Global Demography Concepts and Population Pyramid

Dr Rufaidah Al Dabbagh, MBBS, MPH, DrPH
Prof Abdulaziz Binsaeed, MBBS, DFE, PhD
Community Medicine Unit, Family & Community Medicine Department

17, 9, 2019

Objectives

- Define demography
- Describe major sources of population data
- List the important factors that determine population growth and calculate measures of these factor
- Interpret the population pyramid and differentiate between features of developed and developing countries

Objectives Cont.

- Understand the concept and determinants of demographic equilibrium
- Describe and understand the theory of demographic transition
- Define, compute and interpret the population distribution measures

What is demography?

- It 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**

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

Sources of demographic data

- Vital statistics (Birth and death registration)
- 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

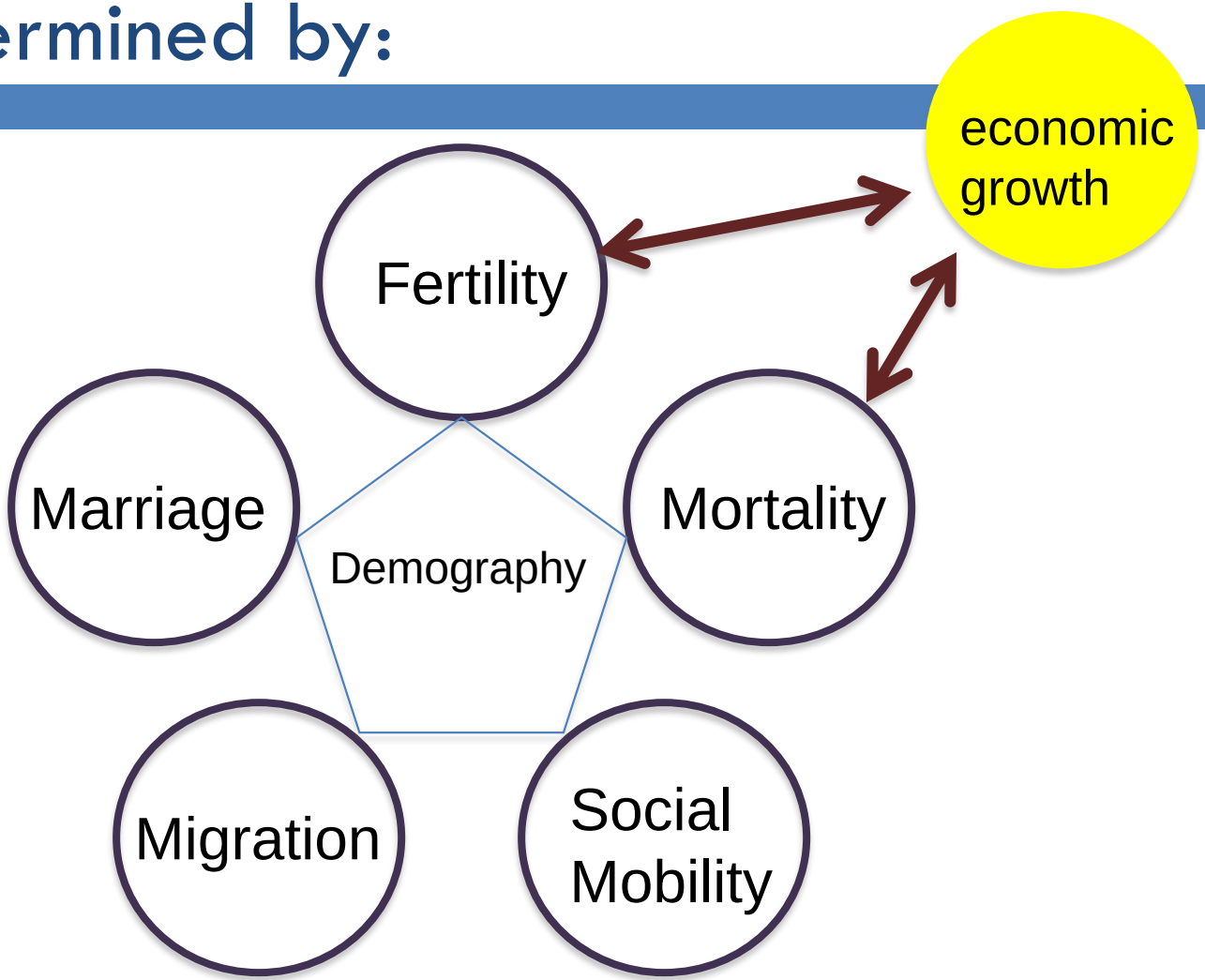
Available Demographic Indicators from GAS

- 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

الهيئة العامة للإحصاء
General Authority for Statistics

What determines demographic distribution of a population and population size?

Population size, distribution and composition are determined by:



1-Fertility

- The actual bearing of children, is determined by:

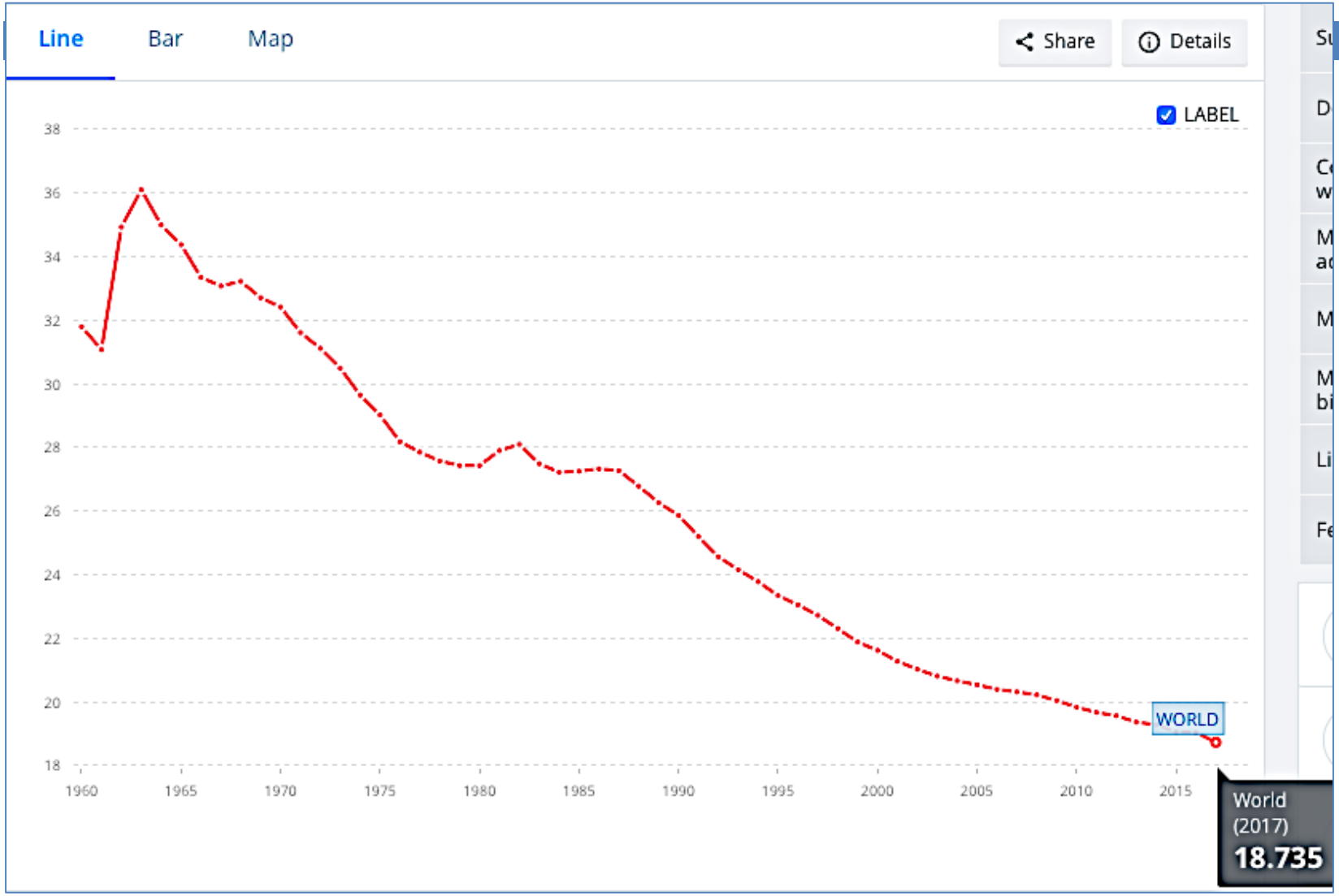
1. *Age at marriage* (inverse relationship)
2. *Duration of married life* (most happen in early y)
3. *Spacing of children*
4. *Education* (inverse relationship)
5. *Economic status* (inverse relationship)
6. *Religion*
7. *Nutrition* (Inverse relationship)
8. *Family planning*
9. *Other factor*….physiological, biological, cultural, social

Measures of Fertility

1. Crude Birth Rate:

$$\frac{\text{Number of live births in a year in a specific locality}}{\text{estimated mid-year population size in that same year and locality}} \times 1000$$

Crude Birth Rate Trend (World Bank)



Source: The World Bank. Available from: https://data.worldbank.org/indicator/SP.DYN.CBRT.IN.

Measures of Fertility cont.

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

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

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

Measures of Fertility cont.

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

Measures of Fertility cont.

4. Age-specific Fertility Rate:

- number of live births in a year to 1000 wome:n 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

Measures of Fertility cont.

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

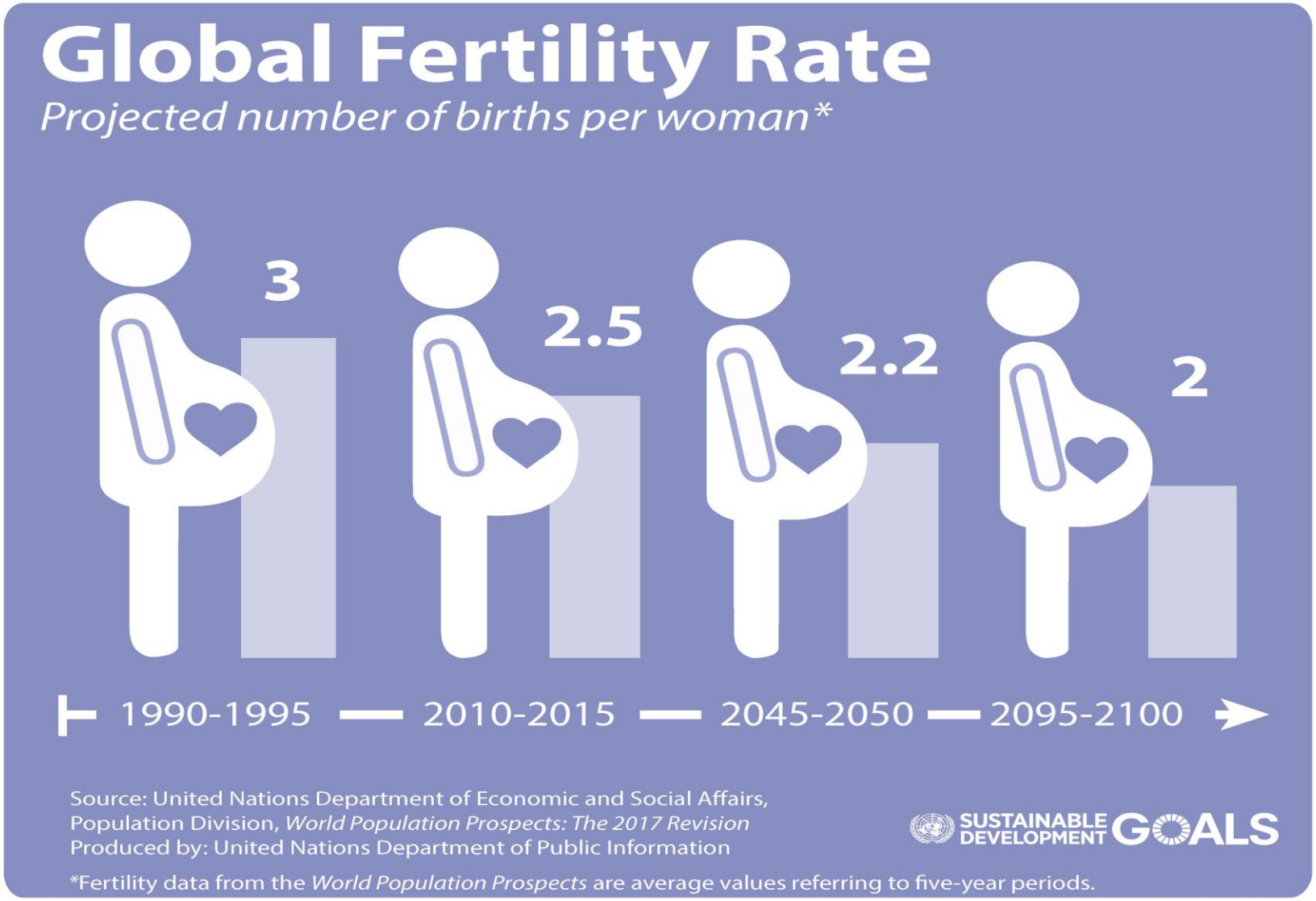
Approximates "completed family size"

$$\frac{\text{Sum of age specific fertility rates}}{1000} \text{ (rate per woman)}$$

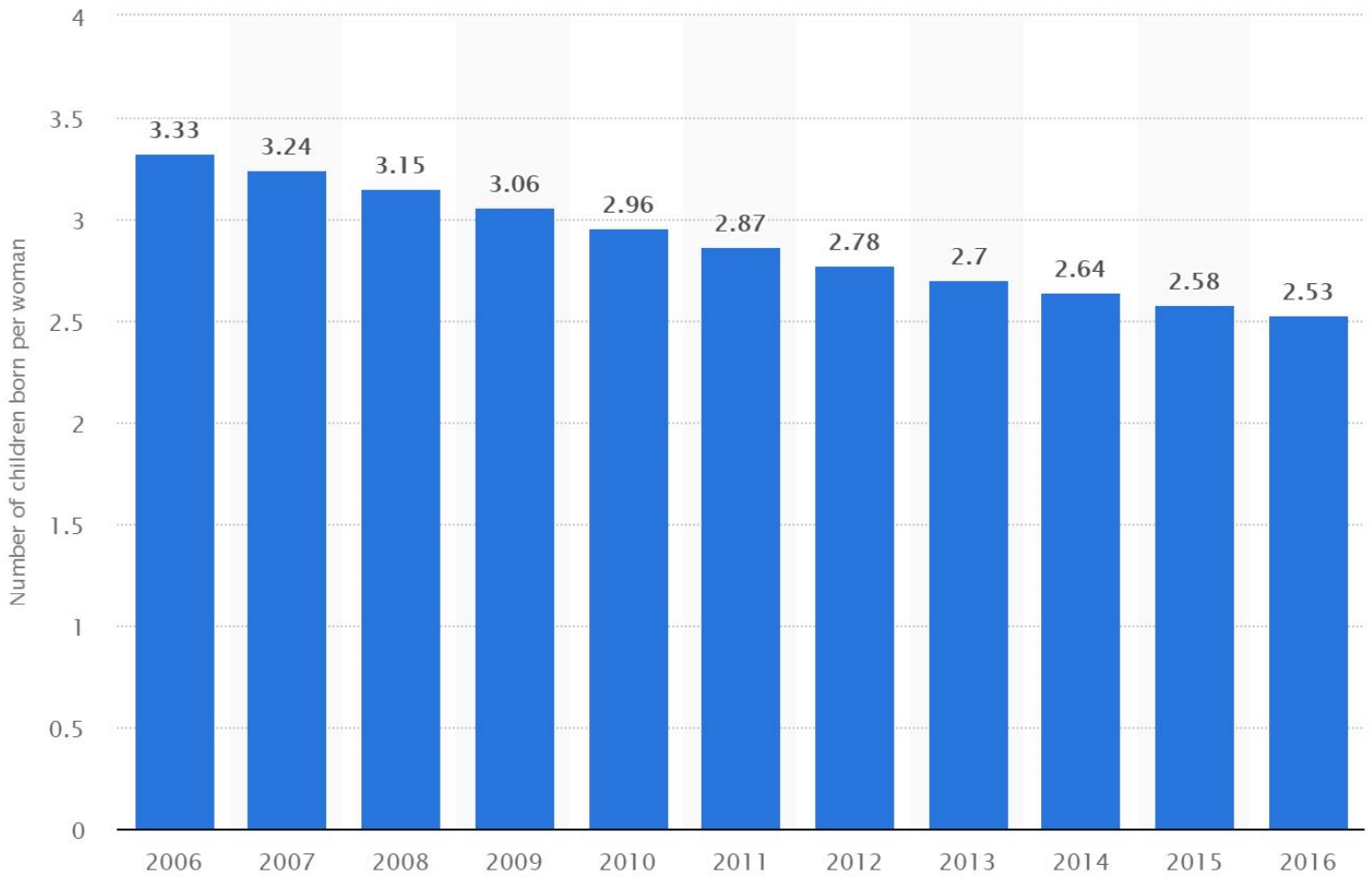
or ***Sum of age specific fertility rate*** (rate per 1000 women)

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

Global Total Fertility Rate 2017



Saudi Arabia Fertility Rate



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 (e.g. developed countries)
- How does that impact healthcare needs?

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

- **Fallacy in their argument:** Only focusing on birth control; 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

Migration continued.

- Ranking of countries that host migrants:

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

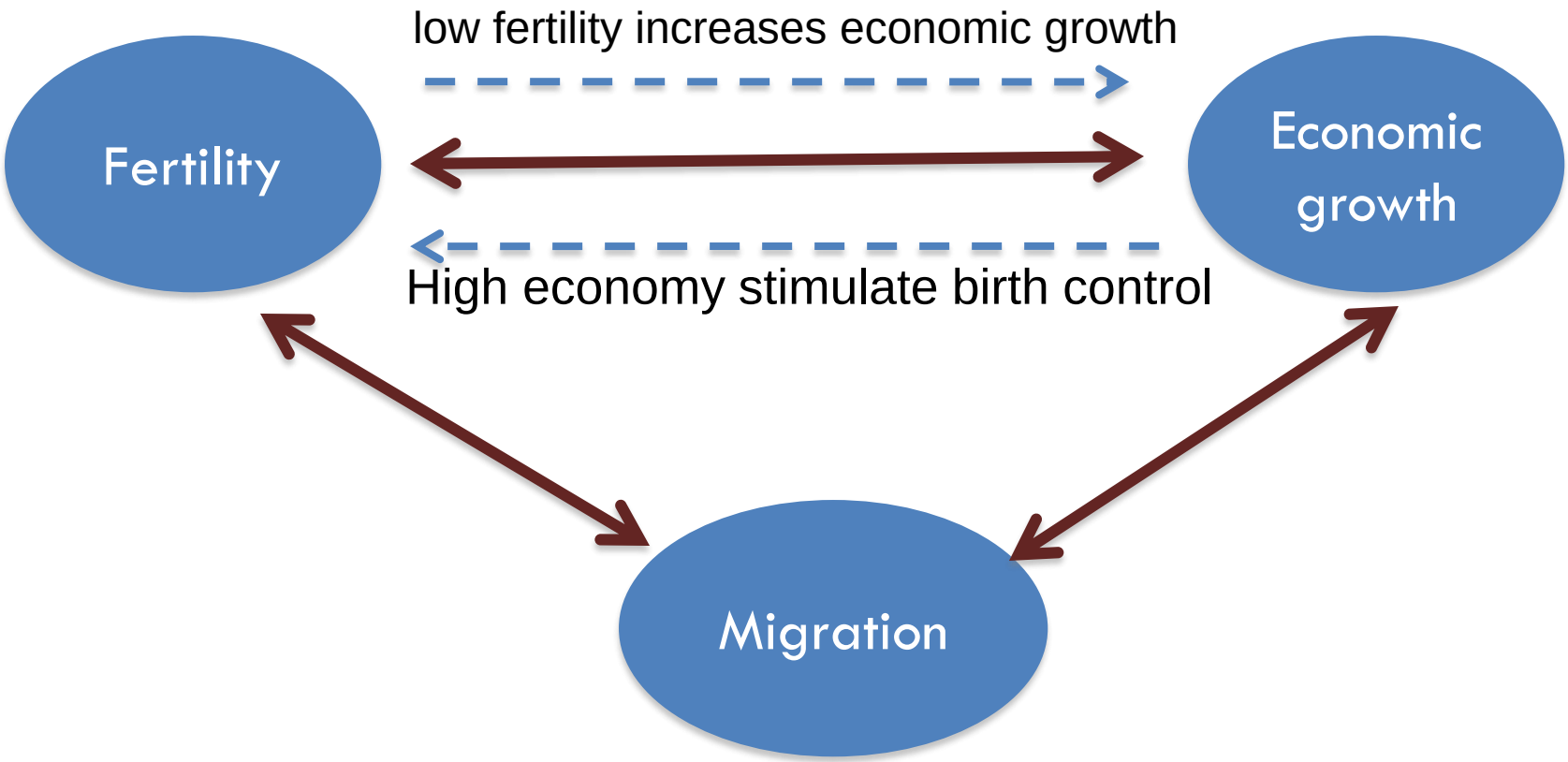
- In 2017, Saudi Arabia ranked the ***second*** worldwide in hosting migrants

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

Why is migration important to follow?

- It helps predict how the population will be shaped
- 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

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

Crude death rate

- 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

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

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

Stages of Demographic Transition

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

5 Stages for Demographic Transition

- **Stage 1:** (High Stationary)
  - High birth rate
  - High death rate

- **Stage 2:** (Early expanding)
  - Birth rates remain the same
  - Death rates begin to decline
  - e.g. many of the countries in developing world

5 Stages for Demographic Transition

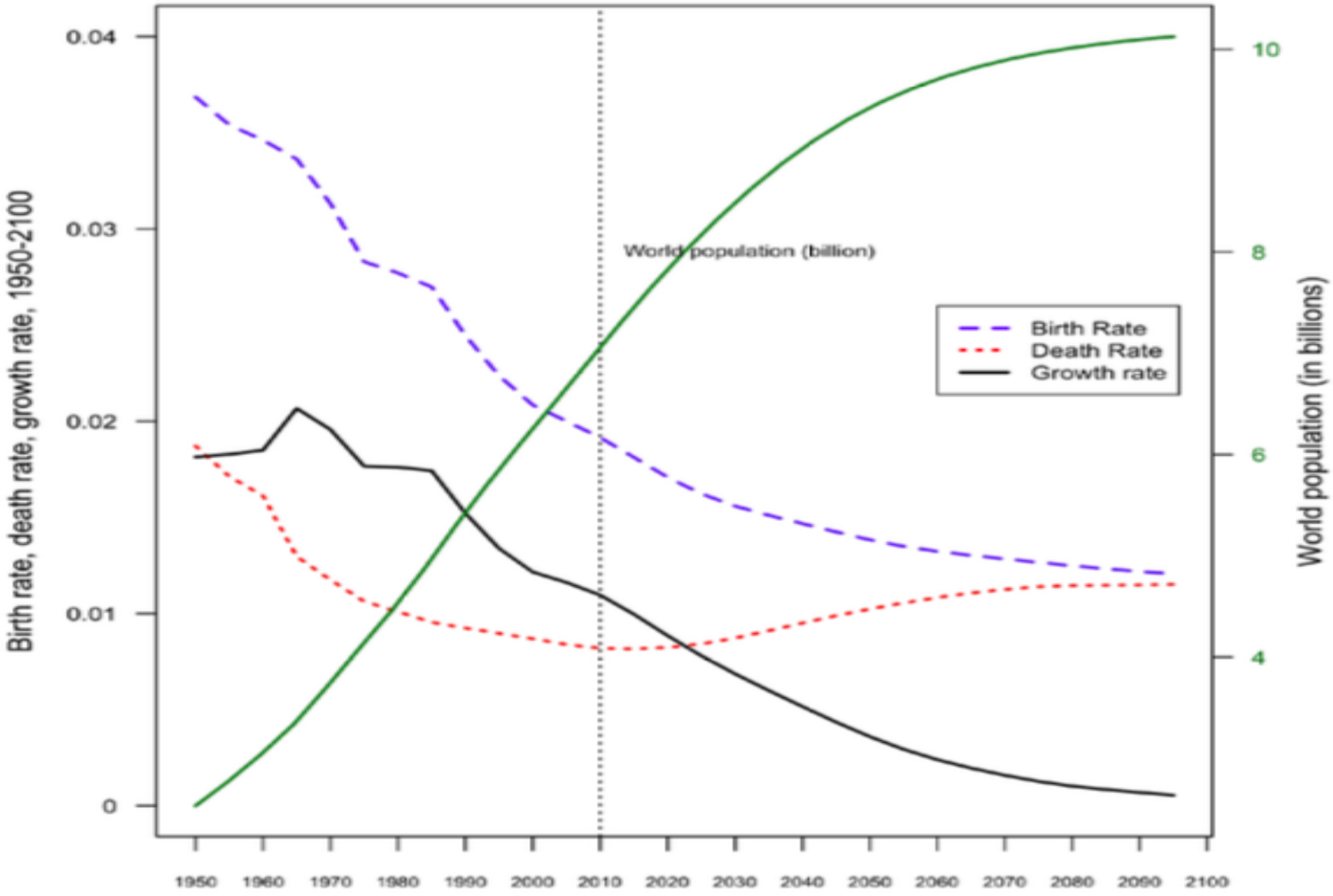
- **Stage 3:** (Late Expanding)
  - Death rates further decline
  - Birth rates begin to fall
  - Birth rates > death rates => population growth

- **Stage 4:** (Low stationary)
  - Low birth rate
  - Low death rate
  - Population becomes stationary; Zero population growth -> *Population equilibrium*
  - Many developed countries

5 Stages for Demographic Transition

- **Stage 5:** (Declining)
  - Birth rates very low
  - Death rates very low
  - Birth rates < death rates
  - Population decline
  - e.g. Germany and Hungary

Expected population growth from 1950-2100



Source: United Nations (2011)

Limitations of Demographic Transition Model

- Migration is not considered in the model

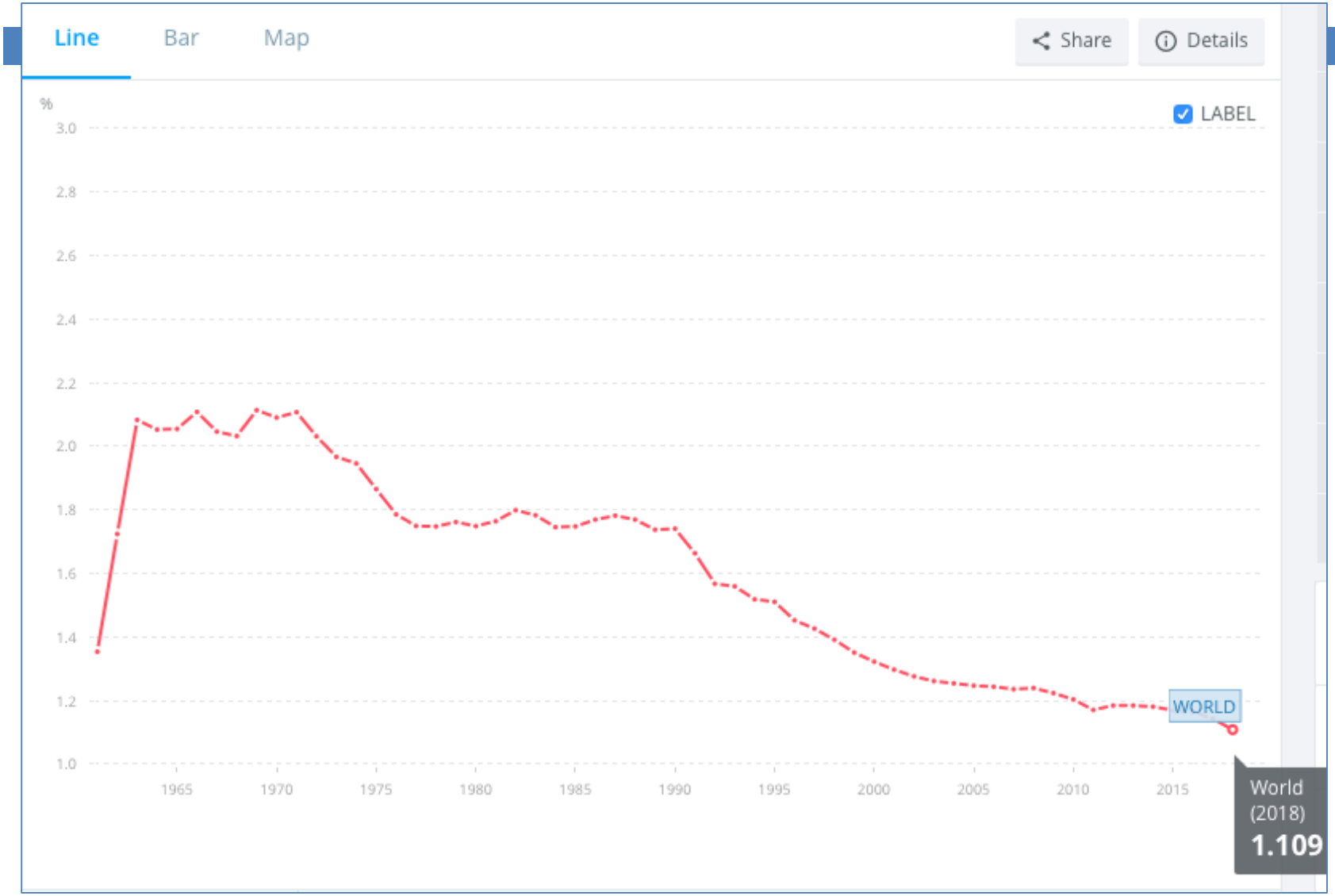
How do we measure population growth

- Population growth

Annual growth rate (expressed in %)=

Crude birth rate – Crude death rate

Annual Population Growth Worldwide



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

Where does KSA stand?

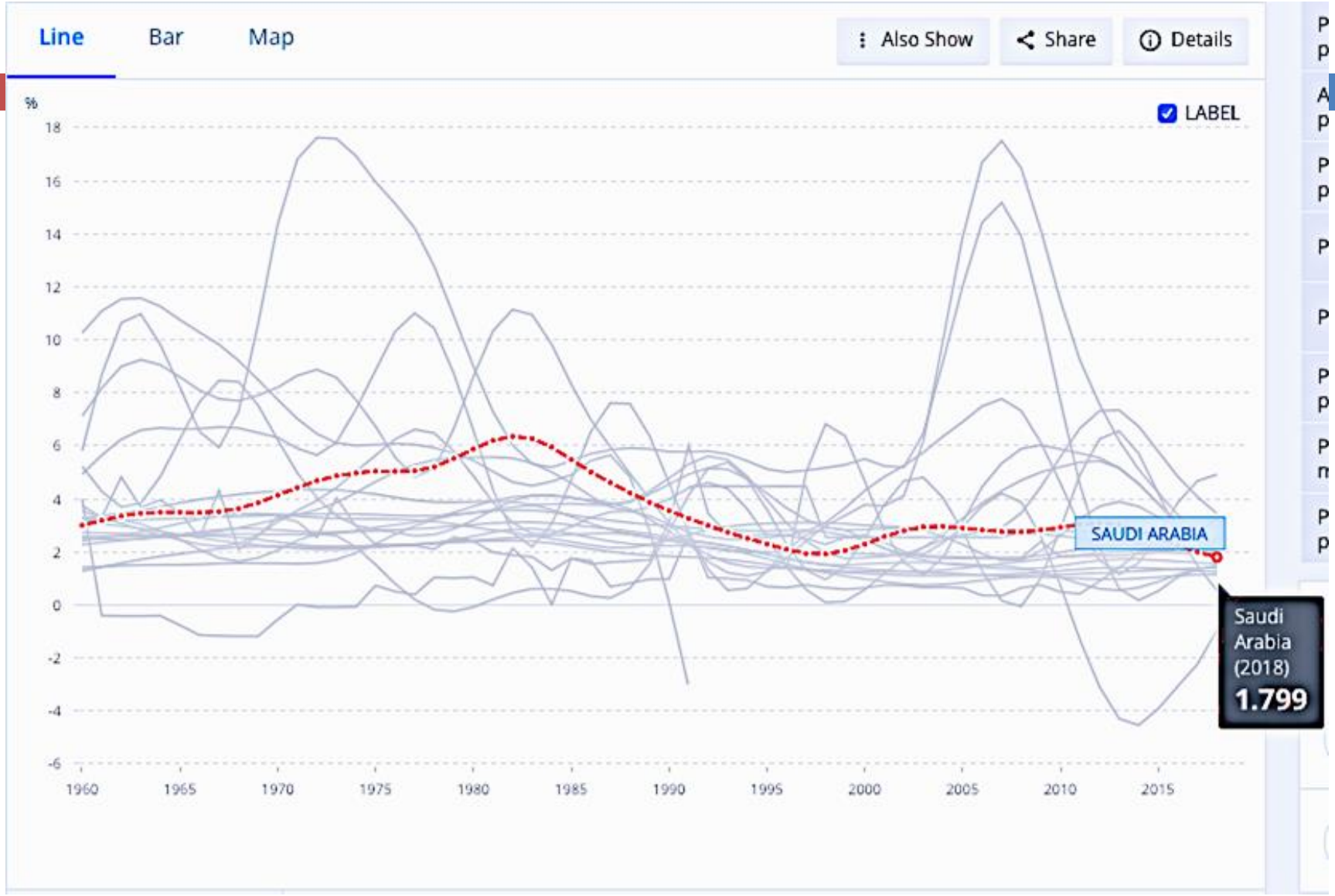
- unique cultural and religious norms
- death rates have decreased
- with economic development, women education and empowerment, fertility rates have not declined as fast as expected (lag in demographic transition)
- Result?

Source: Asharaf AS, Mouselhy MA. Aging in Saudi Arabia: Impact of demographic transition. Bold 2013; 24(1): 13-27

Annual Growth Rate in KSA

- Reported at 2.52% in 2016 (GAS)

ANNUAL POPULATION GROWTH RATE KSA



Source: The World Bank. Population Growth (Annual %), Saudi Arabia. Available at: https://data.worldbank.org/indicator/SP.POP.GROW?contextual=region&locations=SA. Accessed on Sep 17, 2019.

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/growth rate)
- Doubling time should NOT be used, as population growth is determined by many factors, and DOES NOT show exponential growth

Source: Bermingham JR. Exponential population growth and doubling times: are they dead or merely quiescent? Population and Environment 2003; 24(4): 313-327.

Example how "doubling time" is flawed

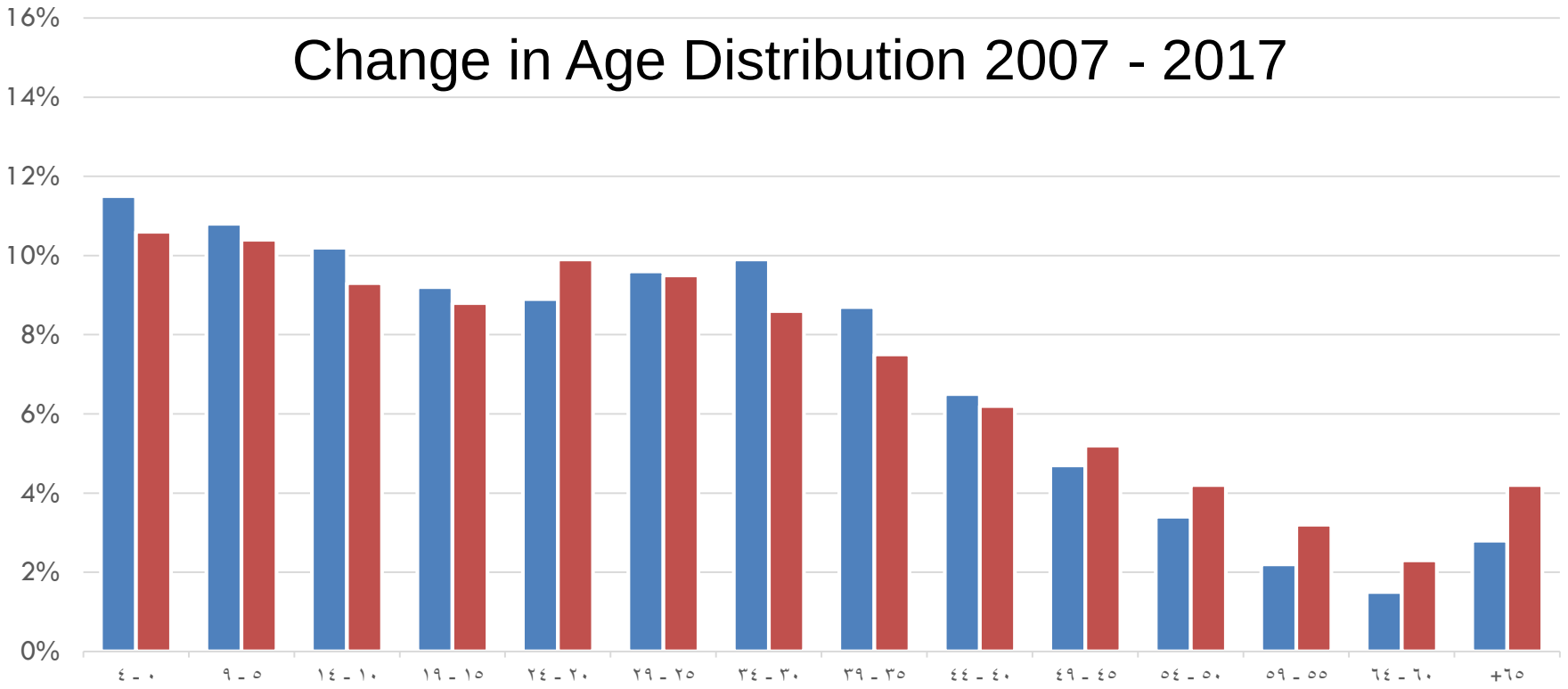
- https://data.worldbank.org/indicator/SP.POP.TOTL?locations=SA&view=chart

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 Saudi Arabia

- **Total Population in 2018:** 33,413,660 (Saudis only: 20,768,627)*



Source: General Authority for Statistics, 2017. Available from: https://www.stats.gov.sa/en/854-0

- Source: General Authority for Statistics, 2018. https://www.saudi.gov.sa/wps/portal/snp/pages/saudiReportsAndStatistics

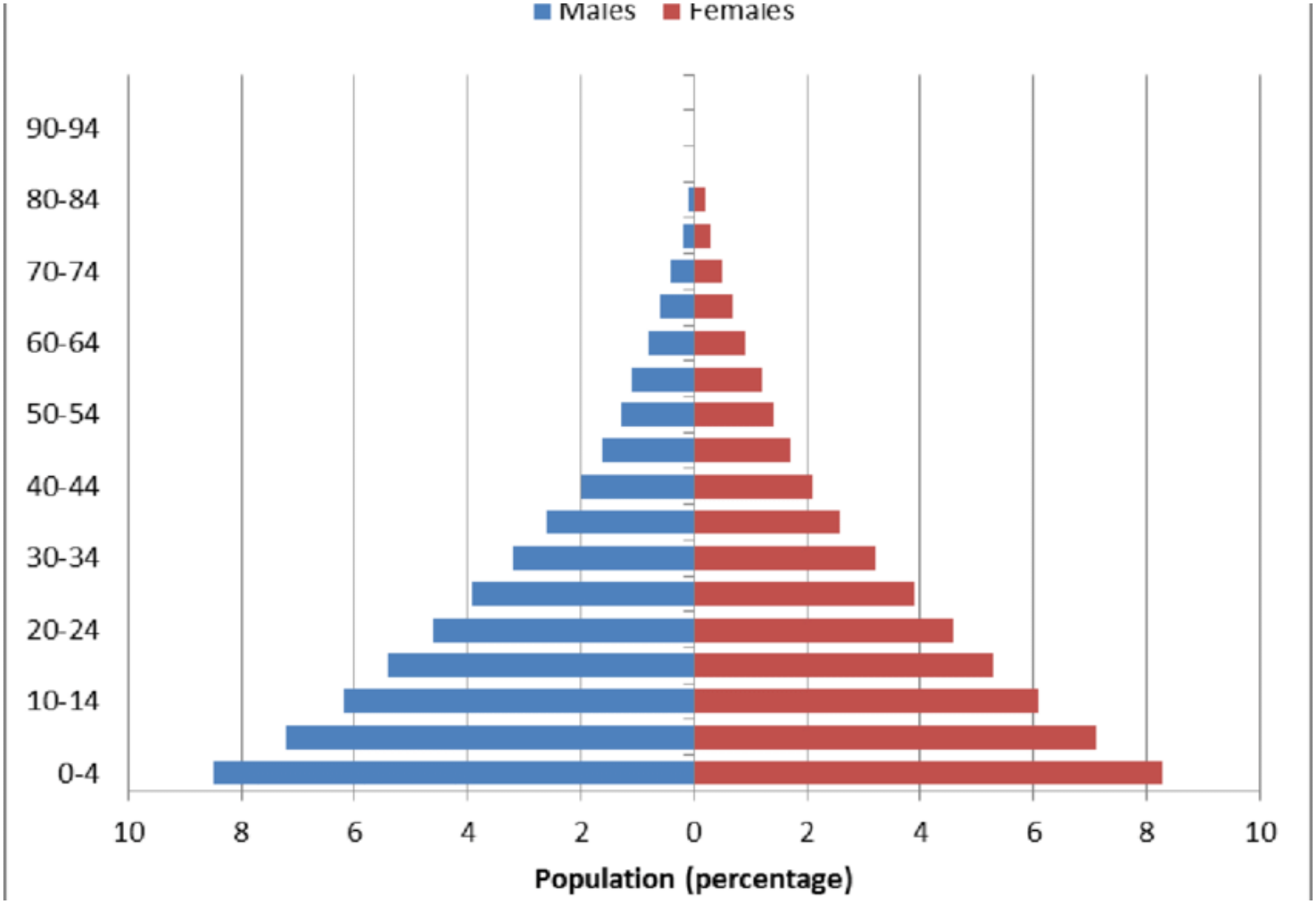
Population Pyramid

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

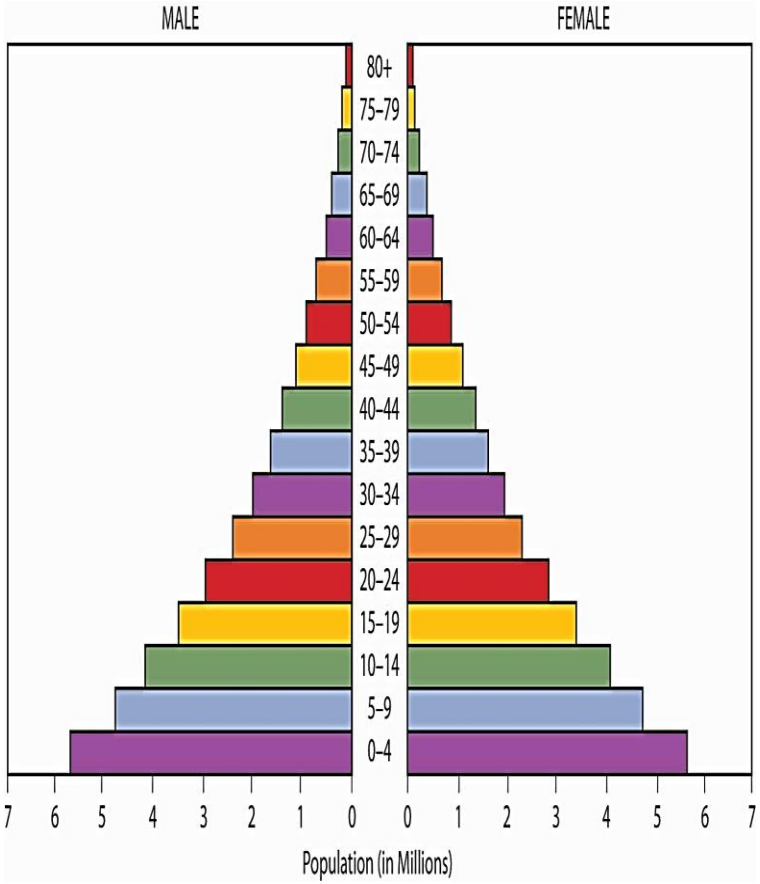
Example of population pyramid



Components of population pyramids

- **Base:** wide => high birth rate

  narrow => low birth rate
- **Apex:** old population (retired population) ….wide? narrow?
- **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 life span

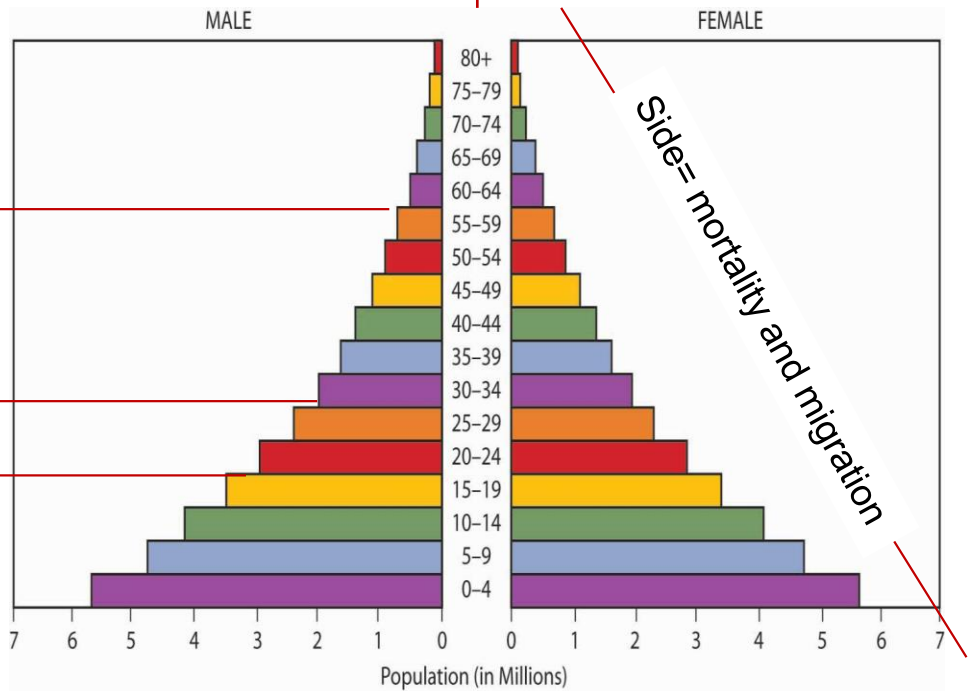
- ***Median age*** -Age that divide the population into two halves

  -Small in population with high births

  -Large in population with low births

Apex= People living to old age

People ≥ 60 years=
Old dependency



Side= mortality and migration

Height= life span

Median age

People < 15 years=
Young dependency

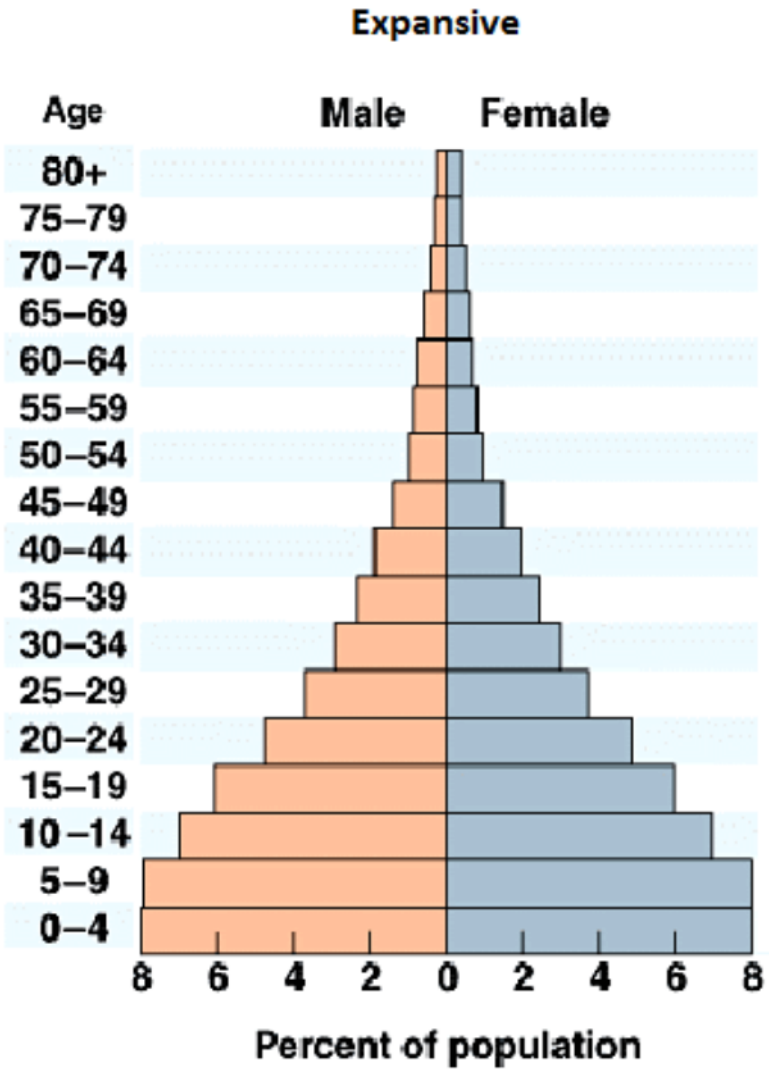
Base= births

Types of population pyramids

1. Expansive
2. Stationary
3. Constrictive

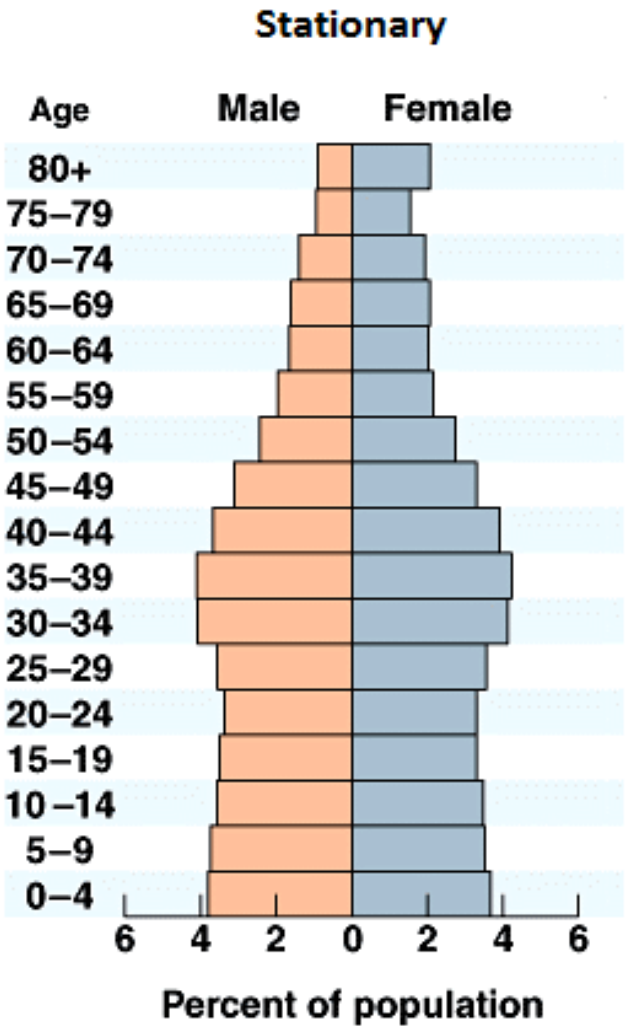
1- Expansive population pyramid

- 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



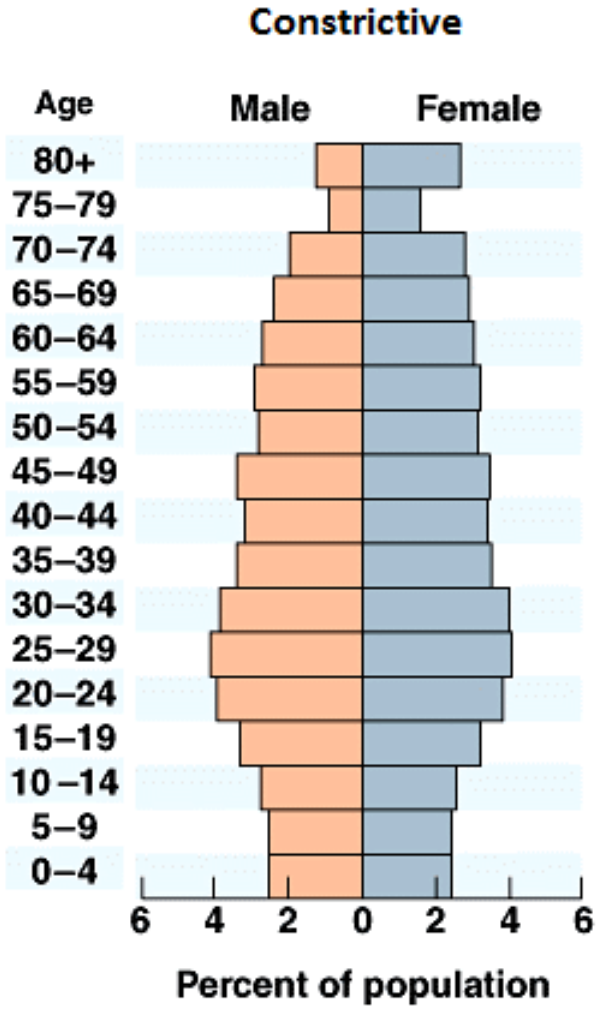
2-Stationary population pyramid

- It is showing unchanging pattern of fertility and mortality
- Age groups almost equal, but it is expected to see smaller figures at the oldest age groups



3-Constrictive population pyramid

- Narrow base
- Apex wider
- It is more common when immigrants are factored out
- Indicated:
  - High level of education
  - Use of birth control
  - Good health care system



Population pyramid in Saudi Arabia over the years

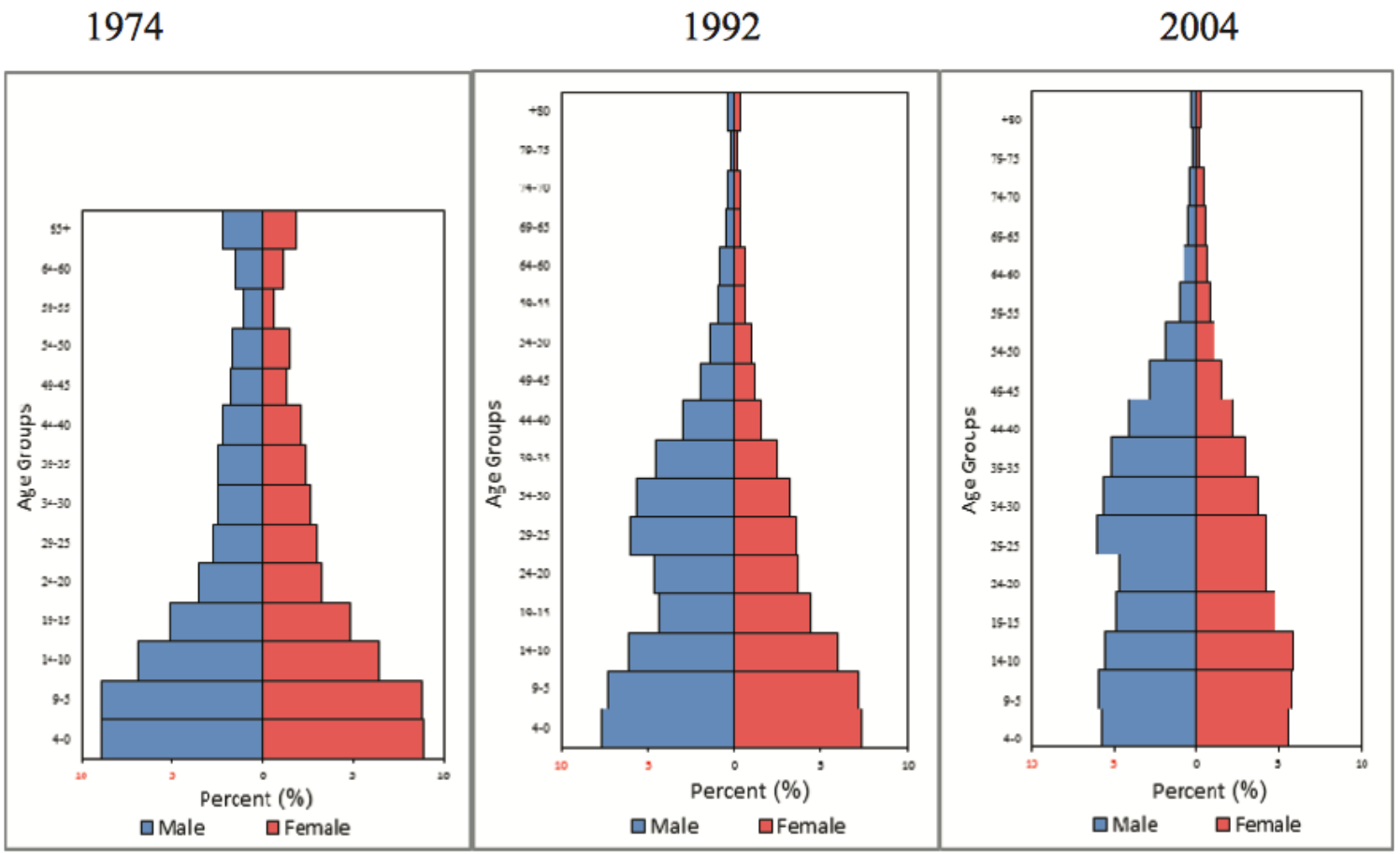


Figure 1. Age pyramid of total population.

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

Population pyramid in Saudi Arabia over the years

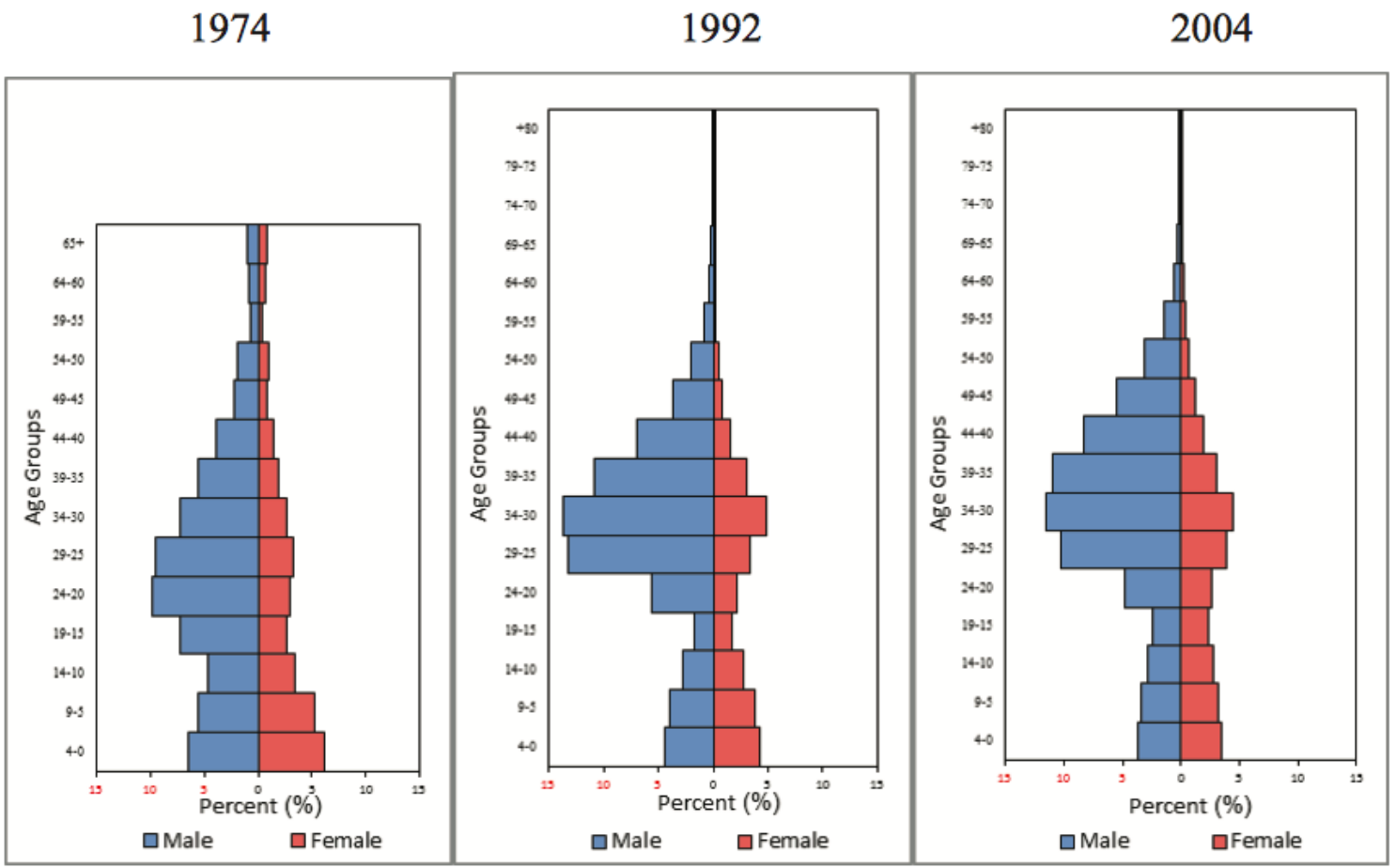
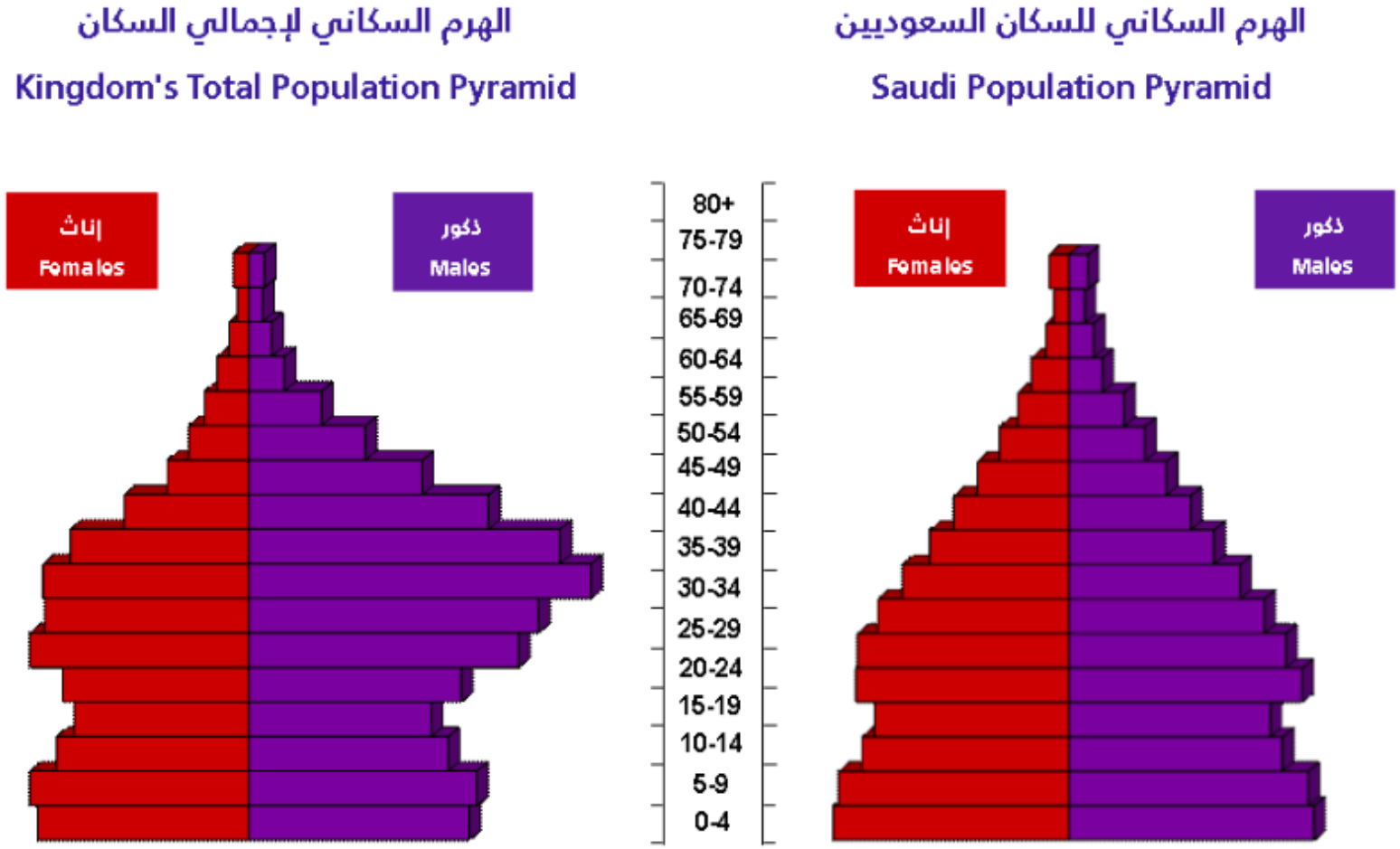


Figure 3. Age pyramid of expatriate population .

Source: Abu Ashwan M, 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

Other important population distribution measures

- Sex Ratio

Other important population distribution measures

- 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)

- 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

Any

Questions?