Public Health

Title = Epidemiology 2

Lec no : 8

Done By = Lama khalaf

وَقُل رَّبِّ زِدْنِي عِلْمًا

Epidemiology (II) L7

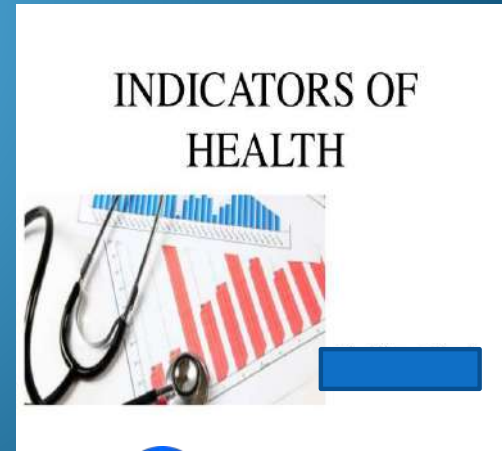**Associate Professor Dr. Eman A. Al-Kamil**

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INDICATORS OF HEALTH

Epidemiology International

Learning objectives:

At the end of the lecture ,the student will have an idea on:

I.   Indicators for measurement of health.
II.   Classification of indicators of health.

1. Fertility indicators
2. Mortality indicators
3. Morbidity indicators

III. Calculation of indicators of health.

INDICATORS OF HEALTH

Measuring the health status of the population

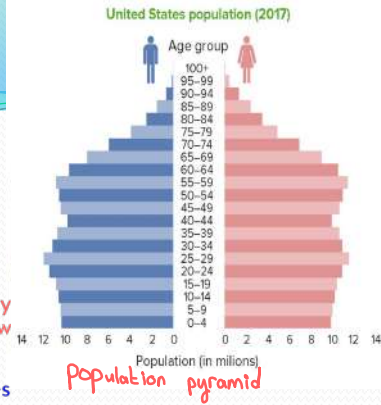1. **Fertility indicators**
2. **Mortality indicators**
3. **Morbidity indicators**

also if we know how many child are born every year we will know if our population is growing increasing or decreasing

they reflect the population pyramid..we know the construction of our community (how many children under 5?.. how many women in the productive age group? how many elderly people?)

all these components need special health care services

United States population (2017)

Age group
100+
95–99
90–94
85–89
80–84
75–79
70–74
65–69
60–64
55–59
50–54
45–49
40–44
35–39
30–34
25–29
20–24
15–19
10–14
5–9
0–4

14 12 10 8 6 4 2 0   0 2 4 6 8 10 12 14
Population (in milions)

Population pyramid

■Population studies are important in many aspects.

■Such studies are important to form a basis for supplying health services and health manpower.

if we knew how many children are born this year...we can predict how many elderly people we will have after 50y so we can plan for programs according to their needs

and what are the components of our population

■Without studying our population: who are they? and how will they be in the future? We can not plan effectively for current and future development programmes including the health care programms

also what are the common diseases in our community?

and plan for appropriate health care services according to the need of our population

MEASUREMENTS OF POPULATION FERTILITY

Demographic data may be measured and presented in many ways. Examples are

is our community fertile or not?

1. Measurements of population fertility: Fertility rates

To measure the level of population fertility we commonly use the following rates of fertility:

الي ماتو ما بدنا اياهم

من كل ألف شخص كم طفل
انولد؟

a. ***Crude birth rate*** is the annual number of <u>live</u> births per 1000 population per year.

الدكتورة حكت هتبعتلنا formulas
ندرب على حساب كل وحده فيهم

من كل الف مرأة**reproductive** كم طفل حي انولد؟

b. *General fertility rate* ,It represents the annual number of live births per 1000 women in the reproductive age (15-49 years).

ني مصادر بتعكي (١٤ - ٤٤)

لكل ألف مرأةمتزوجة كم طفل حي
انولد؟

c. *Marital specific fertility rate*. It represents the annual number of live births per 1000 married women in the reproductive age (15-49 years).

in Muslim countries only married women can have a baby so Marital fertility rate is always our choice in counting population fertility

4.The **natural increase rate :**is the crude birth rate minus the crude death rate of a population, to find out how much a country is growing ,

—كم معدل الزيادة السنوي.. to find out if our population is growing or not..

➢ Usually developing countries have a positive or high natural increase rate . birth rate higher than death rate

cauz we are fertile communities and having high birh rate every year

➢ Developed countries have a negative/neutral or low natural increase rate, but many developed countries have their population increasing due to immigration despite their negative NI.

this is due to good family planning methods .. حكيناا بالمحاضرة الماضية..
(low birth rate and high death rate) → due to high old age group

اليوم مصر صار عددهم 105 مليون نسمة
و الغريب بالموضوع انو خلال 57 يوم
250 الف طفل يعني بأقل من شهرين
زادو ربع مليون

➢ The formula for the rate of natural increase is:
(Crude birth rate −Crude death rate)/ 10, where birth and death rates are in per mil. ؟؟ الف
↗ million

➢ The result is the rate of natural increase in percentage form.

Jordan in 2021:2.7 million population crude birth rate was7.1 and crude death rate was 11.1 so there is a slow increase in birth rate

↙ الجواب بالـ % بطلع

➢ Jordan , crude birth rate (21.48 per 1,000) , Crude death rate (3.9 per 1,000 people in 2019.

per thousand   per thousand   بتصیراعدادها تطلع
                                   per million   acceptable

natural increase rate = 21.48 - 3.9 =17.58 /10=1.7%

what is the

2. Age composition of the population?

The distribution of any population is presented in the form of a table describing age groups in a convenient layout (Age groups), it might be possible to give some idea about the fertility of the population.

morbidity and mortality

-Table below shows the age composition of two populations,

developed countries   developing countries

population A and population B in percentages:

This table is called Frequency table.

Age groups (years)	Population A %	Population B %
<1	less birth rate 1.2	3.7
1-4	5.1	12.8
5-14	12.2	26.4
15-44	43.3	42.1
45-64	21.3	11.3
65+	due to high and good health status and services 16.9 high percentage of old age	3.7 →
Total	100.0	100.0

if above %40 the children percentage this means this population is fertile.

this reflects high fertility and high mortality and morbidity due to lack of development of the health care services

من ال percentage الاكثر من 40% تاعت الاطفال..بس 3.7 ضل عايش منهم بس كبرو

Notice that population B is very fertile as indicated by the high percentage of children under the age of 15 years (42.1%). The crude birth rate in this population is not less than 37 per 1000.

The corresponding percentage for population A is 18.5% and the crude birth rate is not less than 12 per 1000.

Notice also that the percentages of elderly people are very different in the two populations.
These difference indicates :

both high in population B

1. The differences in mortality between the two populations.
2. The differences in morbidity between the two populations
3. The differences in the health status.
4. The differences in the health services.
5. The differences in the socioeconomic state. *Better in population A*
6. The differences in the maternity and child health services, and family planning services.

Factors affecting fertility: Determinants of fertility

The level of fertility is a net of interaction of many factors.

1. Indirect determinants

low socio-economic population has high fertility rate due to not having family planning methods

الي بشتغلو بالزراعة برضو يكون عندهم اطفال كتير خصوصاً اولاد عشان يساعدهم بالزراعة

■ Socioeconomic variables, family income, education, occupation

in middle east we love large extended family

في ناس بحكو انو الاسلام حرم تنظيم النسل بس هو طبعا لأ قال الله تعالى: {وفصاله في عامين} [لقمان:14]

■ Cultural variables ,religion, beliefs and values.

■ Health services (maternity and child health services).

follow up the growth of the child, nutritional متابعه خلال فترة الحمل, *state and vaccination*

2. Direct determinants

■ Proportion **of married women** *we said that only married women can get pregnant*

it's not just for determining the number of babies but regulation and spacing between them so the mother could return back to her normal health

■ Family planning services, Contraception

■ Induced abortion *illegal abortion in unwanted pregnancies when women aren't taking contraceptives*

■ Lactational infecundability *(lactational amenorrhea)* هي نفسها ال *pausing of menstrual cycle during lactation*

natural family planning method

■ Sterility *tubal ligation* بعض النساء بتعمل و الرجال *vasectomy* عشان ما يصير حمل

إما لأسباب متعلقة بالام *(medical condition)*

■ Spontaneous intrauterine death بعض الأحمال ما بتكمل *or malformation of the baby*

■ Duration of the fertile period *differs between women: some menopauses are early in the 40's some at the 50's*

Created with Notewise

OBSTACLES TO POPULATION CONTROL MEASURES

معِقَاتَ

1. Political and racial concerns.
   in china they made a policy because they have a lot of population one child for every family
   some countries in wars forbid family planning methods so the population would increase and fertility rate would increase
   بدك اولاد اكتر براحتك بس انتا بتتحمل مصاريفو و ما الو حقوق

2. Cultural and religious opposition.
   بعض الاديان بتنمع using family planning methods so this increases fertility

3. High childhood loss.
   high morbidity and mortality among children due to infectious diseases specially gastroenteritis in developing countries

4. Rural-agrarian orientation.
   زِراعِي ارِيفِي
   we said before that they prefer having a lot of children to help them with work specially males

5. Low status of women in some societies.
   she is a sub-class in some developing countries
   sometimes they forbid gpher to use contraceptives even if her health wasn't okay to have another baby

6. Problems with current contraceptives, their effectiveness and side effects.
   like infection caused by intrauterine device that has alot of complications even pills increase risk for breast cancer
   اللولب

7. Legal, ethical and religious opposition to abortion, which is very effective fertility control measures
   بالدول العربية و الإسلامية ممنوع ال abortion

Mortality indicators

Mortality expressed as crude death rate (CDR)*.

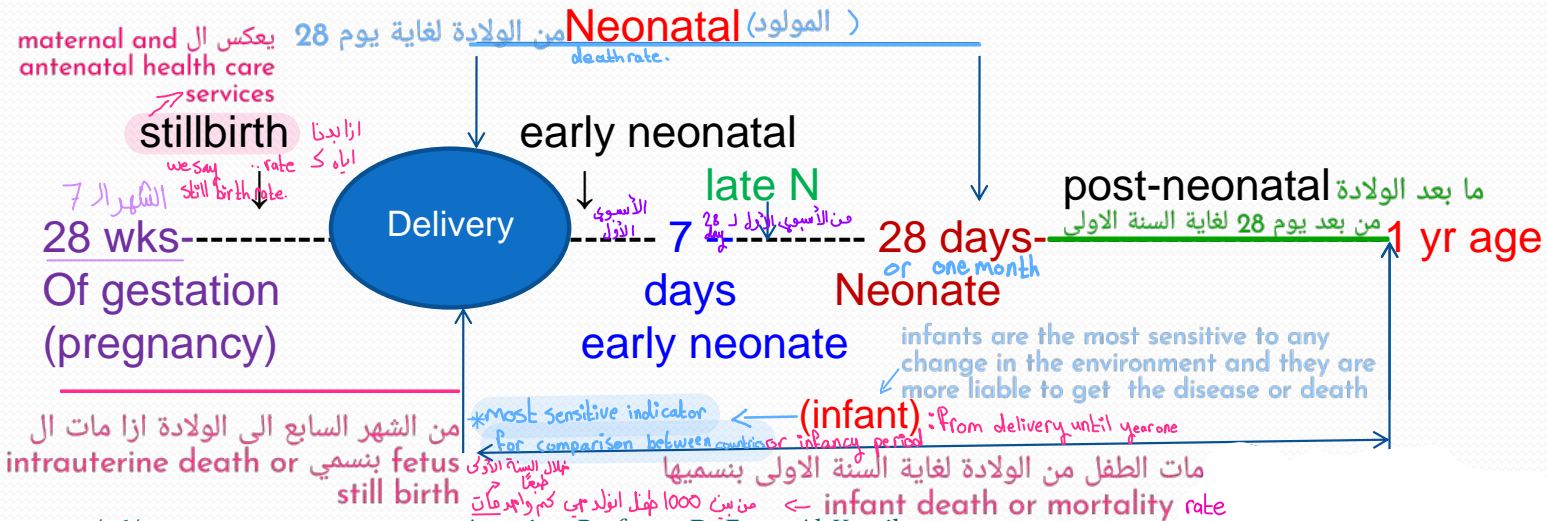*All age groups, both gender, all ages and all causes*

*Crude death rate: is number of all deaths in the community per 1000 population in specific period of time. (usually yearly)

لو مثلا مات بالسنة نص مليون و ال population عشرة مليون:

$1000 \times \frac{500,000}{10 \times 10^6}$

مهم

it's not used for comparison between countries because it is affected by the age composition of the population (in developed countries they have high percentage of elderly so they have high rate of crude death rate we say it is **inflated**)

Rates related to mortality:

These rates measure the impact of disease on the population in terms of death, thus they reflect in general the severity of disease and the quality of health care services. The commonly used mortality rates are:

maternal and ال antenatal health care services
يعكس ال

Neonatal (المولود) من الولادة لغاية يوم 28
death rate.

stillbirth
ازا ابدنا ايا ك rate .. we say birth rate.

early neonatal

late N
من الأسبوع الاول لـ الثاني

post-neonatal ما بعد الولادة
من بعد يوم 28 لغاية السنة الاولى

الشهر ال 7

Delivery

28 wks----------- 7 ------------- 28 days----------- 1 yr age
Of gestation   days   Neonate
(pregnancy)   early neonate   or one month

infants are the most sensitive to any change in the environment and they are more liable to get the disease or death

من الشهر السابع الى الولادة ازا مات ال
intrauterine death or fetus بنسمي
still birth

*Most sensitive indicator for comparison between countries or infancy period

(infant): From delivery until year one

مات الطفل من الولادة لغاية السنة الاولى بنسميها

من سن 1000 طفل انولدجي كم واحد مات
infant death or mortality rate

7/26/2021   Associate Professor Dr Eman Al-Kamil   10

causes of early neonatal death: difficult labor, birth trauma, neonatal infection, pregnancy problem

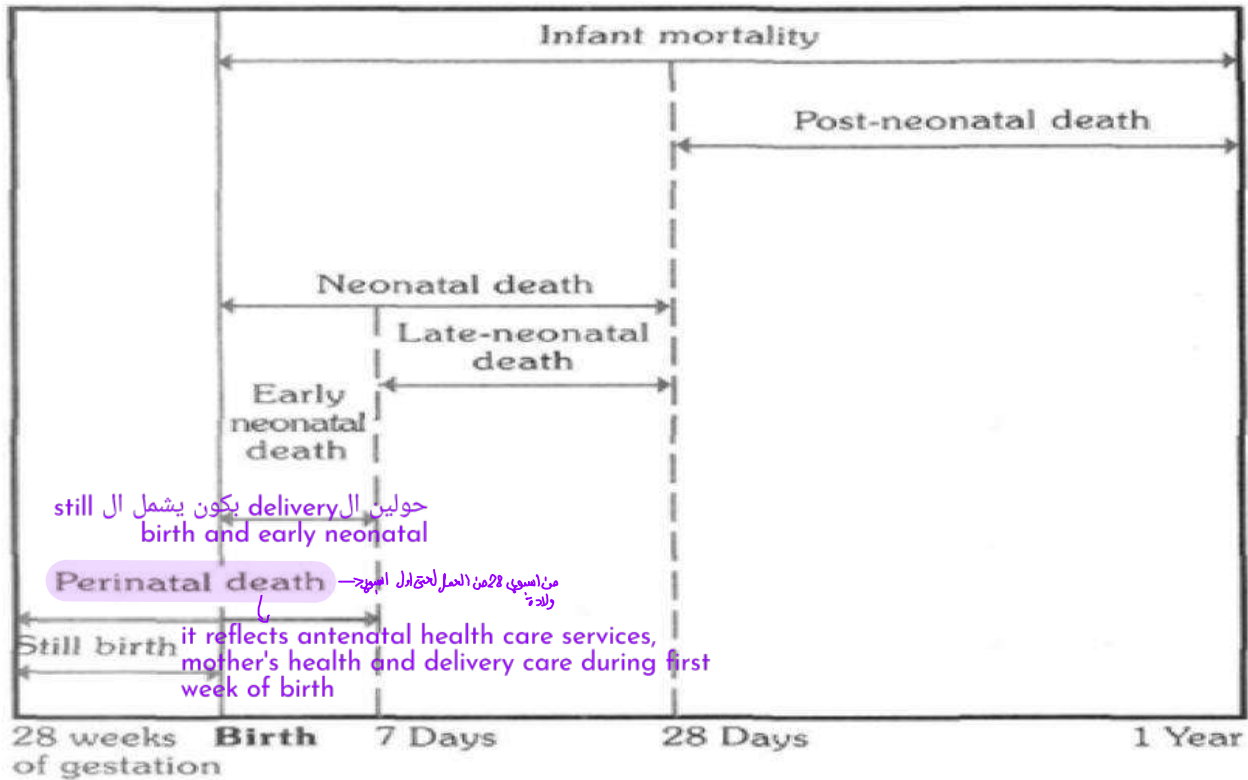causes of post neonatal death: early neonatal reasons+environmental reasons(infection, accidens)

Infant mortality

Post-neonatal death

Neonatal death

Late-neonatal death

Early neonatal death

حولين الdelivery بكون يشمل ال still birth and early neonatal

Perinatal death

من اسبوع 28من الحمل لحد اول اسبوع ولادة

Still birth

it reflects antenatal health care services, mother's health and delivery care during first week of birth

28 weeks of gestation | Birth | 7 Days | 28 Days | 1 Year

FIG. 9

Mortality in and around infancy

handwritten top: → numonater
→ denominater

■ **Peri-natal mortality rate** is the sum of the number of fetal deaths of 28 or more weeks gestation plus the number of newborns dying under 7 days of life in a specified geographic area divided by the total births (number of live births plus the number of fetal deaths of 28 or more weeks gestation) for a specified time period, (usually a calendar year) and multiplied by 1000.

■ **Stillbirth rate** :WHO for international comparison is the number of babies born with no signs of life at or after 28 weeks' gestation divided by total births.

handwritten right: الحياة → ح
و العايشين →

in crude death and birth rate the denominator is number of total population

handwritten right: كل rate يتكون من البسط(numerator)و المقام
multiplied by constant (denominator)
usually 1000
rarely 100,000

■Infant mortality rate in infant and neonatal mortality rate the denominator is live birth
is the death of a child less than one year of age in a specified geographic area divided by the number of live births for a specified time period.

■Neonatal mortality is newborn death occurring within 28 days of life. Neonatal death is often attributed to inadequate access to basic medical care, during pregnancy and after delivery.

■ Post-neonatal mortality is the death of children after 28 days to one year. The major contributors to post-neonatal death are malnutrition, infectious disease, and problems with the home environment.

Age specific death rate: is the total number of deaths of

الدكتورة حكت انو في بعض الكتب بسموها death rate of specific age group ولا اشي بس غيرو ترتيب الكلمات

a specified age group in a specified geographic area

عدد الناس الي بهادي الفئة

divided by the population of the same age group in the same geographic area (for a specified time period, usually a calendar year) and multiplied by 100,000

number of deaths due to certain disease

Cause-Specific Death Rate: This is the mortality rate

always the constant in specific death rate is 100,000

from a specified cause for a population during a specified

time period. like cancer death rate in a specific year   num of population) X 100,000

يلاخذ الوفيات بمرض عالي والي
ماتو قلال وبضرب فيها متود
1500

The numerator is the number of deaths from that cause, and the denominator remains the size of the population.

الدكتورة حكت انو انتبهوا رح يمر علينا اشي عندو نفس البسط الي هو deaths of
و لكن هداك مقامو مختلف..هون شو حكينا المقام؟ yes, total specific disease
num of population

Maternal mortality rate (MMR):

Number of deaths of women due to causes related to pregnancy, delivery and puerperal period النفاس divided by number of live births that occurred among the population

$$MMR = \frac{\text{Number of deaths of women due to causes related to pregnancy, delivery and puerperal period}}{\text{Number of live births that occurred among the population}} \times 1000$$

Maternal mortality has become an important **measure of human and social development**. It is particularly revealing of: الارقام مووو مطلوبة*
➢ women's overall status, maternal health care services
➢ access to health care, and the
➢ responsiveness of the health care system to their needs.

In Jordan 2020: كل سنة الأرقام بتتغير هل الخدمات الموجودة تلبي حاجات المرأة خلال ال حـا pregnancy, delivery and puerperal period or not

The total number of live births for the same period was 194,643 and Jordan's Maternal Mortality Ratio (MMR) was calculate 32.4 per **100,000 live births**.

Case fatality: it reflects severity of the disease
for ex: cancer.. how many people die every year due to cancer.. how fatal is the disease?

It is the proportion of deaths from certain disease out of all "cases" (people with a medical condition), of that disease multiplied by 100.

It is usually expressed as a percentage (%).

$$\text{Case fatality} = \frac{\text{Number of deaths from diagnosed cases of the disease in a given period}}{* \text{Number of diagnosed cases of the disease in the same period}} \times 100$$

ﻻ ﺗﻜﺰﻭ ﻣﻮ ٥٠٠٠٠٠ﻭ١٥٠
ﻣﻮ ﺯﻱ ﺍﻝ specific
death rate

Case fatality reflects :
a. The severity of a disease
b. Availability of effective treatment   how effective the treatment is?

another example lets say coronavirus if we took hospital A and hospital B and the case fertility rate in hospital B was higher
maybe severe casese were admitted to this hospital
or management in hospital A is better and more available resources

and how many individual remain having the disease in the county?

Morbidity indicators : These are used to measure the frequency or occurrence of disease in the population at one point in time or during a period of time. They are very important because they reflect the health status of people and the expected burden on the health care system. Two morbidity rates are in common use:

مثلا ال vaccine ما هي الخدمات التي سنحتاجها؟ كم لازم نقدر نوفر

> incidence
> prevalence

how many individual develop corona **for the first time** for example this year

Incidence rate: Incidence of a disease is the number of new cases or episodes of disease which occur during a specified period of time in a specific population or place. The incidence rate (IR) is the number of new cases or episodes (spells) of disease per unit of size of population.

when we say develop or occur
يعني معناتو انصاب بالمرض لاول مرة

Number of <u>new cases</u> of a disease in a year in a given population

IR = --- ---- X 1000

　　　　　Total population at risk in the same year

Or

as انصاب بالمرض اكثر من مرة بالسنة
coronavirus, gastroenteritis and
common flu

كل مرة انصاب
فيها بتتسجل
as a new case

Number of new spells of disease in a year in a given population

IR =--- X 1000

　　　　　Total population at risk in the same year

Incidence rate is more useful in the following situations:

- To study disease of short duration i.e..in epidemic

- To study the frequency of chronic diseases. not just acute diseases

  for ex how many new cases of diabetes?so we could apply primary prevention services to prevent occurrence of the disease

- To evaluate preventive measures.

  for example if we provided vaccination but still there is not a high coverage rate and still there is new cases so we have to evaluate this method

- To determine the risk of acquiring of disease.

- To assess transmission of infectious agent.

الدكتورة حكت انو يس صار عنا كتير مصطلحات بس ان شاء الله بس تدرسو المحاضره هتفهموها و انو هي كمان رح تبعتلنا اسئلة على تيمز اتدربنا

- The term "attack rate" is often used instead of incidence during a disease outbreak (epidemic) in a narrowly-defined population over a short period of time.

  Attack rate=incidence rate but in epidemic

chronic cases

Prevalence rate: Prevalence refers to the total number of cases
incomplete recovery from a disease like hypertension, diabetes..
of a disease or conditions existing in a given population at a
point in time (point prevalence) .

Number of existing cases (new & old) in a given population
at a point in time

PR= --- X 1000

Total population in the same place and the same point in
time

Prevalence rates are useful for:

1. Diseases of long duration or chronic.

كم رح نحتاج خدمات لازم نوفرها للمرضى

2. Administrative purposes (e.g., planning of health services).

Prevalence is usually given in three 'types':

1. Point prevalence: relates to prevalence with respect to a specific point in time – Did you have an asthma attack on Monday?

   مثلا كم حدا من الدفعة معو anemia اليوم؟

   اكو تنتين بستعملهم

   the constant here is 1000

2. Period prevalence: related to prevalence over a defined period of time – Did you have an asthma attack in January?

   من اول السنه لهلأ باخد سنة تانيه مثلا كل شهر بفحصهم بشوف مين معو anemia .ممكن واحد اول السنه ما كان عندو هلأ صار معو

   للعمر كلو

3. Lifetime prevalence: Have you ever had an asthma attack?

Relationship of incidence and prevalence

➕ Prevalence of disease may vary from place to place or from time to another because of variation in incidence and/ or duration of the disease. الprevalenceيعتمد على ال incidence الي هو كم حالة جديدة طلع عنا ؟كم منهم صار معو complete recovery؟ كم صارو chronic؟ كم منهم ماتو؟

➕In an epidemiologically stable situation, i.e, with constant incidence and duration of disease, the following relationship may be stated:

> **Prevalence = Incidence X Duration**

➕Duration of a disease is a function of its fatality and its tendency to recover.

➕The higher the case fatality of a disease, the shorter the average duration of it. MI either chronic or fatal so low prevalence.. يا بعيش بعدها يا بموت فورا..

➕Similarly, the quicker the recovery of the disease, the shorter the duration is. even if the incidence is high as in common cold or gastroenteritis but high recovery rate

The relationship between incidence and prevalence depends greatly on the natural history of the disease state being .

In the case of an influenza epidemic, the incidence may be high but not contribute to much growth of prevalence because of the high, spontaneous rate of disease resolution.

chronic diseases that has treatment and early intervention... Long duration.. high prevalence

In the case of a disease that has a low (or zero) cure rate, but where maintenance treatment permits sustained survival, then incidence contributes to continuous growth of prevalence.

⊞ In such cases, the limitation on prevalence growth is the mortality which occurs in the population.

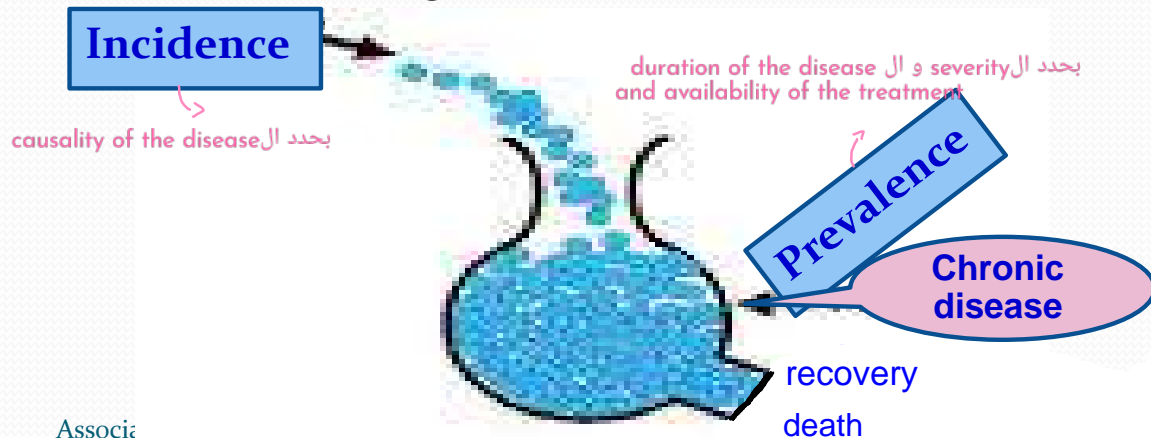*there is a treatment and the cases are chronic so yes low incidence but long duration and high prevalence*

⊞There may be low incidence and a high prevalence – as for diabetes – or a high incidence and a low prevalence – as for the common cold.

short duration and Alot of cases with complete recovery

⊞Colds occur more frequently than diabetes but last only a short time, whereas diabetes is essentially lifelong.

Apart from age, several factors determine prevalence :
1. the severity of illness (if many people who develop a disease die within a short time, its prevalence is decreased);

2. the duration of illness (if a disease lasts a short time its prevalence is lower than if it lasts a long time);
chronic اما الdiseases الي ما بكون فيها complete recovery بس في الها علاج بكون
so long duration and high prevalence

3. the number of new cases (if many people develop a disease, its prevalence is higher than if few people do so).

Incidence

causality of the disease بحدد ال

duration of the disease و ال severityبحدد ال
and availability of the treatment

Prevalence

Chronic disease

recovery

death

▐ Since prevalence can be influenced by many factors unrelated to the cause of the disease, prevalence studies do not usually provide strong evidence of causality.

▐ Measures of prevalence are, however, helpful in assessing the need for preventive action, healthcare and the planning of health services.

▐ Prevalence is a useful measure of the occurrence of conditions for which the onset of disease may be gradual, such as type 2 diabetes or rheumatoid arthritis.

still the incidence of diabetes is high so we need primary preventive methods to avoid occurrence of the disease

▐ The prevalence of type 2 diabetes has been measured in various populations using criteria proposed by WHO ; the wide range shows the importance of social and environmental factors in causing this disease, and indicates the varying need for diabetic health services in different populations.

Factors influencing prevalence

Increased by:	decreased by:
Longer duration of the disease	Shorter duration of the disease
Out-migration of healthy people ~ يقل المقام	In-migration of healthy people
Increase in new cases (increase in incidence)	Decrease in new cases (decrease in incidence)
Prolongation of life of patients without cure *there is treatment but chronic disease*	High case-fatality rate from disease
In-migration of cases	Out-migration of cases
Improved diagnostic facilities (better reporting)	Improved cure rate of cases

■Preventative measures might lower incidence, *e.g.* vaccination, public health campaigns, whereas clinical interventions may decrease duration (recovery), or decrease mortality, resulting in an increase in disease duration. increase prevalence
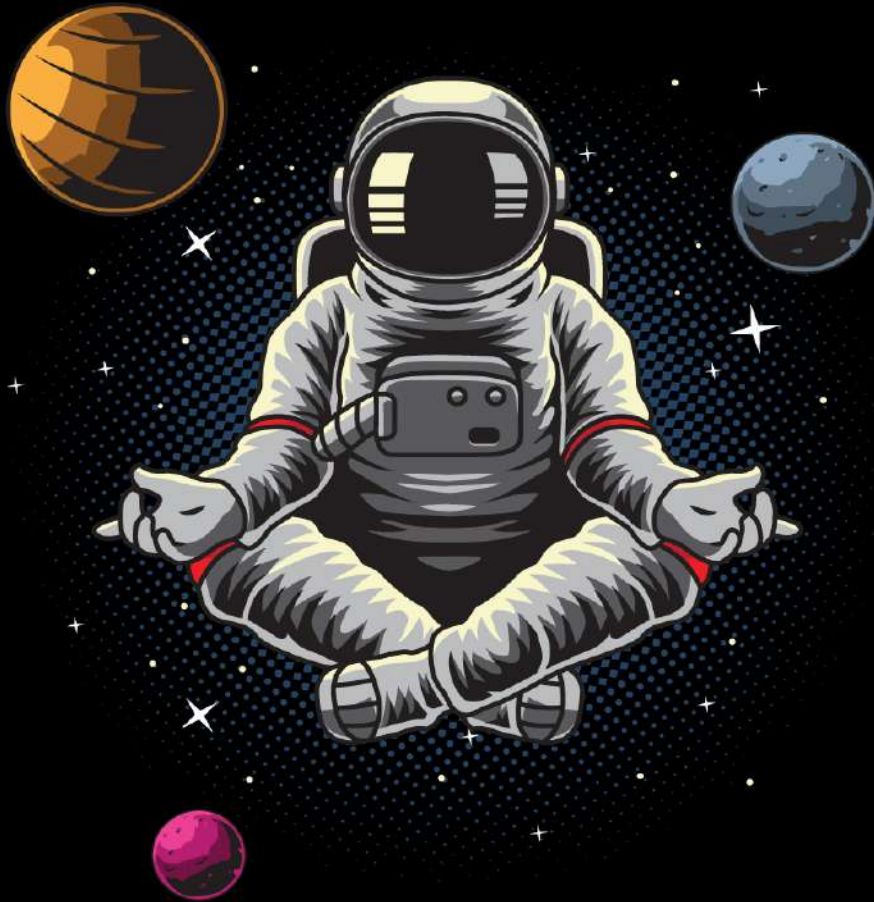
but doesn't affect on prevalence

decrease prevalence

■Prevalence rates are generally used to describe the extent of a disease in a particular population whereas incidence rates look at the rate at which new cases of disease develop.

كم حالة يوجد عنا بالمنطقة

■ Whilst prevalence can be affected by how long people live with a condition, incidence does not take this into account.

■Prevalence is descriptive, often demonstrating public health 'need'. On the other hand, incidence is useful for studying the causes of disease (the etiology) or to look at the order in which events occur.

Life expectancy كم عدد السنين المتوقعة للإنسان انو يعيش

➤ Life expectancy is another measure of the health status of a population. it's a good indicator for the development of the country

➤ Definition: the average number of years an individual of a given age is expected to live. life expectancy is not just determined at birth also when someone become 65 year old we try to determine how many years he will live after that

➤ There are differences in life expectancy between countries; different patterns may emerge according to the measures that are used.

➤ For the world, life expectancy at birth has increased from 46.5 years during the period 1950–1955 to 65.0 years during the period 1995–2000 . due to health services and status development هلا امارت بلاد 80's

➤ Reversals in life expectancy have occurred in some sub-Saharan countries largely due to AIDS. قلت بسبب ال

➤ Life expectancy at birth, as an overall measure of health status.

morbidity is high among women due to pregnancy and delivery   بتعرضو ل risk factors اكثر

➤ In almost all countries, women live longer than men

Thank you

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