Measures of Health and Disease in Populations

- this sheet includes what the doctor mentioned from the book + the explanation and examples mentioned by the doctor regarding what have been mentioned.

- for those who want to study from the book only I will put the link at the end of the sheet and everything mentioned in the lecture will be highlighted.

World Health Organization (WHO) defined health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.". (ideologically)

- even though we look at health as not just the absence of disease ,most of these measurements will be relative to diseases (if the disease is present or not, it's duration and so on…and relative to that with measuring health). (practically)

- according to WHO, disease is anything that leads to discomfort, pain, distress, disability of any kind, or death constitutes disease.

The is a classification system to help us determine which health intervention program will be most useful for whom, when, why and how. Thus, defining disease, understanding the pathogenesis of the disease process, and knowing which underlying risk factors lead to this process are critical for understanding and classifying causes so as to determine the most effective prevention and treatment strategies for reducing the effects of a disease or risk factor.

- measurement process of health and disease is not something that came up abruptly, it developed dramatically over time and especially in the last 2-3 decades where clearer processes of measurements appeared and we are able to give funding and loans to middle income countries where records that give us measurements of health and disease, most of the time, were not precise at all or even not present (for ex: there is a problem such us aids or malaria in a specific country and we want to know what the prevalence is, risk factors, people at higher risk and incidence but there is no data and this is extremely problematic because without a description of the phenomenon it is hard to intervene and if we did intervene, then there will be error and the cost will be high).

- high income countries have a high level of accuracy for documentation due to the systems and processes provided so they are able to determine exactly what the burden of a specific diseases is and this process is still undergoing development in other countries.

By the end of this chapter we need to be able to:

- explains the reasons for and approaches to measuring disease burden in populations.

- describes the need for using quantitative indicators.

- highlights the importance of using data for decision making in health.

- understand the variety of major health indicators.

When measuring health and disease we are talking about their frequency (incidence or prevalence), severity (the mortality-premature mortality- and extent of serious morbidity), consequences (health, social, economic), and the specific people affected (gender, age, social and economic position), all these will help us determine the global burden of a certain disease.

1) frequency (counting) of the disease. (we are talking about incidents and prevalence)

- we have three main quantitative measures

  ➢ cumulative incidence (incidence proportion)
- the number or proportion of new cases of disease that occur in a population at risk for developing the disease during a specified period of time.
- three components are necessary:
1- definition of the onset of the event (new cases)
2- a defined population and a particular period of time. For ex: the incidence of covid in Jordan is X (x: how many people got diagnosed with covid -new cases- from the population at risk for having this disease over a particular period of time).
- we measure it as follows : the numerator is the number of new cases of disease (the event), and the denominator is the number of people at risk (people that don't have the disease or won't have it) for developing the disease. Everyone included in the denominator must have the potential to become part of the group that is counted in the numerator (for example, to calculate the incidence of prostate cancer, the denominator must include only men, because women are not at risk for prostate cancer).
3- period of time, and it depends on the rate of the disease. Diseases that have a very high rate of occurrence will have incident rate/proportion quarterly or monthly (for ex: the new cases of covid are being updated not only daily but also hourly sometimes).

  ➢ incidence density (incidence rate)
- it is often expressed as new events per person-year or per 1,000 person-years, so in other words it is the occurrence of new cases of disease per unit of person per time and we use 1000 as a relative number. (for ex: we say that the incidence rate/density for covid is X per 1000 per year).
- the rate helps giving measurement relative to certain characteristic and these characteristics can be looked at in any population group, defined by age, sex, place, time, sociodemographic characteristics, occupation, exposure to a toxin or any other suspected causal factor. (for ex: the incidence rate for a specific disease is twice in men compared to women).

➢ Prevalence

- a measure of present status rather than of newly occurring disease. It measures the proportion of people who have the defined disease at a specific point of time.

- since the prevalence includes everything that had happened until this point at which we are measuring, it's implicitly including the incident of the disease that has occurred in the past and it's continuation in present or any specified point in time that we chose to measure the prevalence for this disease. (for ex: when we say that the incidence for covid in February of 2019 was 200 and we want to know the prevalence today at this particular point then these cases that were new in the past and are now part of the continuum of the prevalence will definitely be included).

- Incidence and prevalence are complementary of each other, meaning that even if I have the prevalence of certain diseases, this number will indicate how many people have the disease but it doesn't clarify what the acceleration of these of these cases which is the incidence.

- the incidence will show us the severity and variance of the disease and the prevalence gives us a description of the current state of the disease (by prevalence alone we know the number of cases from the past till this point but it doesn't give us the details needed).

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2) severity of disease (morbidity and premature mortality)

- Premature mortality is defined as death before the expected age of death had the disease not occurred (premature means when someone dies due to the disease and if the disease hadn't occurred then the life expectancy for that person would be higher).

- Mortality rates according to age, sex, place, and cause continue to be central information about a population's health status and a crucial input for understanding and measuring the burden of disease, and thereby we can have a clearer vision when we want to make any intervention since we know that the disease is affecting people with these particular characteristics and our intervention will be tailored to people that are mostly affected or are dying due to the disease.

- In high-income countries, vital statistics (i.e., the registration of births and deaths by age, sex, and place) are routinely collected and highly reliable. (for ex: suicide rates in Jordan are much less than in the US and there is no way to convert these numbers even if we measured it relative to the population and the reason behind that is the absence of reliability regarding cases registered in Jordan and the causes vary from cases not being registered to cases that are registered under other reasons due to judicial reasons, stigma and etc.

- the reliability in registration is important in order to depend on the mortality statistics as an indicator for the burden of the disease and this reliability is present in high-income countries. (the presence of a unified system also helps in organizing information and makes it easy for other doctors to follow up the case even in different hospitals since the information is already registered). Mortality measures are important but it's hard to depend on it completely without trusting the reliability of the recordings.

- subcategories/traditional indicators of mortality have been the standard for assessing population health status. Neonatal mortality rates (NMR; deaths of live-born infants before 28 days of age per 1,000 live births), infant mortality rates (IMR; deaths of live-born infants before 12 months of age per 1,000 live births), and child mortality (deaths of children younger than 5 years of age) are considered sensitive indicators of the overall health of nations for the mortality (economic development, the higher the delivered ED the lower rate of child/neonatal/infant mortality).

- we won't be asked about numbers or percentages in the exam, but we might be asked about order (for ex: regarding global burden-explained later on- we will be asked what is highest and most frequent and etc... but not specific # or %)

- Mortality can be expressed in two important quantitative measures (without them it's extremely difficult to compare burden of diseases):

(1) mortality rate (MR)

> It's a form of incidence rate, is expressed as the number of deaths in a defined population in a defined time period. (incidence of death not incidence of the disease)

(2) case fatality ratio (CFR)

> is the proportion of those persons with a given disease who die of that disease (per age, sex, place).

- Morbidity is a statement of the extent of disability (which differs from handicap and incapacitation) that a person suffers as a consequence of the disease over time.

Demographic and Epidemiologic Transitions

- The term transition refers to the shift away from a stable population in which very high birth rates are balanced by very high death rates to a stable population in which low birth rates are balanced with low death rates. (for ex: one of the reasons that helped decrease the mortality rate for children under 5 years of age are the efforts towards tackling communicable diseases, malnutrition, neonatal and antenatal care).

TABLE 1-2 Health-Related Metrics		
Type	Indicator	Definition/Interpretation
Demographic indicators: reproductive health	Maternal death	Death of a woman while pregnant or up to 42 days post-delivery from any cause except accident
	Maternal mortality ratio	Maternal deaths per number of pregnancies (maternal deaths per 100,000 live births)
	Maternal mortality rate	Maternal deaths per number of women of reproductive age (maternal deaths per 100,000 women aged 15–49)
	Lifetime risk of maternal mortality	Cumulative loss of human life due to maternal death over the female life course
	Total fertility rate	Average number of children a woman would bear if she lived to the end of her reproductive period
	Life expectation at birth	Average number of years a newborn would live if his or her life were lived under the mortality conditions for the place and year in question
Anthropometric indicators: nutrition	Weight for age	Underweight
	Height for age	Stunting
	Weight for height	Wasting
	Mid-upper arm circumference	Wasting
Mortality (death) indicators	Mortality rate	Number of deaths in a specified time period/number of persons at risk of dying during that period
	Infant mortality rate	Number of deaths of live born infants before 12 months of age per 1,000 live births
	Under-5 mortality rate	Number of deaths of children younger than age 5 per 1,000 live births averaged over the last 5 years
	5q0	Probability of death of a newborn by age 5
	Neonatal mortality rate	Number of deaths of live-born infants before 28 days of age per 1,000 live births
	Stillbirth rate	Number of babies born with no signs of life at or after 28 weeks' gestation per 1,000 births
	Perinatal mortality rate	Number of fetal deaths (28 or more weeks of gestation) + postnatal deaths (first week) per 1,000 live births
Disease frequency	Endemic	Usual occurrence of a given disease in a defined population
	Epidemic	Occurrence of a given disease in a defined population clearly in excess relative to its usual occurrence
	Pandemic	A worldwide epidemic involving large numbers

> The doctor didn't say that we have to memorize the definitions but we must know the indicators mentioned ☺ and maybe just read the definitions of the disease frequency indicators just to make sure you know what each one means.
>
> Check the link in last page for clearer pic, page 7 of book or 42 of pdf.

Morbidity and Disability

- Measures of mortality have been the principal indicators of population health status for generations. However, the key limitation with mortality-based indicators is that they "note the dead and ignore the living".

- morbidity measures and indicators helps us to know about any disability affecting the population that is alive or any effects that resulted from a specific disease which we can't know through mortality.

- limitations of morbidity:

1- several components of disability need to be assessed (social, emotional, spiritual, economical,... components of disability that needs to be measured).

2- there may be a substantial subjective aspect to grading the extent or severity of a condition (high subjectivity, for ex: someone with mental disability thinks that what he have is less severe than having a mental disability).

- The International Classification of Impairments, Disabilities, and Handicaps (ICIDH) was developed by WHO and. ICIDH categories included impairment (loss or abnormality of psychological, physiological, or anatomic structure or function), disability (restriction or lack of ability to perform an activity considered normal), and handicap (disadvantage from a disability or impairment for a given individual based on the inability to fulfill a normal role as defined by age, sex, or sociocultural factors). (a handicap is an individual who had an impairment which led to a disability and this disability made it hard for them to perform and they need special assistance)

- the presence of these indicators is important to help measure impairment free, disability free and handicap free life expectancies relative to certain disease)

Measuring Disability

- measurement of disability must quantify the duration of time spent in a disabled state and severity (extent/various forms) of this complex phenomenon that resulted from various forms of diseases in a unified scale in order to be able to say that a certain disease is more disabling than another.

- the data that we collect from general surveys tells us how many of the population are disabled, it's general enough to give us general indication but it's not sufficient to give us a qualification for the extent of that disability

- three components of disability need to be assessed in order to know how disabling a certain disease is. The first component is the case disability ratio (CDR)-the proportion of those diagnosed with the disease who have disability for most diseases that are diagnosed clinically, the second component of disability is its extent or severity—how incapacitated the person is as a result of the disease and the third component is the duration, we count it from the inset of a disability until cured/ recovery or even death along with the extent or severity and the CDR.

- the variation of the indicators of health and disease makes it difficult to make a comparison between several diseases or disability in terms of its burden, so the approach of composite measures is important, in this approach we summarize mortality and morbidity occurring in a population through the use of a single number then safely take it and compare it to another single number from a different disability/ disease and this makes it easier to make decisions regarding health spending. (for ex: which is better? To put money into programs that reduce mortality in children or into programs that reduce disabling conditions in adults? In order to answer this we need single numbers that takes into consideration every detail regarding being an adult with a disability vs having a child dying from certain diseases).

- such measures (composite measures) entails two major processes: the measurement of healthy life, including losses of time from premature mortality and disability; and the valuing of life, which incorporates issues of duration, age, extent of future life, productivity, dependency, and equity. (it's more than having a certain disease or not; it's about the consequences of it. When we say disease, we don't mean hypertension, diabetes or cancer; we mean any condition that causes discomfort or pain such as a fracture, injury, RTA)

- Two types of composite summary measures have been developed: health gap measures (healthy life lost), such as healthy life years (HeaLYs) or disability-adjusted life years (DALYs), and health expectancies, such as disability-free life expectancy (DFLE) or health-adjusted life expectancy (HALE).

- The healthy life year (HeaLY) is a composite measure that combines the amount of healthy life lost due to morbidity with that lost due to death that is, loss of life expected had the disease not occurred. In studying HeaLY we are interested in knowing the pathogenesis, natural history of diseases, and the associated morbidity and mortality in order to determine the proper interventions for these diseases.

- the second health-gap measure is the disability-adjusted (taking into consideration the years lost due to death and due to disability to get the life year adjusted for that disability) life years (DALYs) which is a health gap population summary measure that combines time lost due to disability with that lost due to death and the two components are (1) years of life lost (YLL), referring to the loss of healthy life from death, and (2) years of life lived with disability (YLD)-->DALY = + YLL YLD

- The central notion behind the Quality-Adjusted Life Year (QALY) is that a year of life spent in one health state may be preferred to a year spent in another health state and it gives us the ability to allocate resources among alternative health interventions by ranking interventions in terms of cost per QALY, so the idea was to develop a single measure of quality of life that would enable investigators to compare expected outcomes from different interventions—a measure that valued possible health states both for their quality of life and for their duration.

Second type of composite measures--> health-Adjusted Life Expectancies

- we have two types, disability-free life expectancy (DFLE); its scores are dichotomous and calculated by whether the individual is/isn't having a disease and this causes loss of information regarding the severity of the disability and health life adjusted expectancy (HALE).

The link of the book highlighted (pdf pages 36-54) (book pages 1-20) :

[Click here](#) ☺

- the doctor said that everything she mentioned is required.

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