



Community Medicine

Global demography concept & population pyramid

● Objectives:

- 1- Define demography
- 2- Describe major sources of population data
- 3- List the important factors that determine population growth and calculate measures of these factor
- 4- Interpret the population pyramid and differentiate between features of developed and developing countries
- 5- Understand the concept and determinants of demographic equilibrium
- 6- Describe and understand the theory of demographic transition
- 7- Define, compute and interpret the population distribution measures

Done by : Fahad alharbi - Majd albarrak - Rinad alghoraiby - sami alharthi

Leader: Aljouhara Alibrahim

Reviewed by: Yazeed Al-Dossare

Resources :

Slides

Doctors notes

Demography

What is demography?

- It is the scientific study of human populations
- It encompasses three domains:

Change in population size

Composition of a population

Distribution of a population in space

Why is demography important?

The health of people in a community depends on the dynamic interaction between size of the population and the space they occupy. I need to know the distribution of a population to prepare for the next 10 or 20 years kinds of services do i need for this population that is going to grow. this information is important for us to make policy about healthcare

Sources of demographic data:

- **Vital statistics** (Birth and death registration) (Must also record the cause of death. Limitation that it must be very accurately recorded)
- General Authority for Statistics (GAS)
- Ministry of health
- World Health Organization statistics
- United Nations
- World Bank Statistics

Sources of their Saudi Data are not clear

Available demographic indicators from GAS:

Demographic Indicators Reported by:

- Age groups (reported in 5-year bins)
- Gender
- Region of residence
- Nationality (Saudi vs. Non-Saudi)
- Marital status
- Education status
- Number of live births
- Use of OCP
- Number of deaths
- Disability

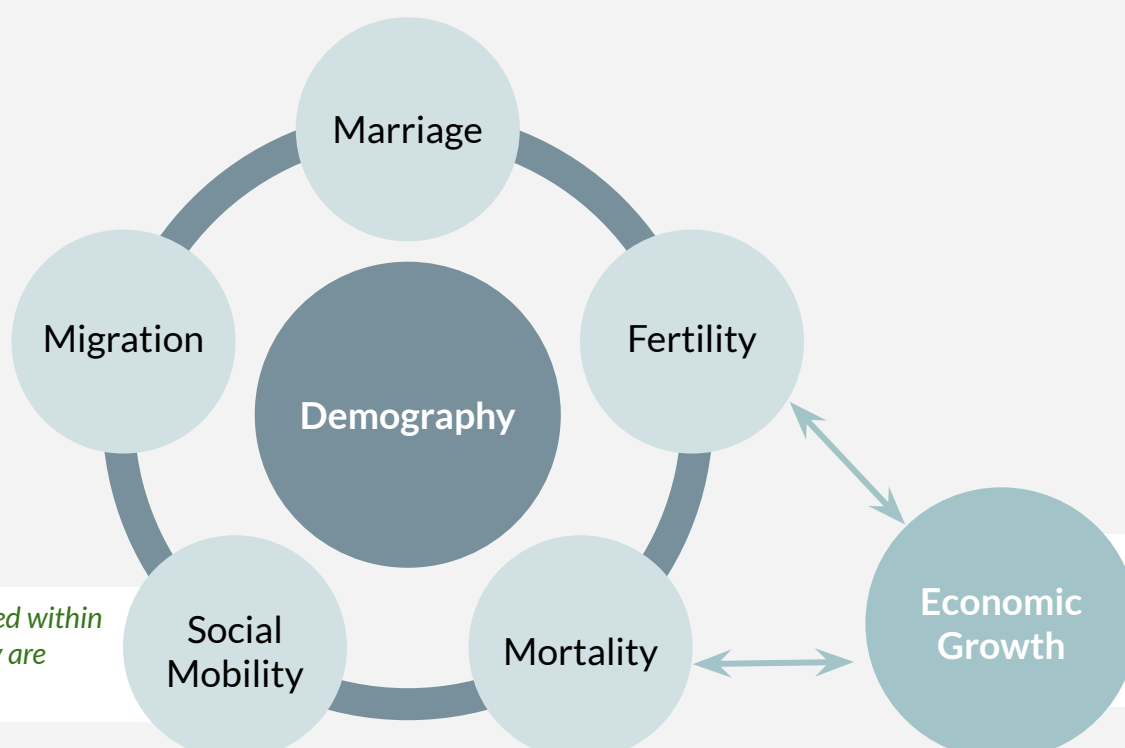


In recent years there has been reporting of health indicators.

- Prevalence of diabetes based on self-report.
- Prevalence of chronic diseases based on self-report.
- Prevalence of people who have health insurance.

What determines demographic distribution of a population and population size?

Population size, distribution and composition are determined by:



Where are people clustered within the country and how they are distributed.

Economic growth on:

- Healthcare systems
- Reducing mortality (whether child or all age)
- Empowering women (reduces fertility)

1- Fertility

The actual bearing of children, is determined by:

1. Age at marriage (inverse relationship)
2. ↑ Duration of married life (most happen in early y)
↑ Fertility
3. Spacing of children
4. Education of the mother (inverse relationship)
Most probably working → busy
5. Economic status of the country (inverse relationship)
The country doesn't need more manpower to generate income.
6. Religion
7. Nutrition (Inverse relationship)
8. Family planning
9. Other factor.... physiological, biological, cultural, social

Measures of Fertility

1. Crude Birth Rate:

Number of live births in a year in a specific locality X 1000
estimated mid-year population size in that same year and locality

2. General Fertility Rate:

Number of live births per 1000 women in the reproductive age-group (15-44 or 49 years) in a given year.

Number of live births in a year in a specific locality X 1000
Mid-year female population age 15-49 (reproductive age)
in that same year and same locality

Problems?—not all women in denominator at risk for childbirth or married

3. General Marital Fertility Rate:

Number of live births per 1000 **married** women in the reproductive age group (15-44 or 49) in a given year.

Number of live births in a year in a specific locality X 1000
Mid-year female married population age 15-49
in that same year and same locality

Limitation:
There are women who aren't married getting pregnant.

4. Age-specific Fertility Rate:

Number of live births in a year to 1000 women in any specified age-group.

Number of live births among a specific age group X 1000
Mid-year female population in that age group
in that same year and same locality

5. Total Fertility Rate: (rate per woman)

The average number of children a woman would have if she were to pass through her reproductive years bearing children at the same rates as the women now in each age group.

Approximates “completed family size”

Sum of age specific fertility rates (rate per woman)
1000

or **Sum of age specific fertility rate** (rate per 1000 women)

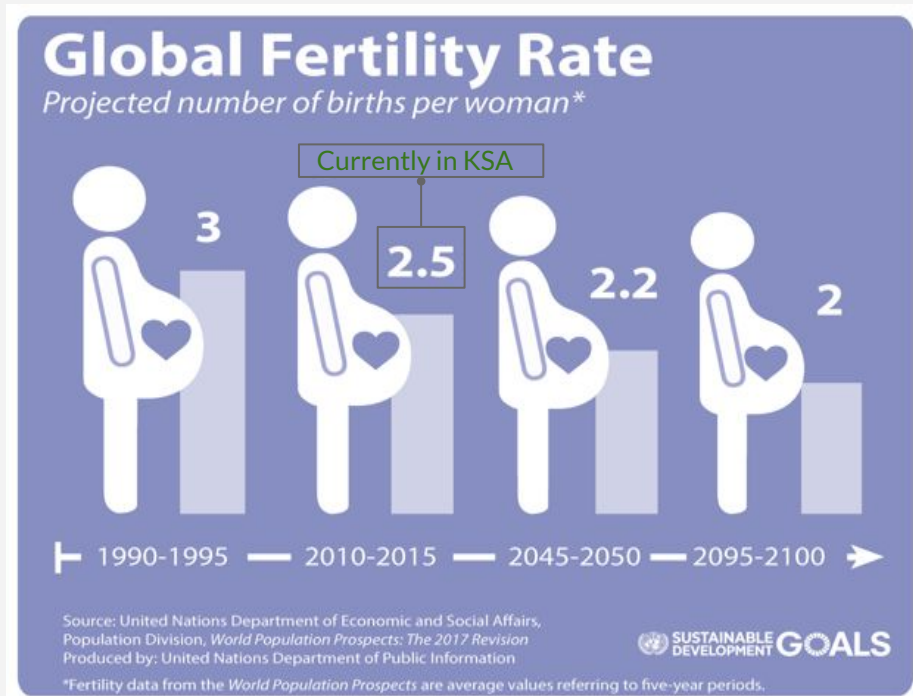
If using a 5-year period, then: Σ age specific fertility rate x 5

Crude Birth Rate Trend
(World Bank)

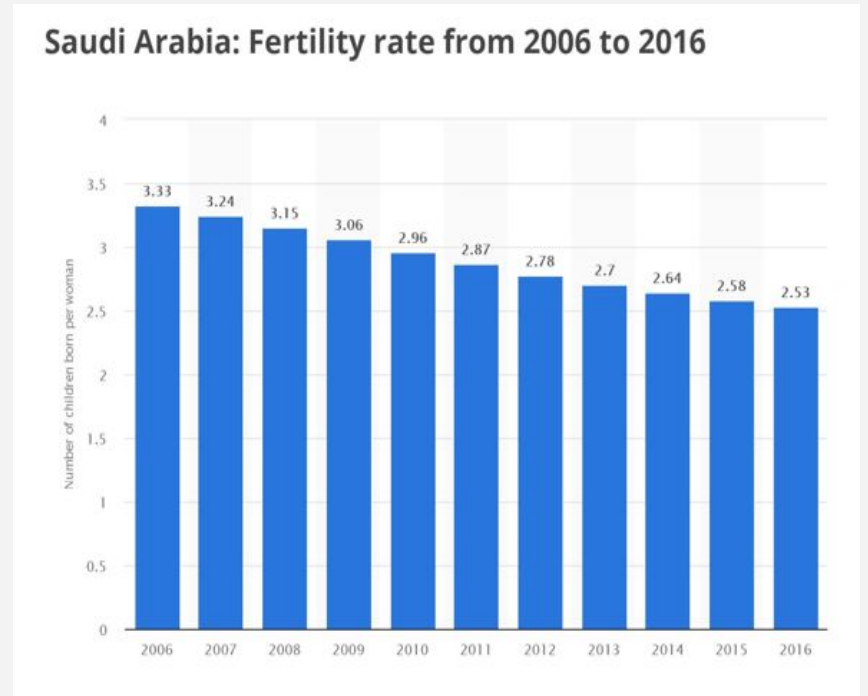


1- Fertility

Global Total Fertility Rate 2017



Saudi Arabia Fertility Rate



Notice:

- Not a major change.
- The change is due to ↑ age of marriage and ↑ education of women.

Impact of Fertility on Age Distribution in a Population:

- High fertility → High proportion of young people in the population (e.g. developing countries)
- Low fertility → Condensed proportion of retired people in a population *mortality rate is not high* (e.g. developed countries)

How does that impact healthcare needs?

- You need to focus efforts on preventing infant mortality in *developing countries* by:
 - Vaccines
 - Sterile equipment
- More chronic disease care is needed in *developed countries* so you need to focus as a ministry of health on services targeting this age group.

Fertility and Population Explosion:

- Controversy starting from the late 1700s
- Thomas Malthus theory
- Paul Ehrlich: Author of “Population Bomb” ~ 1968
- **Argument:** unless population of the world is controlled, civilization on earth would end.

Very flawed and unethical argument.

- **Fallacy in their argument:** Only focusing on birth control & *poor people*; not meeting healthcare and development needs of disadvantaged populations.

2- Migration

- According to UN reports, 258 million people live outside the country where they were born.
- Of these, 26 million (10%) are refugees or asylum seekers.
- Migration (for economic opportunities) is towards high-income countries, except for refugees mostly migrate to low-income countries.
- Median age of migrants is 39 years.
- Mostly women → for refuge.
- Mostly men → for work.

Ranking of countries that host migrants:

	Country	No. of migrants hosted
1	USA	49.8 million
2	Saudi Arabia	12 million Mostly for work
3	Germany	around 12 million
4	Russia	around 12 million
5	UK	9 million

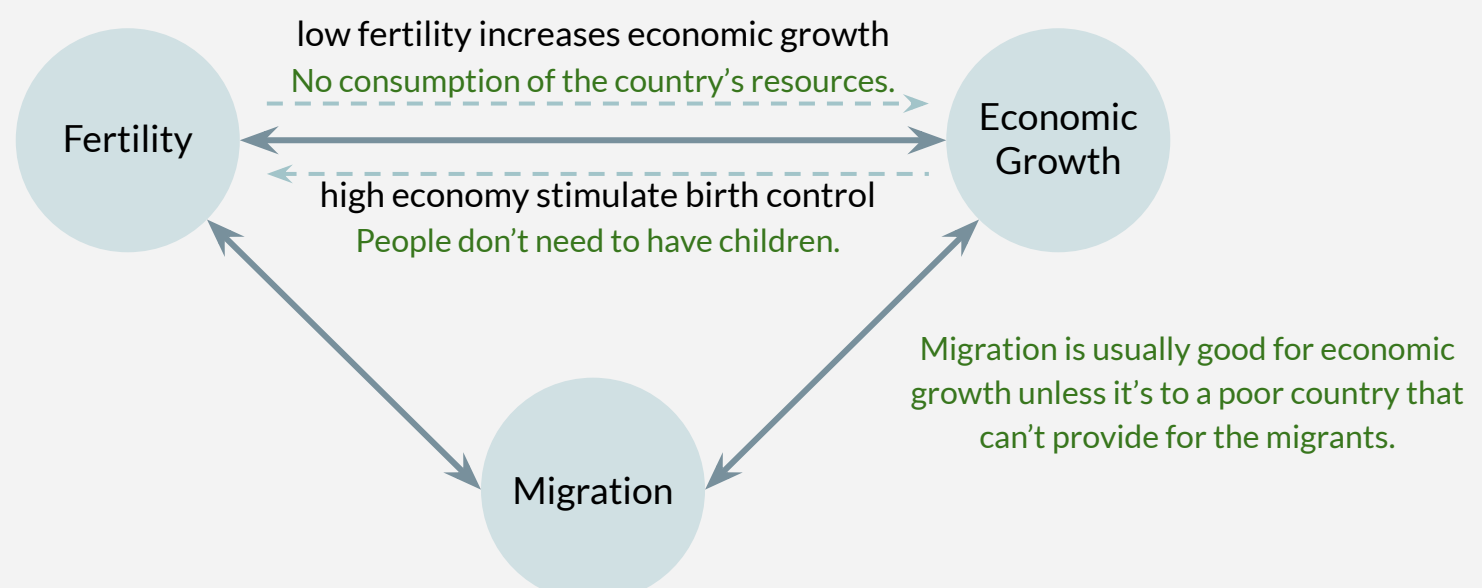
Source: UN International Migration Report 2017.
<https://www.un.org/development/desa/publications/international-migration-report-2017.html>

→ In 2017, Saudi Arabia ranked the **second** worldwide in hosting migrants.

Why is migration important to follow?

- It helps predict how the population will be shaped. (20-40's ↑)
- Migration usually goes from low income to more industrialized countries (more economic opportunity).
- Younger and healthier people migrate to more industrialized areas to work.
- Migration affects economic growth and is affected by economic growth.

Relationship between fertility, migration and economic growth:



3- Mortality

Mortality Rate:

- Number of deaths in a given population in a specific period of time
- Expressed as per 100 population or per 1000 population

$$\text{MR} = \frac{\text{\# of deaths in a given period of time} \times 100 \text{ (or 1000)}}{\text{Total population in the same given period of time in that same population}}$$

Crude Death Rate:

- Number of deaths in a given population in a specific period of time over the mid-year population of that same time period

$$\text{CDR} = \frac{\text{\# of deaths in a given period of time} \times 1000}{\text{mid-year population in the same given period of time in that same population}}$$

Other Measures of Mortality:

- Age-specific mortality rate
- All cause mortality rate
- Cause-specific mortality rate
- Infant mortality rate
- peri-natal mortality rate
- neonatal mortality rate
- Post-neonatal mortality rate
- Maternal mortality rate
- Maternal mortality ratio

Peri-natal: From pregnancy → 28 days

Neonatal: After birth → 28 days

Post-neonatal: After 28 days

Infant: 1 year

Stages of Demographic Transition

It explains the changes of birth rates and death rates and describes the population growth cycle relation to economic development.

Stage 1

(High Stationary)

- High birth rate
- High death rate

- In countries with famines/disasters.
- The death rate is so high that the cause is killing those being born.
- No population growth.

Stage 2

(Early expanding)

- Birth rates remain the same
- Death rates begin to decline
- e.g. many of the countries in developing world

Stage 3

(Late Expanding)

- Death rates further decline
- Birth rates begin to fall *not so much*
- Birth rates → death rates → *Net result: population growth (most countries in the world)*

Stage 4

(Low stationary)

- Low birth rate
- Low death rate
- Population becomes stationary; Zero population growth → *Population equilibrium given that there is no migration*
- Many developed countries

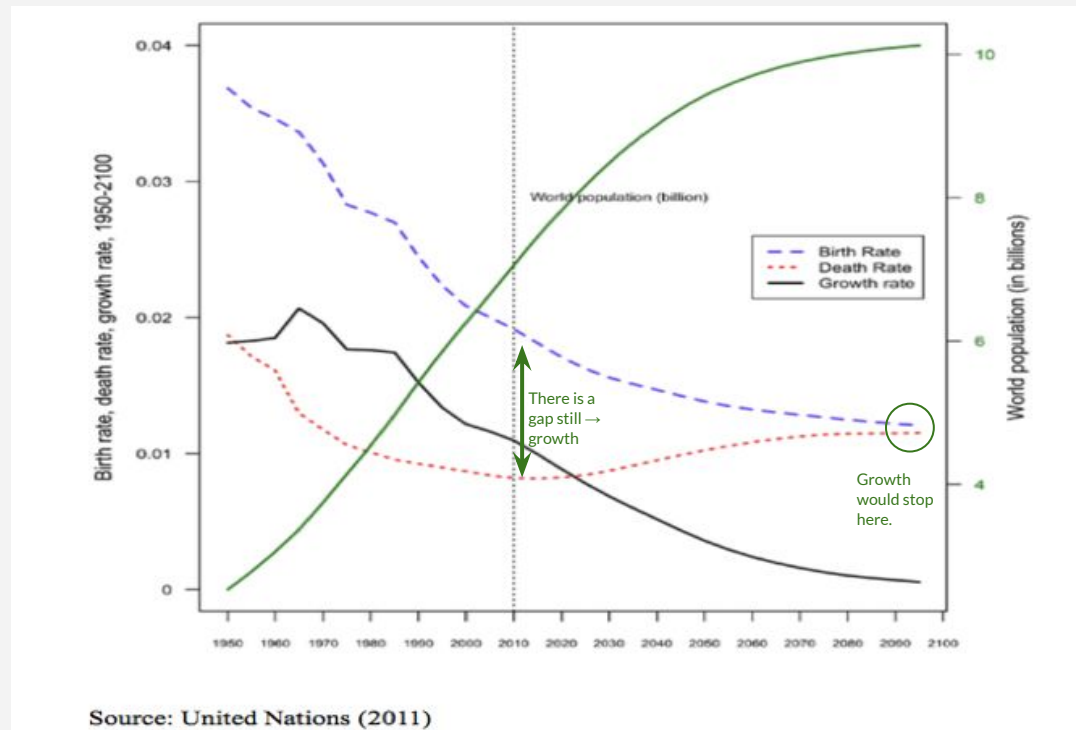
Stage 5

(Declining)

- Birth rates very low
- Death rates very low
- Birth rates < death rates
- Population decline *people are dying at a very old age.*
- e.g. Germany and Hungary

Demographic Transition

Expected population growth from 1950-2100:



Limitations of Demographic Transition Model:

Migration is not considered in the model.

How do we measure population growth:

Annual growth rate (expressed in %) = Crude birth rate - Crude death rate

Annual Population Growth Rate:



Source: The World Bank. Available from:
<https://data.worldbank.org/indicator/SP.POP.GROW>

KSA

Where does KSA stand?

- unique cultural and religious norms
- death rates have decreased
- with economic development, women education and empowerment, fertility rates have not declined as fast as expected (lag in demographic transition)
- **Result?**

Annual growth rate in KSA:

Reported at 2.52% in 2016 (GAS)

Annual Population Growth Rate KSA



Exponential growth and doubling time concept:

- In the 1970s a theory was developed that population size grows exponentially.
- Actual data historical data until now rebuke this theory.
- Based on exponential growth, the time needed to double population size (population doubling time) was calculated: $(70/\text{growth rate})$.
- **Doubling time should NOT be used**, as population growth is determined by many factors, and **DOES NOT** show exponential growth.

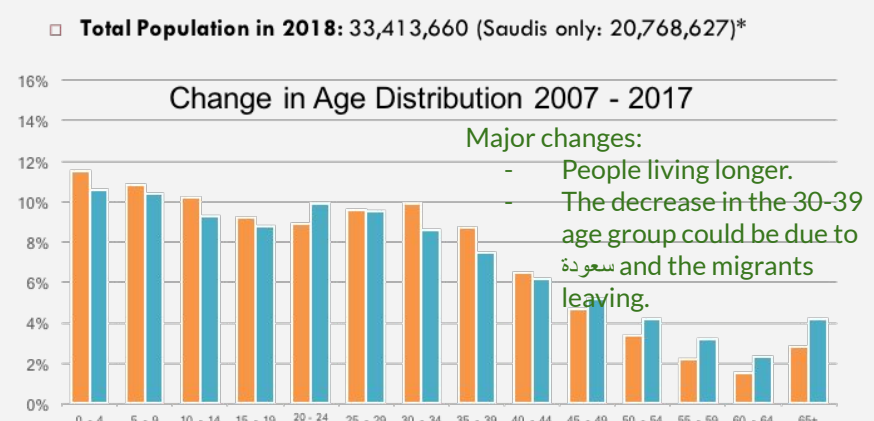
Example how “doubling time” is flawed:

- <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=SA&view=chart>

Using World Bank data:

- In 1988:
 - Annual growth rate = 4.2%, size = 15,070,082
 - Exponential growth theory suggests 16.6 years for population to double
- In 2013: 30,052,518
- In 2014: 30,916,994
- Took 26 years for KSA population to double in size

Population distribution in KSA:

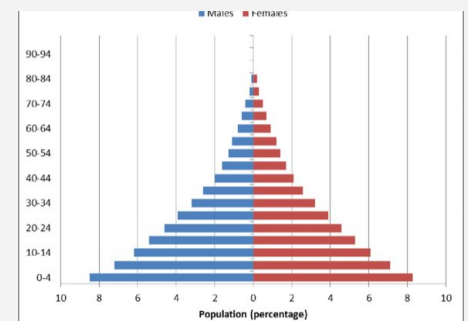


Population Pyramid

Population Pyramid:

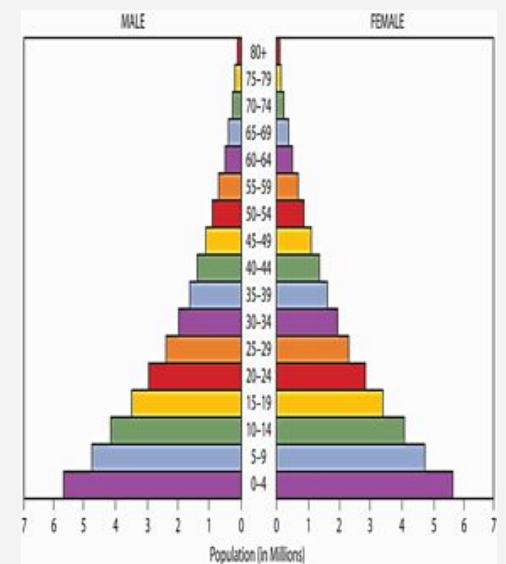
- This shows the age structure in a certain population.
- By looking at the shape, you will be able to get an idea about:
 - Proportion age groups in a population
 - Male to female ratio

Example of Population Pyramid



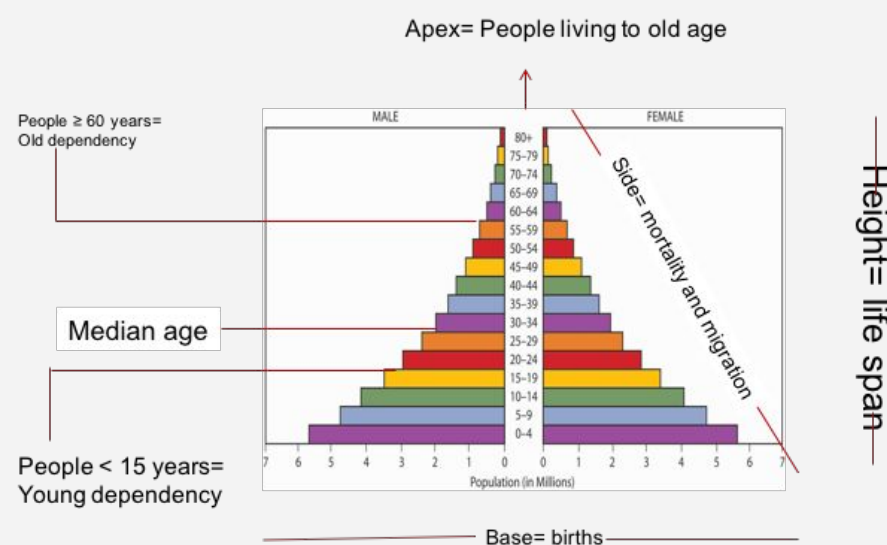
Components of Population Pyramids:

- **Base:** wide → high birth rate (developing country)
narrow → low birth rate
- **Apex:** old population (retired population) ...wide? narrow?
A narrow apex would be in a lower level economic country. (Less elderly due to people not aging)
A wider apex would be in a better economic level country. (People are aging)
- **Height:** life span
- **Side:** change in population size due to death or migration



Important Demarcating Points:

- **Less than 15**
 - Size of dependent youth < 15
 - Large size in rapidly growing population
 - Small size in slowly growing population
- **60 + years**
 - Represents the size of dependent old ≥ 60
 - Large size in population with longer life span
 - Small size in population with short lifespan
- **Median age**
 - Age that divide the population into two halves
 - Small in population with high births
 - Large in population with low births



Population Pyramid

Types of Population Pyramids:

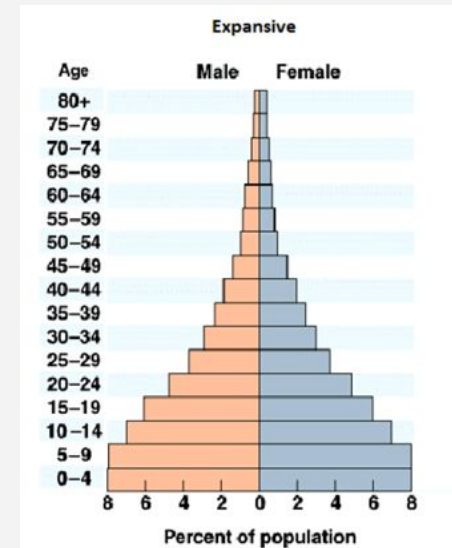
Expansive

Stationary

Constrictive

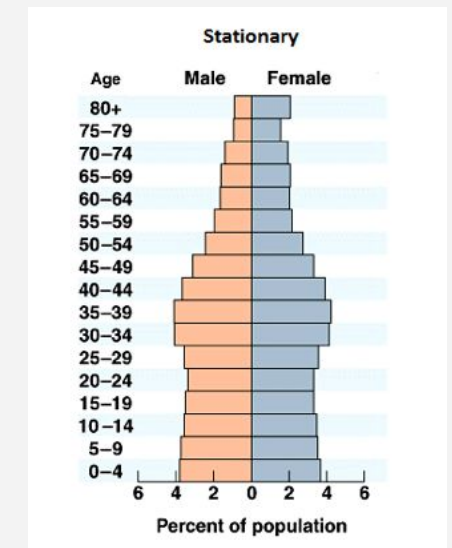
Expansive

- Expansive or expanding pyramid usually presents itself in the form of triangular shape with concaved edges
- High population growth due to:
 - High birth rate
 - Shorter life expectancy
 - (high death rate)
- Usually associated with lower standard of living the younger population composes the highest proportion of this area reflect unhealthy developing country



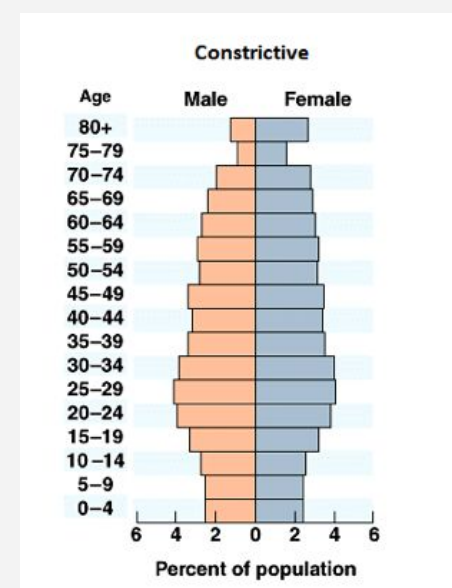
Stationary

- It is showing unchanging pattern of fertility and mortality
- Uniform distribution
- Age groups almost equal, but it is expected to see smaller figures at the oldest age groups (developed country) (high life span)



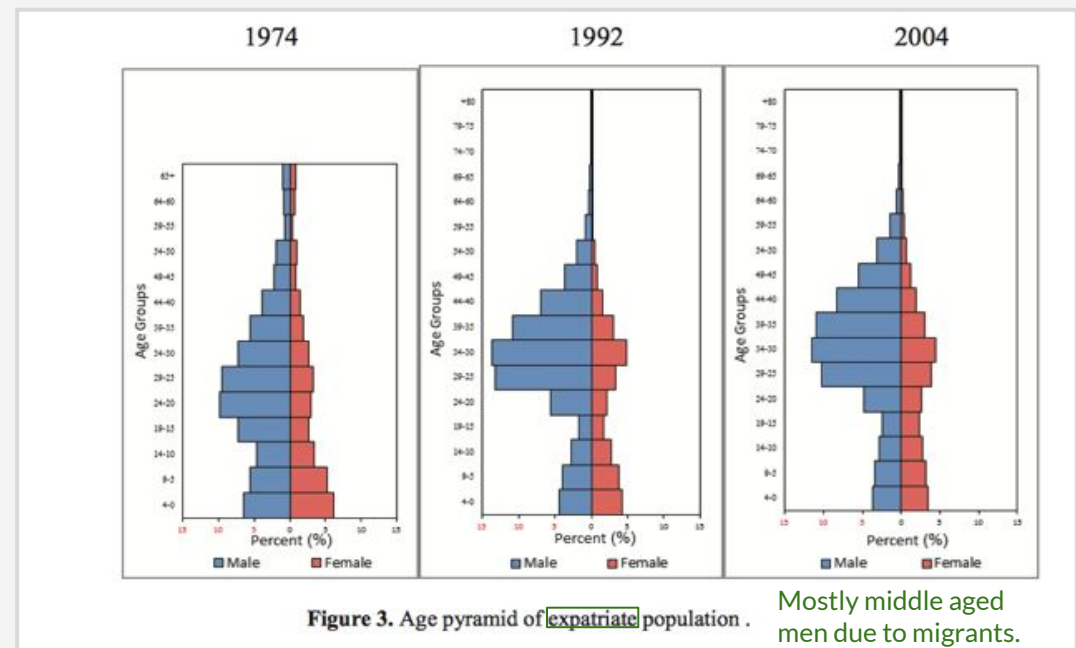
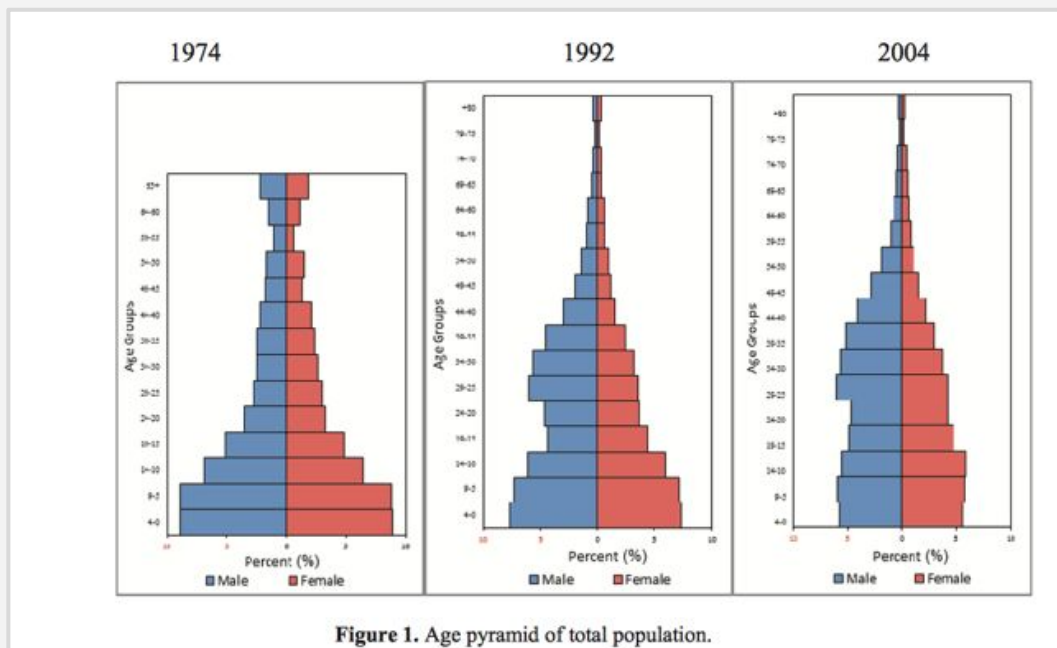
Constrictive

- Narrow base fertility rate is too low
- Apex wider aging population
- It is more common when immigrants are factored out
- Indicated:
 - High level of education
 - Use of birth control low birth rate
 - Good health care system
 - Very high developed country



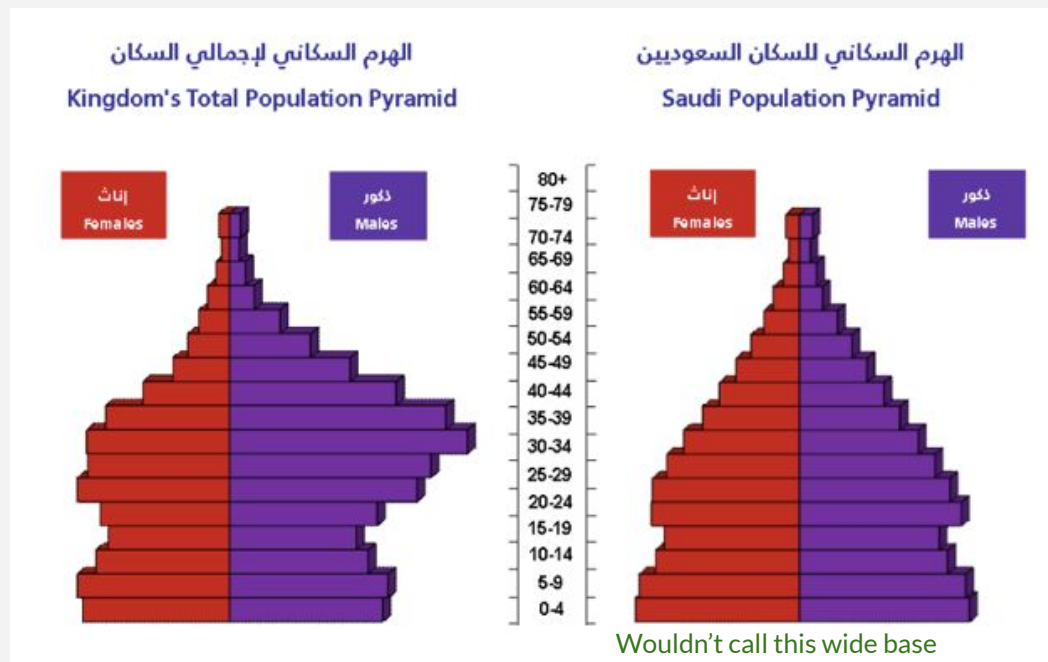
Population Pyramid

Population Pyramid in Saudi Arabia Over the Years:



Source: Abu AshwanM, Abdul Salam A, Mouselhy MA. Population growth, structure and distribution in Saudi Arabia. Humanities and Social Sciences Review 2012; 1(4):33-46

Most Recent KSA Population Pyramid (2016):



Source: General Authority for Statistics, 2016

Life span: the maximum length of time for which a person lives on average.
Life expectancy: Probability of a person in that age group to life to a certain age given that they experience the life of a normal person in that age group.

Other Important Population Distribution Measures:

- **Sex ratio**
- **Dependency ratio (x 100)**
 The proportion of persons above 65 years of age and children below 15 years of age are considered to be dependant on the economically productive age group (15-64 years) dependency ratio of people above 65 years only is reflective of a higher developed country and dependency ratio of people below 15 years is reflective of developing country
- **Total dependency ratio (x 100)**
 The ratio of the combined age groups 0-14 years plus 65 years and above to the 15-65 years age group is referred to as the total dependency ratio.

Population Density:

- Total population in a certain region divided by the surface area of that same region important for crowding and pollution

Summary

demography is: is the scientific study of human populations

It encompasses three domains:

1. Change in population size
2. Composition of a population
3. Distribution of a population in space

Population size, distribution and composition are determined by:

economic growth: 1-fertility 2-mortality 3-marriage 4-migration 5-social mobility

fertility: actual bearing of children

DETERMINED by:

1. Age at marriage (inverse relationship) 2. Education (inverse relationship) 3. Duration of married life (most happen in early y) 4. Economic status (inverse relationship)

1. Crude Birth Rate 2. General Fertility Rate 3. General Marital Fertility Rate 4. Age-specific Fertility Rate 5. Total Fertility Rate

High fertility > High proportion of young people in the population (e.g. developing countries)

Low fertility > Condensed proportion of retired people in a population (e.g. developed countries)

Migration

why is migration important to follow ?

1-It helps predict how the population will be shaped

2-Migration usually goes from low income to more industrialized countries (more economic opportunity)

3-Younger and healthier people migrate to more industrialized areas to work

4-Migration affects economic growth and is affected by economic growth

Mortality rate: Number of deaths in a given population in a specific period of time Expressed as per 100 population or per 1000 population.

Crude death rate: Number of deaths in a given population in a specific period of time over the mid-year population of that same time period.

STAGE OF DEMOGRAPHIC TRANSITION

It explains the changes of birth rates and death rates and describes the population growth cycle relation to economic development.

Has five stages :

1. Stage 1: (High Stationary) 2. Stage 2: (Early expanding) 3. Stage 3: (Late Expanding) 4. Stage 4: (Low stationary) 5. Stage 5: (Late Expanding)

Limitations : Migration is not considered in the model.

How do we measure population growth:

Annual growth rate = Crude birth rate – Crude death rate

Summary

Population Pyramid

- This shows the age structure in a certain population
- By looking at the shape, you will be able to get an idea about:
 - Proportion age groups in a population
 - Male to female ratio

Components of population pyramids

Base: wide => high birth rate narrow => low birth rate

Apex: old population (retired population)wide? narrow? Height: life span

Side: change in population size due to death or migration.

Types of population pyramids :

1.Expansive :

Expansive or expanding pyramid usually presents itself in the form of triangular shape with concaved edges

2.Stationary:

It is showing unchanging pattern of fertility and mortality

3.Constrictive:

- Narrow base
- Apex wider
- It is more common when immigrants are factored out.

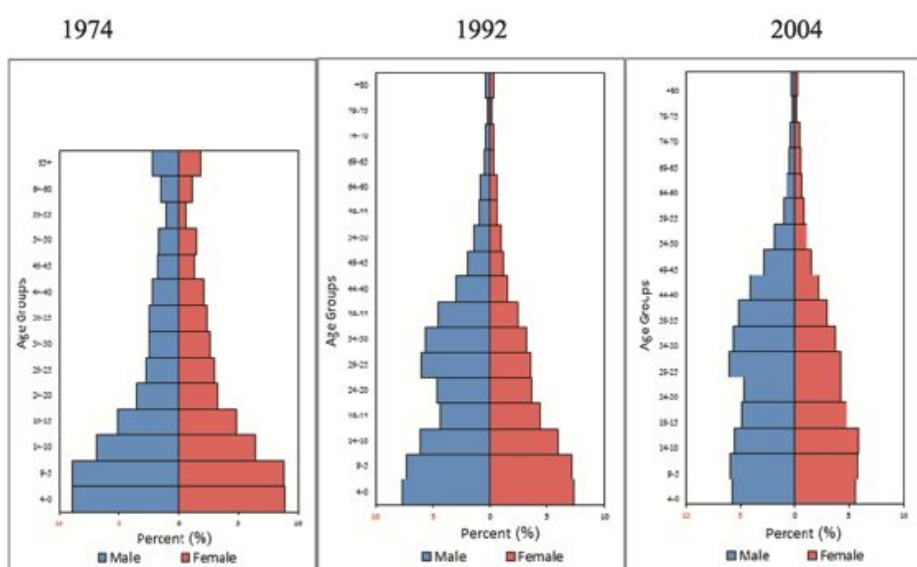


Figure 1. Age pyramid of total population.

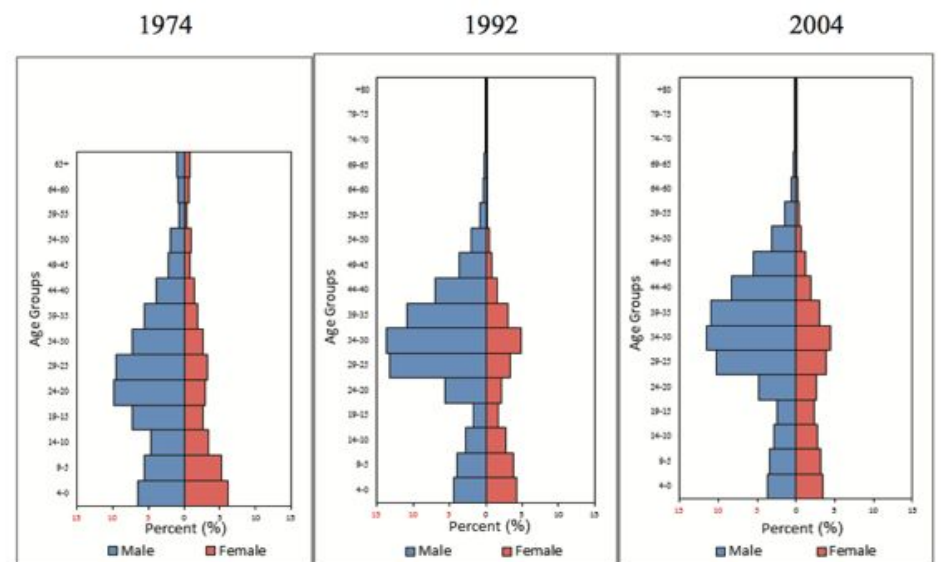


Figure 3. Age pyramid of expatriate population .

MCQs

1- Number of deaths in a given population in a specific period of time over the mid-year population of that same time period is ?

- 1-crude death rate
- 2-mortality rate
- 3-fertility
- 4-all above

2- What determines demographics distribution of a population and population size ?

- 1-fertility
- 2-marriage
- 3-migration
- 4-all above

3- What is type of population is showing unchanging pattern of fertility and mortality ?

- 1-expansive
- 2-stationary
- 3-constrictive
- 4-all of above

4- This equation is used to measure ?!

$$\frac{\text{\#of deaths in a given period of time} \times 1000}{\text{mid-year population in the same given period of time in that same population}}$$

- 1-mortality rate
- 2-crude death rate
- 3-migration
- 4-non of above