

DEMOGRAPHY: POPULATION DYNAMICS

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LECTURE OBJECTIVES:

At the end of the lecture the student should be able to:

- List factors affecting Population Dynamics (Cont.)
- Define and Calculate fertility rates
- Define and calculate mortality rates
- Define and mention types of migration



FACTORS AFFECTING POPULATION DYNAMICS

1. **Fertility** (births)
2. **Mortality** (deaths)
3. **Migration**.

1. Mortality Rates

A **mortality rate** is a measure of the frequency of occurrence of death in a defined population during a specified period of time.

$$\text{Mortality rate} = \frac{\text{deaths occurring during a given time period}}{\text{size of the population among which the deaths occurred}} \times 10^n$$

○ **Crude Death Rate (CDR)**

The crude mortality rate is the mortality rate from all causes of death for an entire population.

We usually multiply by 1000.

Crude Death Rate =

$$\frac{\text{Total number of deaths in a certain year and locality}}{\text{Estimated mid-year population (Same year and locality)}} \times 1000$$

= ... Deaths/1000 individual in the specified year and locality.

Mid-Year Population

- It is important to use the population size at the midpoint of the time interval as an estimate of the average population at risk especially if:
- A denominator population is growing or shrinking during the period of time for which a rate is to be computed.

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- e.g. If a death rate is to be calculated for the year 2000, then the population of July 1, 2000 is used for the denominator.

Age-Specific Mortality Rates

- An age-specific mortality rate is a mortality rate limited to a particular age group.
- The **numerator** is the number of deaths in that age group
- The **denominator** is the number of persons in that age group in the population.
- Examples of age-specific mortality rates are neonatal, post-neonatal, infant and under 5-years mortality rates.

$$\text{Age specific death rate} = \frac{\text{Number of persons dying in a certain age and a certain year and area}}{\text{Total number in the same age group in the same year and same area}} \times 1000$$

Infant Mortality Rate (per 1 000 live births)

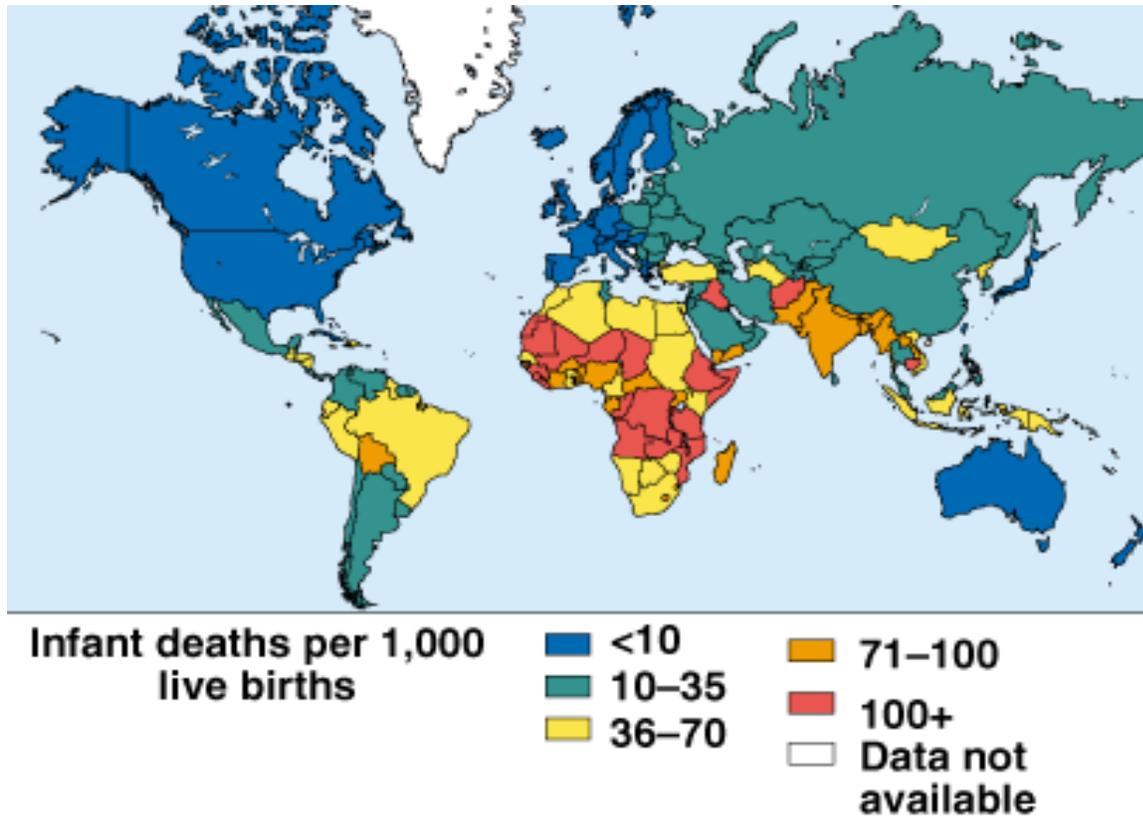
Infant mortality rate is the probability of a child born in a specific year or period dying before reaching the age of one.

In Saudi Arabia (2006)

- both sexes 21.0
- female 20
- male 22.0

$$\text{Infant mortality rate} = \frac{\text{Total number of deaths from zero up to less than one year during a year and in a given locality}}{\text{Total number of live births in the same year and locality}} \times 1000$$

Infant Mortality Rate



Neonatal Mortality Rate (per 1 000 live births)

The number of deaths of neonates (infants <28 days of age) in a calendar year, divided by number of live births in that year; multiplied by 1000.

In Saudi Arabia (2004):

- Neonatal Mortality Rate =11

$$\text{Neonatal mortality rate} = \frac{\text{Total number of deaths from zero up to less than 28 days during a year and in a given locality}}{\text{Total number of live births in the same year and locality}} \times 1000$$

Post-Neonatal Mortality Rate

(per 1 000 live births)

Post-neonatal mortality rate is the number of deaths among infants from **28 days** up to **1 year** of age during a given time period divided by the number of live births during the same time period multiplied by 1,000

$$\text{Post - Neonatal mortality rate} = \frac{\text{Total number of deaths from 28 days up to less than one year during a year and in a given locality}}{\text{Total number of live births in the same year and locality}} \times 1000$$

Period of Infancy



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Stillbirth rate (per 1000 total births)

- For international comparison purposes, stillbirths are defined as third trimester fetal deaths (> or = 1000 grams or > or = 28 weeks).
- Total births: "Total births" is defined as the sum of live births and still births.

$$\text{Still birth rate} = \frac{\text{Number of still births during a year and in a given locality}}{\text{Total births (live births + still births) in the same year and locality}} \times 1000$$

Still Birth Ratio (Per 1000 Total Births)

Number of fetal deaths of **28 weeks of gestation or more** in certain year and locality per 1000 live births.

Still birth ratio

$$= \frac{\text{Number of fetal deaths of 28 weeks of gestation or more in a year and in a given locality}}{\text{Number of live births in the same year and locality}} \times 1000$$

The difference between Stillbirth RATE and RATIO: difference in denominator:

Rate: total births (live and stillbirths)

Ratio: live births (ratio means comparing so u r comparing stillbirth to live)

Perinatal Mortality Rate

It is expressed as the sum number of still births and early neonatal deaths (less than 7 days of life) per 1000 total births (still births plus live births).

Perinatal M.R. =

$$\frac{\text{No. of stillbirths} + \text{No. of early neonatal deaths in certain year and locality}}{\text{Total births (Still and livebirths) in the same year and locality}} \times 1000$$

It the best indicator of Maternal and Child Health services

Under-5 Mortality Rate

(per 1 000 live births)

Under-five mortality rate is the probability of a child born in a specific year or period dying before reaching the age of five. (from zero to less than 5)

In Saudi Arabia (2006)

- both sexes 26
- female 23
- male 28

The under 5 - years mortality rate

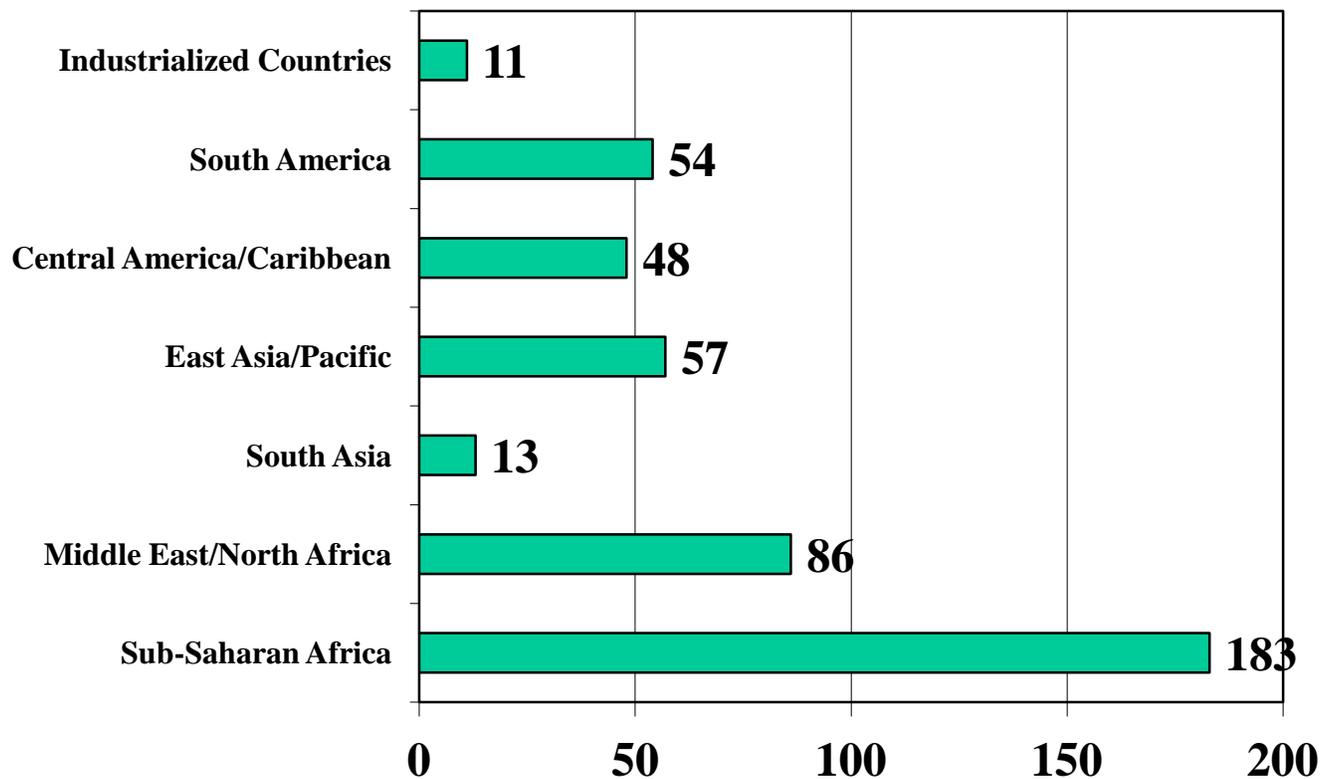
$$= \frac{\text{Total number of deaths among children under 5 - years of age during a year and in a given locality}}{\text{Total number of live births in the same year and locality}} \times 1000$$

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Child Mortality Rates

(deaths of children under age five per 1,000 live births)



Sub-Saharan Africa has the highest child mortality rates 183 deaths per 1000, industrialized countries have the lowest.

Adult Mortality Rate (Per 1000 Population)

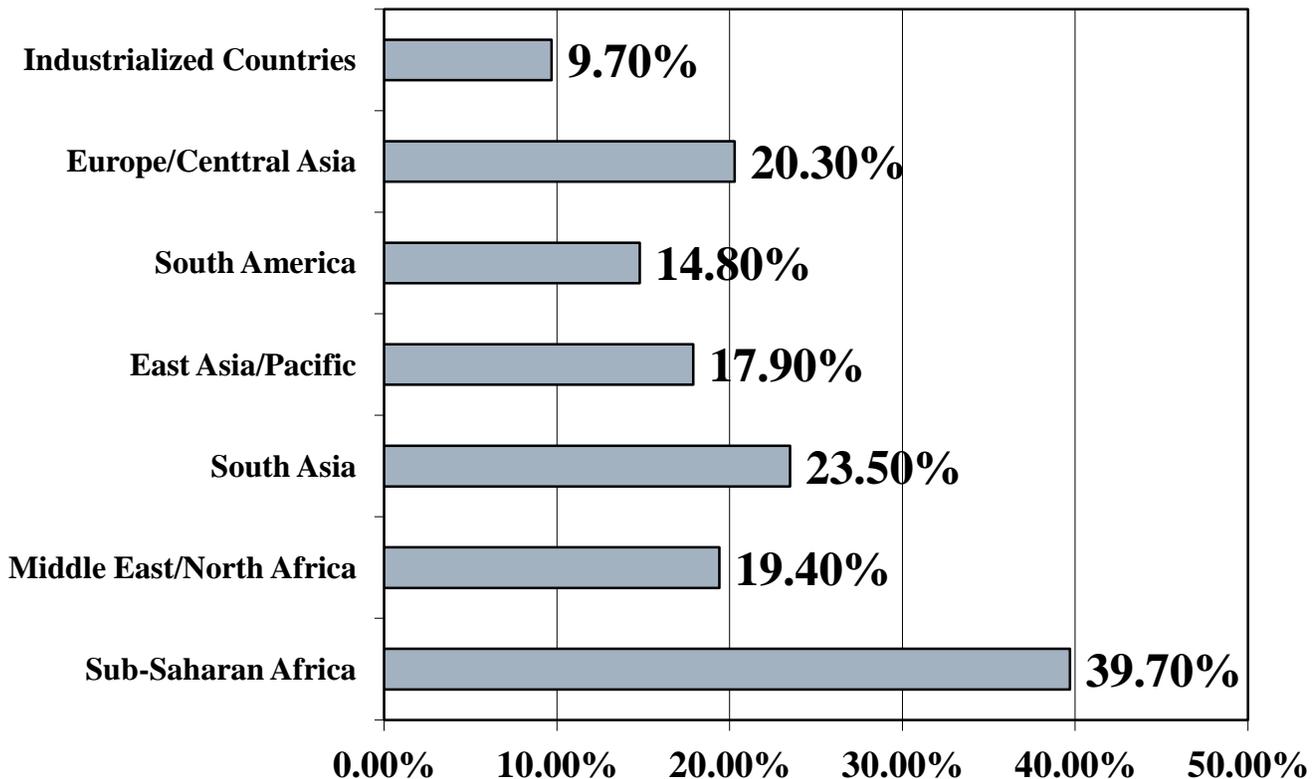
- Probability that a 15 year old person will die before reaching his/her 60th birthday.
- In Saudi Arabia (2006)
 - both sexes 178
 - female 136
 - male 205

Adult mortality rate

$$= \frac{\text{Number of persons dying between 15 - 60 in a certain year and area}}{\text{Total number of population between 15 - 60 in the same year and same area}} \times 1000$$

Adult Mortality Rates

(probability of death between ages 15 and 60)



Maternal Mortality Ratio

(per 100 000 live births)

The number of maternal deaths per 100 000 live births during a specified time period, usually 1 year.

- In Saudi Arabia (2005)
- MMR= 18

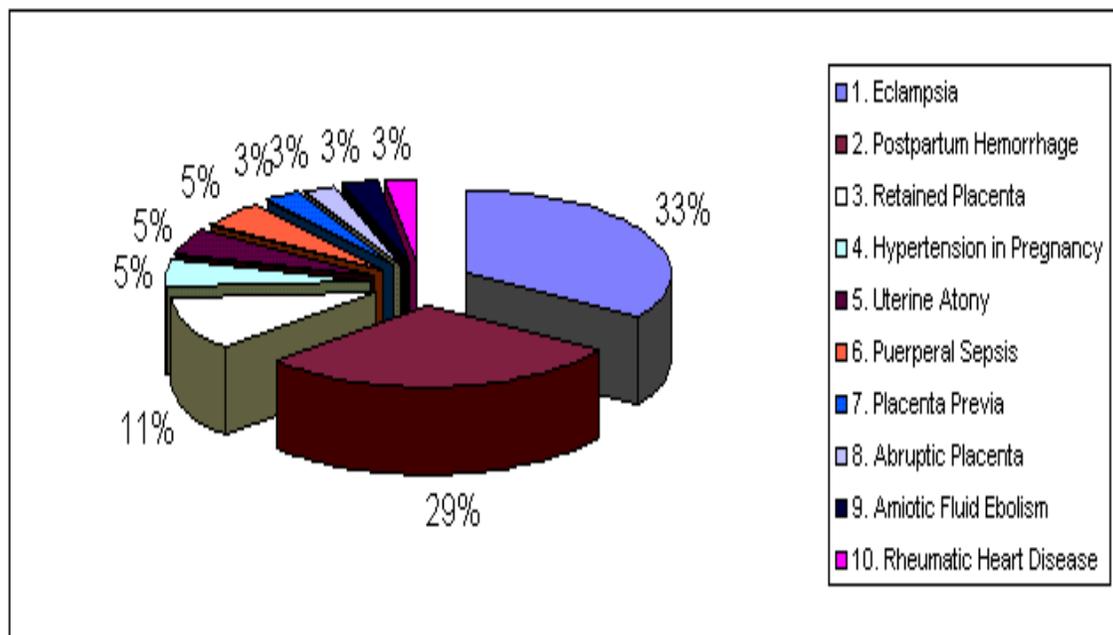
Maternal death is the death of a woman **while pregnant or within 42 days after termination of pregnancy**, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.

Maternal mortality ratio

$$\frac{\text{Number of Maternal deaths assigned to causes related to pregnancy in a given year and locality}}{\text{Number of live births in the same year and locality}} \times 100,000$$

Maternal Mortality: Leading Causes

Percent Distribution
2001



Cause-Specific Mortality Rate

- The number of deaths attributed to a specific cause divided by the population at the midpoint of the time period multiplied by 100,000.

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

Example of Cause-specific mortality rates

- Deaths due to tuberculosis (per 100 000 population)
- In Saudi Arabia (2006) =5.0

Specific death rate due to tuberculosis =

$$\frac{\text{No. of deaths of TB in a certain year and locality}}{\text{Estimated mid-year population in same year and locality}} \times 100,000$$

Proportionate Mortality Rates

Defined as the number of deaths assigned to a specific cause in a calendar year, divided by the total number of deaths in that year, the quotient multiplied by 100

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

Case Fatality Rate (Death To Case Ratio)

$$\text{Case fatality rate} = \frac{\text{Total number of deaths from a certain disease in a year and in a given locality}}{\text{Total number of cases having the same disease in the same year and locality}} \times 100$$

It reflects severity and virulence of diseases

Frequently used measures of mortality

Measure	Numerator (x)	Denominator (y)	Expressed per number at risk (10 ⁿ)
Crude Death Rate	total number of deaths reported during a given time interval	Estimated mid-interval population	1,000 or 100,000
Cause-specific Death Rate	# deaths assigned to a specific cause during a given time interval	Estimated mid-interval population	100,000
Proportional Mortality	# deaths assigned to a specific cause during a given time interval	Total number of deaths from all causes during the same interval	100 or 1,000
Death-to-Case Ratio	# deaths assigned to a specific disease during a given time interval	# new cases of that disease reported during the same time interval	100
Neonatal Mortality Rate	# deaths under 28 days of age during a given time interval	# live births during the same time interval	1,000
Postneonatal Mortality Rate	# deaths from 28 days to, but not including, 1 year of age, during a given time interval	# live births during the same time interval	1,000
Infant Mortality Rate	# deaths under 1 year of age during a given time interval	# live births reported during the same time interval	1,000
Maternal Mortality Rate	# deaths assigned to pregnancy-related causes during a given time interval	# live births during the same time interval	100,000

2. MIGRATION

Migration is the movement of populations across a specified boundary for the purpose of residing.

Migration is the change of residence of a person or group of persons for better life and higher standard of living.

- The terms **immigration** and **emigration** are used to refer to moves between countries (international migration). (*immigration means coming to a country to live in it while emigration means leaving a country*).
- The parallel terms: **in-migration** and **out-migration** are used for internal movement between different areas within a country (internal migration).

Types of Migration

I- Internal migration

It is the movement within the boundaries of a given country.

Examples of internal migration:

- 1 - Rural - Urban migration.
- 2 - Movement of nomads.
- 3 - Movement of temporary and seasonal nature.
- 4 - Movement between and within urban areas.

II- External migration

a) Permanent migration:

An example is the permanent movement of Arabs to the U.S.A., Australia and Canada.

b) Temporary migration:

It is the migration over the borders of one society to another for the aim of working for a number of years, with the intent of an eventual return to the motherland.

e.g. migration of Egyptian professionals and laborers to Arab Countries.

In many countries, the effect of migration is minimal when compared to fertility and mortality.

References

- Last JM, editor. Dictionary of epidemiology. 4th ed. New York: Oxford University Press; 2001
- World Health Statistics 2011. Indicator compendium. *Indicator Code Book*.
World Health Statistics - World Health Statistics indicators
- Core Health Indicators, Health indicators WHO. Available at:
http://apps.who.int/whosis/database/core/core_select.cfm?strISO3