% tested negative in the screening test

(f) Percentage of false-positive = b/(b + d) × 100

= 120/900 X 100 = 13.3%

➔ Among those who don't have the disease , 13.3% tested positive in the screening test

Questions and answers

Exercise 2:

A new non invasive test has been developed to diagnose breast cancer. Of 1000 patients; 50% were diagnosed positive. Of those who tested positive, a Biopsy test yielded 475 with positive results. Of those who tested negative; 50 patients were actually Cancer breast positive when tested against the Biopsy.

		Diagnostic test		
		+ve breast cancer	-ve breast cancer	Total
Screening test	+ve	475	25	500
	-ve	50	450	500
	Total	525	475	1000

(a) Sensitivity = a/ (a + c) × 100

475/525X 100=90.5%

➔ Among those who are diseased, 90.5% will show positive in the screening test

(b) Specificity = d/(b + d) × 100

450/475X 100= 94.7%

➔ Among those who doesn't have the disease, 94.7% will show negative in the screening test.

(c) Predictive value of a positive test = a/(a + b) × 100

475/500X 100= 95%

➔ Among those who tested positive, 95% are actually have the disease

(d) Predictive value of a negative test = d/(c + d) × 100

450/500X 100= 90%

➔ Among those who tested negative, 90% will not have the disease

(e) Percentage of false-negatives = c/(a + c) × 100

50/525X 100=9.5%

➔ Among those who have the disease, 9.5% tested negative in the screening test

(f) Percentage of false-positive = b/(b + d) × 100

25/475x100= 5.2%

➔ Among those who don't have the disease , 5.2% tested positive in the screening test

Questions and answers

Exercise 3:

A psychiatrist devised a short screening test for depression. An independent blind comparison was made with a gold standard for diagnosis of depression among 200 psychiatric outpatients. Among the 50 outpatients found to be depressed according to the gold standard, 35 patients were positive for the test. Among 150 patients found not to be depressed according to the gold standard, 30 patients were found to be positive for the test.

		Diagnostic test		
		+ve	-ve	Total
Screening test	+ve	35	30	65
	-ve	15	120	135
	Total	50	150	200

(a) Sensitivity = a/ (a + c) × 100

35/50X 100=70%

➔ Among those who are diseased, 70% will show positive in the screening test

(b) Specificity = d/(b + d) × 100

120/150X 100=80%

➔ Among those who doesn't have the disease, 80% will show negative in the screening test.

(c) Predictive value of a positive test = a/(a + b) × 100

35/65X 100=53.8%

➔ Among those who tested positive, 53.8% are actually have the disease

(d) Predictive value of a negative test = d/(c + d) × 100

120/135X 100=88.9%

➔ Among those who tested negative, 88.9%% will not have the disease

(e) Percentage of false-negatives = c/(a + c) × 100

15/50 100=30%

➔ Among those who have the disease, 30% tested negative in the screening test

(f) Percentage of false-positive = b/(b + d) × 100

30/150x100= 5.2%

➔ Among those who don't have the disease , 5.2% tested positive in the screening test

Questions and answers

Exercise 4 :

1-The property of a test to identify the proportion of truly having the disease in a population who are identified with the illness by a screening test ·

A. Sensitivity
B. Specificity
C. **Positive predictive value**
D. Negative predictive value

2-The capacity of a test or procedure to screen as "positive" those having a specific disease is

a) **sensitivity**
b) specificity
c) positive predictive value
d) negative predictive value

Questions and answers(439)

Exercise 5:

Match the following sentences with the appropriate term:

I. The ability of a test to correctly identify those who have a disease (**sensitivity**)

II. The proportion of those without the disease correctly identified as negative by screening test (**Specificity**)

III. Ability of the test to detect true negative cases (**Specificity**)

IV. Probability of disease in patients with positive test result (**PP+ve**)

V. Probability of not having the disease in a subject with negative test result (**PP-ve**)

Exercise 6:

300 known diabetics (positive on the glucose tolerance test) and 250 normal volunteers (negative on the glucose tolerance test) are given finger prick tests, the results are:

		Glucose tolerance test		
		+ve	-ve	Total
Finger Prick	+ve	282	20	302
	-ve	18	230	248
	Total	300	250	550

Sensitivity of the test is:
a) 20% b) 90%
c) 94% d) 98%

Specificity of the test is:
a) 90% b) 92%
c) 94% d) 98%

The capacity of a test or procedure to screen as “**negative**” those NOT having a specific disease is:

a) sensitivity b) positive predictive value
c) specificity d) negative predictive value

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