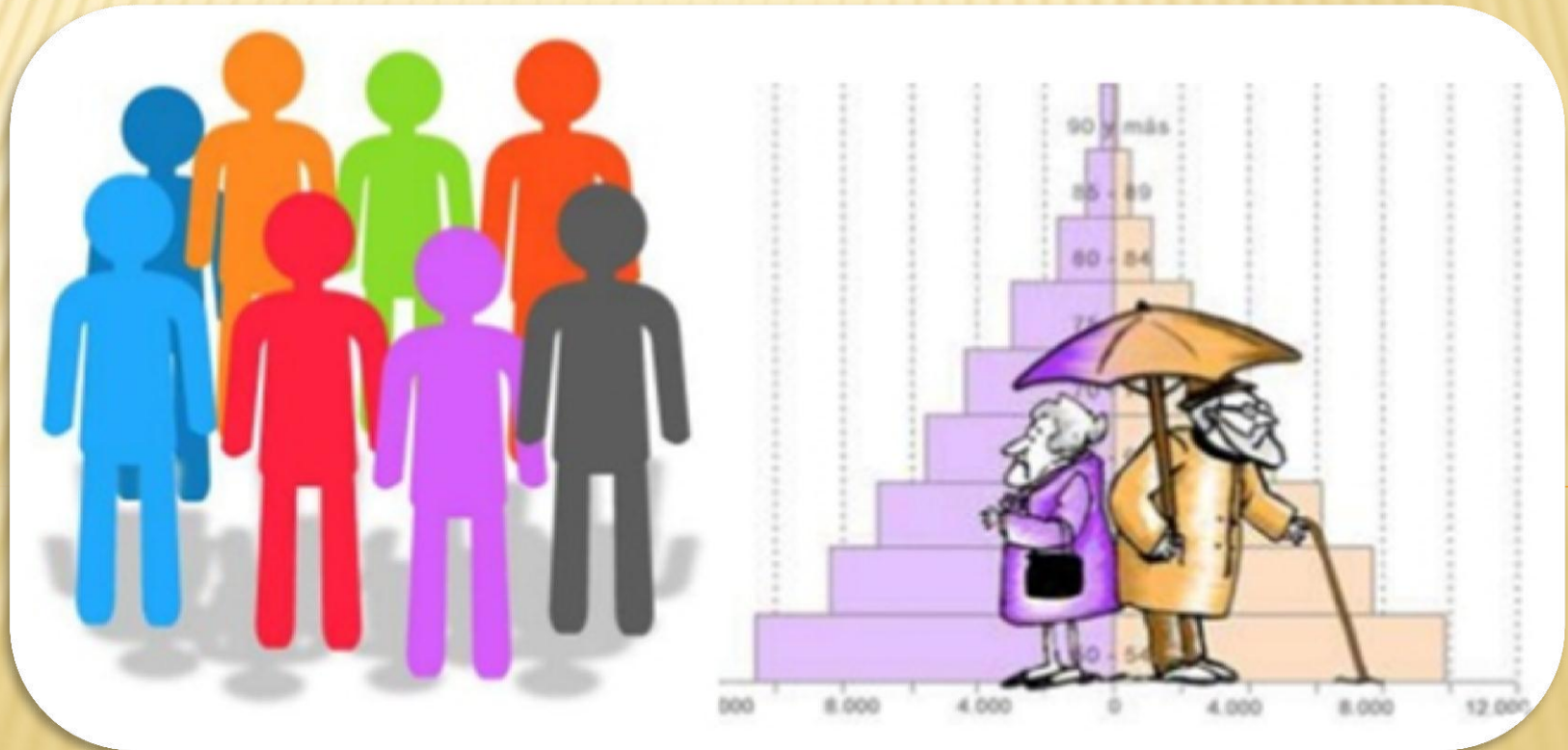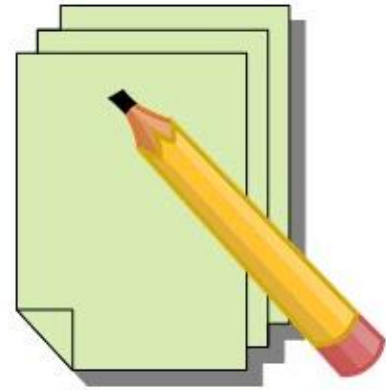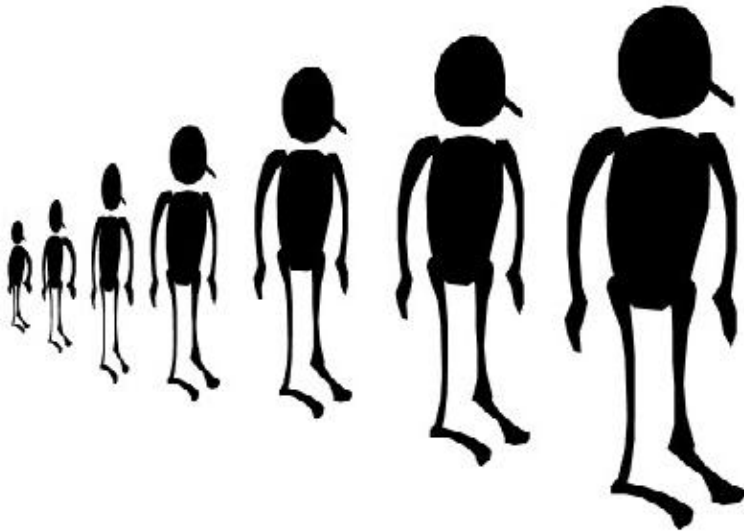# VITAL INDICES

HEALTH INDICES (VITAL RATES)

Vital indices are **quantitative measures** that describe various aspects of health status of a defined community & summarize the vital events in the human life.

Births   **Marriage**   **Fertility**   **Diseases**   **Deaths**

Birth	Fertility	Morbidity	Mortality
Crude Birth Rate (CBR)	CBR	Incidence	Crude Death
	General Fertility	Prevalence	Age specific Mortality
	Age-specific Fertility	Attack	Age-Sex specific Mortality
	Total Fertility	Case Fatality	Proportional (Relative) Mortality
	Fecundity		
	Gross Reproduction		
	Net Reproduction		

CRUDE BIRTH RATE (CBR)

Crude Birth Rate (CBR) (births/1000 people)

$$= \frac{\text{total number of births}}{\text{total population}} \times 1000$$

In 2020, crude birth rate for Jordan was 21.11 births per thousand population. Crude birth rate of Jordan fell gradually from 50.02 births per thousand population in 1971 to 21.11 births per thousand population in 2020.

Examples:

- 180,000 live births in calendar year 2005 among state residents 12,300,000 estimated population in calendar year 2005 for state residents (180,000/12,300,000) x 1,000 = 14.6 live births per 1,000 state residents in 2005

Although CBR describes the increase in population over time, yet it is **not specific** for comparison between countries because the denominator is the whole population.

The rate must exclude young girls, unmarried and menopausal women who are infertile.

Yet, this rate is used for its **simplicity**, easy to know birth number because of **legal registration** in health office & population number at any time (from census and inter censuses methods).

FERTILITY INDICES

Birth	**Fertility**	**Morbidity**	**Mortality**
Crude Birth	CBR	Incidence	Crude Death
	General Fertility	Prevalence	Age specific Mortality
	Age-specific Fertility	Attack	Age-Sex specific Mortality
	Total Fertility	Case Fatality	Proportional (Relative) Mortality
	Fecundity		
	Gross Reproduction		
	Net Reproduction		

FERTILITY

The reproduction performance of a population

GENERAL FERTILITY RATE (GFR)

GFR=

$$\frac{\text{No. of live births}}{\text{No. of women (15- 49ys) in the same locality \& year.}} \times 1000$$

Since, women in the reproductive age constitutes about 25% (1/4) of the population, therefore the GFR is considered to be about 4 times the CBR.

Advantages	Disadvantages

- GFR is a more accurate index than CBR because:
  - It is related only to females in the reproductive age.
  - It is more suitable for comparison between countries since it eliminates the difference in sex composition.

- It doesn't consider that not all females in the reproductive age are married & fertile.
- It doesn't consider the difference in females' age distribution in different countries.

AGE-SPECIFIC FERTILITY RATE (ASFR)

It is calculated for **every 5 years** of the reproductive age of a woman. It is important for differentiating between fertility behaviors at different age groups.

ASFR=

$$\frac{\text{No. of live births born to mothers aged 15 -19 years old}}{\text{No. of women of the same age group (15-19 years) in a certain locality \& year.}} \times 1000$$

Therefore there are "7" ASFRs (every 5 years) for all women in the reproductive period.

It is a better index than the GFR as it takes into account the difference in age distribution of females in different areas & the degree of fertility in each age group.

TOTAL FERTILITY RATE (TFR)

It is the average no. of live children that would be born to a woman if she passes through her child bearing period following the ASFR in a given year & locality.

It equals the summation of the 7 ASFRs.

TFR in Jordan 2.76 births per woman (2018) children / woman. 3.33 births per woman (2018) in Egypt

TFR = 5 Σ ASFR (for 5-year age for 7 groups)

TFR in 2016= 5 (SFR 15-19ys + SFR 20-24 +SFR 25-29 + SFR 30-34 + SFR 35-39+ SFR 40-44 + SFR 45-49)

FECUNDITY RATE (FR)

$$FR = \frac{\text{No. of live births}}{\text{Married women in a certain locality \& year.}} \times 1000$$

It is a better index than the GFR as it includes only married women.

GROSS REPRODUCTION RATE (GRR)

GRR =

Only born females, (expected to be future mothers) X 1000
Women in the childbearing period.

= TFR **X** Proportion of females in relation to the total births.

- ❑ **In Jordan, it is estimated to be (1.57), which means that every woman will give birth to 1 to 2 women during her childbearing period (2016)**
- ▪ However, it does not consider the possibility of deaths of women during their child bearing period.

NET REPRODUCTION RATE (NRR)

It takes into consideration the deaths of women during their childbearing period using life tables of females.

NRR = GRR X Life expectancy of females during childbearing period from life tables.

The best measure of fertility.

FACTORS AFFECTING FERTILITY:

Age & sex structure of the population	• The greater the no. of women in childbearing period in a certain pop. the higher fertility level.
Age of marriage	• The younger the age of marriage the higher is the fertility.
Socioeconomic conditions	• Higher economic status & higher level of education of women are associated with low fertility rates.
Fecundity	• Physiological capability of couples to reproduce is affected by their health conditions.
Fertility Motives	• Reasons that motivate a couple to increase or decrease No. of children they will have.

| High Fertility Motives	Low Fertility Motives
• **Economic motives:** Children as a source of income to the family.	• **Economic motives:** large expenses for good education & health.
• **Health motives:** High infant & preschool death rates.	• **Health motives:**
• **Cultural & religious motives:**	- Mother & Children Health are better with suitable spacing of pregnancies.
- Traditions & community "large family is considered as a source of power & social status".	- Large family:
- Some wives "large no. of children ensure security& prevent divorce".	*Bad effect on physical, mental, social & spiritual health of the family.
- Family planning is prohibited in Islam.	*Hazards of deprivation, child abuse, delinquency.

MORBIDITY INDICES

MORBIDITY RATES

They are disease occurrence data that are used in disease surveillance.

The most widely used measures of illness in a population are incidence & prevalence rates.
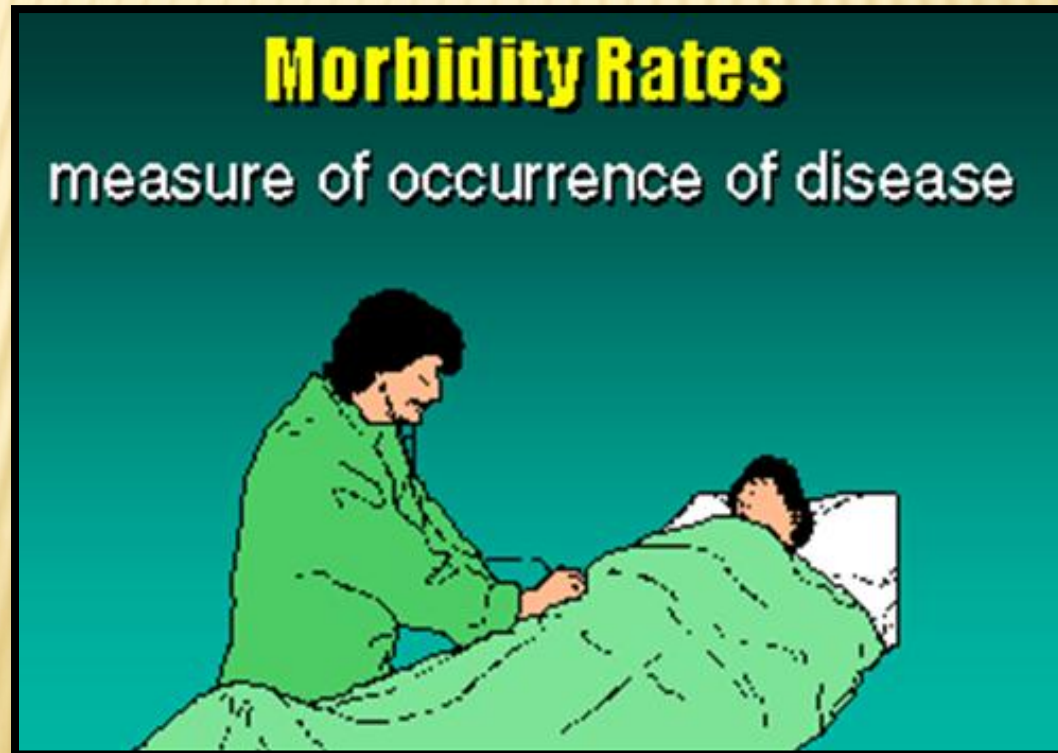
Birth

Crude Birth

Fertility

CBR

General Fertility

Age-specific Fertility

Total Fertility

Fecundity

Gross Reproduction

Net Reproduction

Morbidity

Incidence

Prevalence

Attack

Case Fatality

Mortality

Crude Death

Age specific Mortality

Age-Sex specific Mortality

Proportional (Relative) Mortality

INCIDENCE RATE

Incidence rate = $\dfrac{\text{Number of new cases over a time period}}{\text{Total population at risk during the same time period}}$ X multiplier (e.g., 100,000)

Number of new cases = 1,085
Population at risk = 37,105

Incidence rate = $\dfrac{1,085}{37,105}$ = 0.02924/8 = 0.003655 x 100,000

= 365.5 cases per 100,000 women per year

Incidence

The **population at risk** can be the entire population in a specified area, or specific group of people "people of certain age, sex etc".

Importance

It is very important parameter in epidemiology.

It tells us about new cases & thus we can associate this event of illness with the possible causal factors.

It can be calculated for both chronic & acute diseases.

It measures the relative importance of one illness over the other.

PREVALENCE RATE

Point prevalence

- The no. of current cases of an illness (old & new) at a point of time / Population examined at same point of time X Constant.
- Point of time is a short period (hours, days…).

Period Prevalence

- The no. of current cases of an illness (old & new) over a period of time / midyear population of the same period X Constant.
- Period of time is longer (months, years).

$$\text{Point prevalence rate} = \frac{\begin{array}{c}\text{Number of existing cases}\\\text{of the disease}\end{array}}{\text{Total study population}} \text{ At a point in time} \times 1,000$$

$$\text{Period prevalence rate} = \frac{\begin{array}{c}\text{Number of existing}\\\text{cases of the disease}\end{array}}{\text{Average study population}} \text{ Within a time period} \times 1,000$$

Importance

It is an indicator of the burden of a disease on a population since it reflects the no. of cases whether old or new.
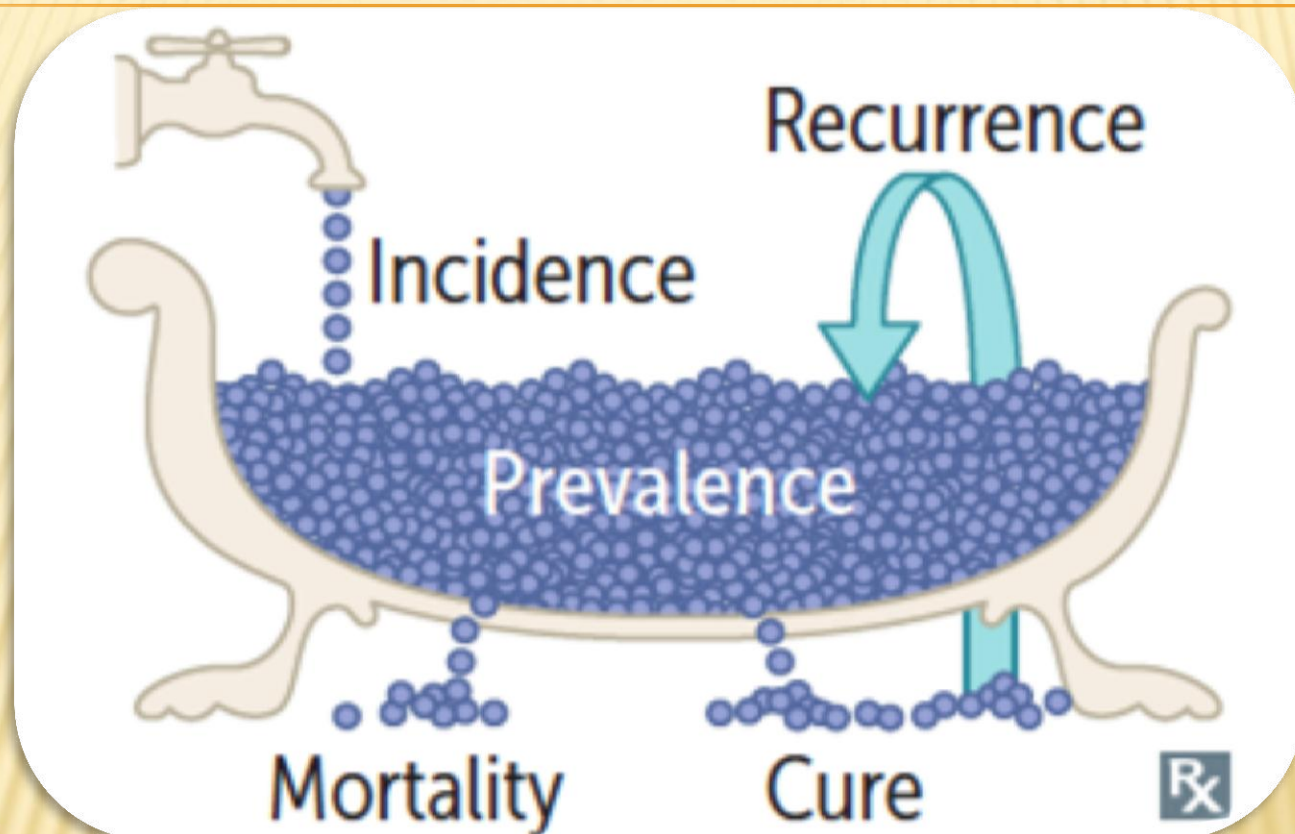
It measures the relative importance of one illness over the other.

It can be used for evaluation of health services.

INCIDENCE VS PREVALENCE

Prevalence	Measures **existing** cases of disease and is expressed as a proportion
Incidence	Measures **new** cases of disease and is expressed in person-time units

EXAMPLE:

- Suppose we were interested in the problem of diabetes in a nursing home with 800 residents. We would begin by doing blood tests on all residents to determine which were diabetic. If 50 of the residents were diabetic initially, then the **prevalence** of diabetes at this point in time would be 50/800 = 0.0625. The standard way of expressing this would be to say that the prevalence was 62.5 per 1000 residents or 6.25 per 100 residents, or 0.0625%

- If we want to estimate the **incidence** of diabetes in this population over the next 12 months, we need to exclude the 50 people who are already diabetic and focus on the 750 residents who are disease-free initially. We would then need to do additional blood tests to determine how many new cases developed during the span of time. Because some of the residents might die or be transferred to other facilities during the year, we ideally would like to take blood tests frequently, but for financial and logistical reasons, we might simply conduct a second series of blood tests after one year. If 25 were found to be diabetic at the end of a year, then the incidence would be 25/750 = 0.0333 or about 3.3 per hundred (3.3%) over a year. Note that we are describing the time span, i.e. the period of observation, when we report the incidence.

ATTACK RATE

It is an incidence rate estimated in an epidemic (or outbreaks) when observation of population at risk is for short period.

Attack rate =

$$\frac{\text{No. of new cases of specific disease during an epidemic}}{\text{Total no. of persons at risk during the same time.}} \times 100$$
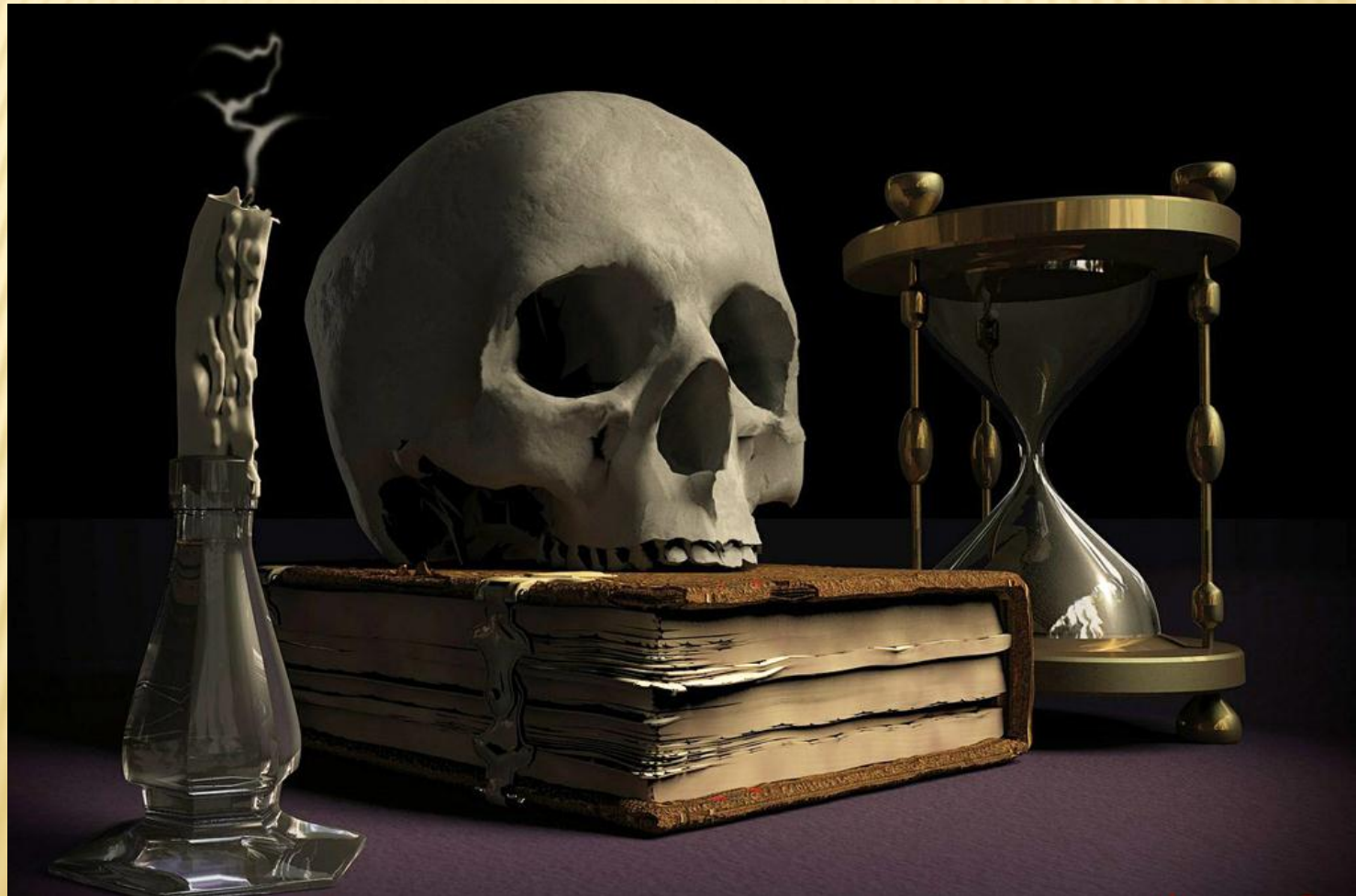
CASE FATALITY RATE

CFR =

No. of deaths of cases from specific illness   X constant.
No. of cases of the same illness in the same time and place

It measures the virulence of an agent & the severity of a disease.

Therefore is considered as a morbidity measure although it involves deaths.

MORTALITY RATES

DEATH INDICES (MEASURES OF MORTALITY)

Although not effective as the morbidity indices but sometimes they are the only available data.

• Death rates are important indicators of the health status in a community.

• They can indicate the impact of a particular cause on the population.

• They can study the relation of a certain cause to the disease occurrence.

Birth	**Fertility**	**Morbidity**	**Mortality**
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CRUDE DEATH RATE (CDR)

$$\frac{\text{Total No. of Deaths from all causes in 1 year} \times 1000}{\text{No. of persons in the population at mid year}}$$

In 2020, death rate for Jordan was 3.9 per 1,000 people. Fell from 9.9 per 1,000 people in 1971 to 3.9 per 1,000 people in 2020.

This improvement can be attributed to: **community development**, **better health services**, **application of modern techniques**, **new drugs**, and **health education** etc.

CDR is **not specific rate** as it includes all deaths in a population irrespective of its age, sex distribution or cause of death.

AGE SPECIFIC MORTALITY RATE (ASMR)

ASMR =

$$\frac{\text{No. of deaths in a specified age group \& specific time}}{\text{Population of the same age group \& at the same time period}} \times \text{constant}$$

ASMR describe the rate of deaths in each age group. The causes of deaths among age groups are different and therefore by using this rate we can prioritize these causes to be solved.
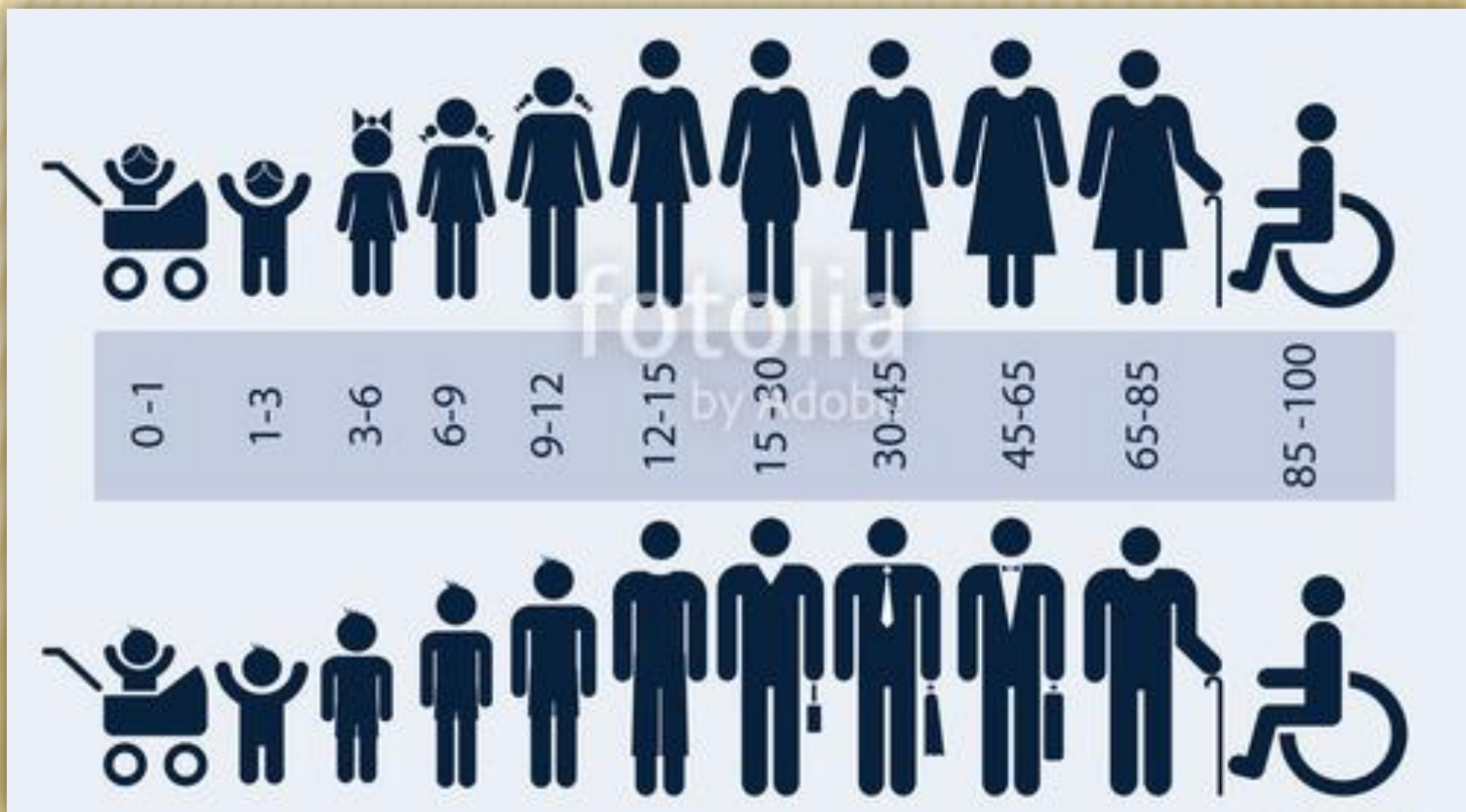
$$\text{Age specific mortality rate} = \frac{\text{Number of deaths of persons age 1--14 in a given year}}{\text{Total persons aged 1--14 in the same period (1 year)}} \times 100{,}000$$

$$\text{Age specific mortality rate} = \frac{\text{Number of deaths of rural elderly age 55+ in a given year}}{\text{Average population of rural elderly in the same period}} \times 100{,}000$$

AGE-SEX SPECIFIC MORTALITY RATE (ASSMR)

$$\frac{\text{No. of deaths of males at certain age group}}{\text{No. of males of the same age group in the same area and time}} \times 1000$$

CAUSE SPECIFIC MORTALITY RATE

$$\frac{\text{No. of deaths from a specific cause}}{\text{Population at the same time period}} \quad X \text{ constant}$$

Cause specific MR describes the severity of the disease to cause deaths.

Cancer has high cause specific MR.

PROPORTIONAL (RELATIVE) MORTALITY RATE

$$\frac{\text{No. of deaths from a specific cause}}{\text{Total deaths from all causes in the same area \& time}} \quad \text{X constant}$$

It describes the relative importance of a specific disease as a cause of mortality in relation to other causes

THANKS FOR LISTENING