Health Indecators

by
Prof. Mamduh A. El-Messeiry

B.Sc., M.P.H.; Dr. P.H. Sc.

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	objectives
	By the end of this lecture students will be able to: Explain the need to use “indicators” to measure “health” status 1. State the characteristics of health indicators 2. List the uses of health indicators 3. State with examples the types of health indicators 4. Compute indicators 5. Interpret the result of the indicator Through scenario exercises.

TYPES OF HEALTH INDICATORS

1. Morbidity indicators
2. Mortality indicators
3. Disability indicators
4. Nutrition indicators
5. Healthcare delivery indicators
6. Healthcare utilization indicators
7. Social and mental health indicators
8. Socioeconomic indicators
9. Environmental indicators
10. Quality of life indicators

HEALTH INDICATORS

Health indicators are

- **Variables that measure indirectly a status which can not be measured directly**
- **They are a reflection of a given situation**
- **They are used to compare between areas or population group at a certain time**
- **They are used to measure changes over a period of time**

HEALTH INDICATORS QUANTIFY THE HEALTH OF THE POPULATION

Health indicators should be

- **Valid** — Corresponds to the actual status
  Measures what it is supposed to measure
- **Reliable** — Precise, Reproducible
  Give the same results on repeated measurement by different individuals
- **Sensitive** — Reflects the smallest change in the health status of the population
- **Specific** — Reflects changes only in the situation concerned

Uses of Health Indicators

- Reflect the health status of a given population
- Reflect changes in the health profile of the same population over time
- Provide international comparison
- Determine areas of health priority
- Diagnosis of community needs
- Allow evaluation of health services and specific interventions
- Chart progress towards specific targets
- Allow future projection of the health status of the population

- ✓ Rate: Numerator (a) is a part of denominator (b) and multiplier is 1000 or 10,000 or 100,000 or so on…
- ✓ Ratio: Numerator (a) is not a part of denominator (b) and BOTH numerator and denominator are unrelated
- ✓ Proportion: Numerator (a) is a part of denominator (b) and multiplier is 100. and Proportion is always expressed in percentage (%)

Definition of rate

In epidemiology, a rate is a measure of the frequency with which an event occurs in a defined population over a specified period of time. Because rates put disease frequency in the perspective of the size of the population, rates are particularly useful for comparing disease frequency in different locations, at different times, or among different groups of persons with potentially different sized populations; that is, a rate is a measure of risk.

Definition of ratio

A ratio is the relative magnitude of two quantities or a comparison of any two values. It is calculated by dividing one interval- or ratio-scale variable by the other. The numerator and denominator need not be related

Definition of proportion

A proportion is the comparison of a part to the whole. It is a type of ratio in which the numerator is included in the denominator. You might use a proportion to describe what fraction of clinic patients tested positive for HIV, or what percentage of the population is younger than 25 years of age. A proportion may be expressed as a decimal, a fraction, or a percentage.

https://www.cdc.gov/ophss/csels/dsepd/ss1978/lesson3/section1.html

MORBIDITY INDICATORS

- Incidence rate
- Prevalence
- Attendance to out-patient clinics or health centers
- Admission – re-admission – discharge rate
- Length of hospital stay
- Spells of sickness or absence from school or work

MORTALITY INDICATORS

- Crude death rate
- Age specific mortality rate
  - Infant mortality rate
  - Perinatal mortality rate
  - Neonatal mortality rate
  - Post-neonatal mortality rate
- Mortality rate of children below 5 years of age
- Maternal mortality rate and ratio
- Cause specific mortality rate
- Proportionate mortality rate
- Life expectancy

DISABILITY INDICATORS

- **Event-type indicators**
  - Number of days of restricted activities
  - Number of days confined to bed
  - Number of days lost from work
- **Person-type indicators**
  - Limitation of mobility
  - Confined to bed
  - Confined to house
  - Getting around with aids

Limitation of activities

- Limitation of basic activities (toilet – bathing)
- Limitation of major activities (house work or work)

HEALTHCARE DELIVERY INDICATORS

- Doctors – population ratio
- Nurses – population ratio
- Bed – Population ratio
- Center or sub-center – population ratio
- Midwives – female in the fertile age group ratio

HEALTHCARE UTILIZATION INDICATORS

- Percentage of children attending for immunization
- Percentage of children attending for routine check-up
- Percentage of pregnant female attending for ante-natal care
- Percentage of pregnant female attended by a trained birth attendant
- Percentage of female attending family planning clinics
- Bed occupancy rate
- Bed turn over ratio

NUTRITION INDICATORS

- Specific nutritional indicators
  - Percentage of the population who have low weight for age - height for age – weight for height
  - Percentage of infants born with a low birth weight
  - Percentage of the population who have low HB level
  - Percentage of children with clinical signs of malnutrition
  - Percentage of those whose protein and caloric intake below the required
  - Percentage of those who have 2 meals or fewer per day
  - Increases in prices as a percentage increase in minimal wages
  - Percentage of expenditure on food from total income
- Mortality indicators
  - MMR – IMR – children <5 years
  - Morbidity rates for certain diseases as measles and diarrhea
  - Cause specific mortality rate as from measles and tuberculosis

SOCIOECONOMIC INDICATORS

- Rate of population growth
- Per-capita gross national production (GNP)
- Percentage of unemployed
- Percentage of literacy
- Average family size
- Crowding index
- Dependency ratio

SOCIAL AND MENTAL INDICATORS

Rate of

- suicide
- homicide
- delinquency
- Alcohol and substance abuse
- rape
- child abuse
- wife abuse
- neglected or abandoned youth

ENVIRONMENTAL INDICATORS

Percentage of the population with

- safe water supply inside dwellings
- sanitary refuse and sewage disposal
- living nearby a source of pollution

QUALITY OF LIFE INDICATORS

- Physical quality of life **PQLI**

  Averaging three indicators :Infant mortality - Life expectancy at 1 year of age - Literacy rate yielding a score on a scale ranging from 0 (worst) to 100 (best)

- Subjective quality of life
  - Physical — Pain, fatigue, lack of energy
  - Psychological — Memory, concentration, self esteem
  - Level of independence — Mobility, daily activity, working capacity,
  - Social relation — Personal relations, social support

Examples of Tools of Measurement in Epidemiology

Parameter	Formula	Numerator (N) & Denominator (D)	Conclusion
Infant mortality rate (IMR)	No. of infant deaths X 1000 No. of Live births	N is a part of D; multiplier NOT 100	Rate
Maternal mortality rate (MMR)	No. of maternal deaths X 100000 No. of Live births	N is NOT a part of D; both unrelated	Ratio
Sex ratio (SR)	No. of females X 1000 No. of males	N is NOT a part of D; both unrelated	Ratio
Incidence	No. of new case X 1000 Total population at risk	N is a part of D; multiplier NOT 100	Rate
Prevalence	No. of new + old cases X 100 Total population	N is a part of D; multiplier 100	Proportion
Case fatality rate (CFR)	No. of deaths X 100 No. of cases	N is a part of D; multiplier 100	Proportion
Relative risk (RR)	Incidence among exposed Incidence among non-exposed	N is NOT a part of D; both unrelated	Ratio

How to Calculate

Incidence

- *Incidence*: Is defined as the *'no. of new cases'* occurring in a defined population during a specified period of time
- *For a given period,*

$$\frac{\text{No. of new cases of a disease in a year}}{\text{Total population at risk}} = \times 1000$$

– *Incidence is a **RATE***, expressed per 1000

- *Special types of incidence rates*:
  - *Attack rate*: Incidence rate used when population is exposed for a small interval of time, e.g. epidemic
  - *Secondary Attack Rate (SAR)*: Is no. of exposed persons developing the disease within range of incubation period, following exposure to the primary case
- Incidence is the best measure of disease frequency in etiological studies
  - *Incidence can be determined from*: Cohort study

Prevalence

- *Prevalence*: Is total current (Old + New) cases in a given population over a point or period of time
- *Types of prevalence*:
  - a point of time (*Point Prevalence*)
  - a period of time (*Period Prevalence*)

$$\frac{\text{No. of total (new + old) cases of a disease in a year}}{\text{Total population}} \times 100$$

- Prevalence is a **proportion** (Prevalence IS NOT A RATIO): Numerator is a part of denominator, and is always expressed in percentage

Prevalence can be determined from: Cross Sectional Study

• *Relationship between Incidence and Prevalence*:
Given the assumption that population is stable AND incidence & duration are unchanging,

Prevalence = Incidence × Mean duration of the disease

$P = I \times d$

– Prevalence describes balance between incidence, mortality and recovery
– Incidence reflects causal factors
– Duration reflects the prognostic factors

Mortality rate is the number of deaths expressed as per 1000 or per 100 of the population among which the deaths occurred.

$$Mortality\ rate = \frac{Deaths\ in\ a\ given\ period\ of\ time}{Size\ of the\ population\ among\ which\ deaths\ occurred\ in\ the\ same\ period\ of\ time} \text{ x Constant}$$

Crude Death Rate (CDR)

Mortality from all causes of death in a given period usually expressed as per 1000 of the estimated mid year population

$$CDR = \frac{Total\ deaths\ in\ a\ given\ period\ of\ time\ and\ locality}{Estimated\ mid\ year\ population\ in\ the\ same\ year\ and\ locality} \times 1000$$

Mid year population is an adjustment of the size of the population as of 1st of July of the same year

Age specific mortality rate

Mortality from all causes of death among a certain age group in a given period and locality usually expressed as per 1000 of the estimated mid year population of the same age group in the same period and locality

$$ASM = \frac{Total\ deaths\ among\ a\ certain\ age\ group\ in\ a\ given\ period\ of\ time\ and\ locality}{Estimated\ mid\ year\ population\ of\ the\ same\ age\ group\ in\ the\ same\ year\ and\ locality} \times 1000$$

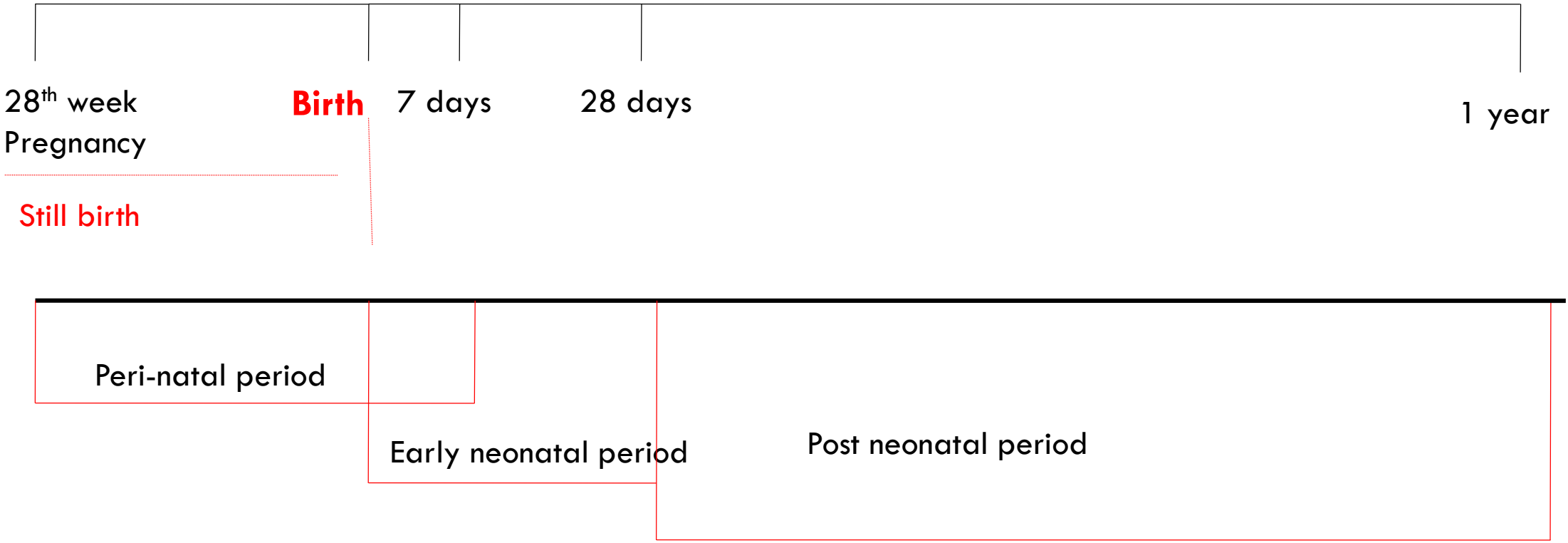
Infant mortality rate (IMR)

Deaths in the first year of life expressed as per 1000 of total live births

$$IMR = \frac{Deaths\ below\ 1\ year\ of\ age\ in\ a\ given\ year\ and\ locality}{Total\ number\ of\ live\ births\ in\ the\ same\ year\ and\ locality} \times 1000$$

Reflects socioeconomic development and heath services

INFANT MORTALITY RATES



Neonatal mortality rate

Deaths in the first 28 days of life expressed as per 1000 of total live births

$$Neonatal\ mortality = \frac{Deaths\ below\ 28\ days\ of\ age\ in\ a\ given\ year\ and\ locality}{Total\ number\ of\ live\ births\ in\ the\ same\ year\ and\ locality} \times 1000$$

Reflects primarily quality of obstetric care and neonatal care as well as maternal nutrition and health status

Post neonatal mortality rate

Deaths between 28 days of life to less than 1 year expressed as per 1000 of total live births

$$Post\ neonatal\ mortality = \frac{Deaths\ from\ 28\ days\ to\ less\ than\ 1\ year\ of\ age\ in\ a\ given\ year\ and\ locality}{Total\ number\ of\ live\ births\ in\ the\ same\ year\ and\ locality} \times 1000$$

Reflects infants' health care, nutrition and sanitation of the environment

Peri-natal mortality rate

Deaths between 28th week of gestation to less than 7 days of life expressed as per 1000 of total births (live and still)

$$Peri\ natal\ mortality = \frac{Deaths\ from\ 28th\ week\ of\ gestation\ to\ less\ than\ 7\ days\ of\ age\ in\ a\ given\ year\ and\ locality}{Total\ number\ of\ births\ (live\ and\ still)\ in\ the\ same\ year\ and\ locality} \times 1000$$

Reflects maternal health status, quality of maternal care and obstetric services

Under-5 mortality rate

Deaths below 5 years expressed as per 1000 of the number of children below the age of 5 years

$$Under-5\ mortality = \frac{Deaths\ below\ 5\ years\ of\ age\ in\ a\ given\ year\ and\ locality}{Total\ number\ of\ children\ below\ 5\ years\ of\ age\ in\ the\ same\ year\ and\ locality} \times 1000$$

Maternal Mortality Ratio (MMR)

Deaths due to maternal causes (pregnancy, delivery and puerperium) in a given year and locality expressed as per 100 000 live births in the same year and locality

$$MMR = \frac{Deaths\ due\ to\ maternal\ causes\ in\ a\ given\ year\ and\ locality}{Total\ number\ of\ live\ births\ in\ the\ same\ year\ and\ locality} \times 100\ 000$$

Reflects the status of maternal health and nutritional status, the quality of antenatal, natal and postnatal care as well as family planning services

Cause Specific death rate

Deaths from a certain cause (as accidents, cardiovascular diseases) expressed as per 100 000 of the population among which the deaths occurred

$$Cause\ specific\ death\ rate = \frac{Deaths\ from\ a\ certain\ cause\ in\ a\ given\ year\ and\ locality}{Estimated\ mid\ year\ population\ \ in\ the\ same\ year\ and\ locality} \times 100\ 000$$

Reflects the leading causes of mortality

Proportionate mortality rate

Deaths from a certain cause (as accidents, cardiovascular diseases) expressed as percentage of the total deaths in the same year and locality

$$Proportionate\ mortality\ rate = \frac{Deaths\ from\ a\ certain\ cause\ in\ a\ given\ year\ and\ locality}{Total\ deaths\ from\ all\ causes\ in\ the\ same\ year\ and\ locality} \times 100$$

Reflects the burden of diseases in the community

Proportional Mortality Rate (PMR)

- PMR is number of deaths due to a particular cause (or in a specific age group) per 100 (or 1000) total deaths

- *Advantages of PMR*:
  - Is 'simplest measure of estimating the burden of a disease' in the community
  - *Is a useful health status indicator*: Indicates magnitude of preventable mortality
  - Is used when population data is not available

- *Disadvantages of PMR*:
  - Is of limited value in making comparisons between population groups or different time periods
  - Does not indicate the risk of members of population contracting or dying from the disease

Standardization of Death Rates

• *Adjusted or standardized rates*:

– While comparison of death rates of two populations, '*crude death rate is not the right yardstick*', as age-compositions are different

– Age-adjustment or age-standardization removes confounding effect of different age structures

– Standardization may be direct or indirect

– Standardization is carried out beginning by using a '*Standard Population*'

• *Standard population*: Is a population where numbers in each age and sex group are known

Case fatality rate

Deaths from a certain disease expressed as percentage of the total number of cases of the same disease in the same year and locality

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

Reflects the virulence and pathogenicity of the organism

Survival Rate (SR)

- *Survival rate*: Is the proportion of survivors in a group (e.g. of patients), studied and followed over a period of time (e.g. over a period of 5 years)
- Is used to '*describe prognosis*' in certain disease conditions
- Quite useful in cancer studies
- Can be used as a '*yardstick for the assessment of standards of therapy*'
- Survival period is usually calculated from date of diagnosis or start of treatment

$$SR = \frac{\text{Total no. of patients alive after 5 years}}{\text{Total no. of patients diagnosed/treated}} \times 100$$

Case Fatality Rate (CFR)

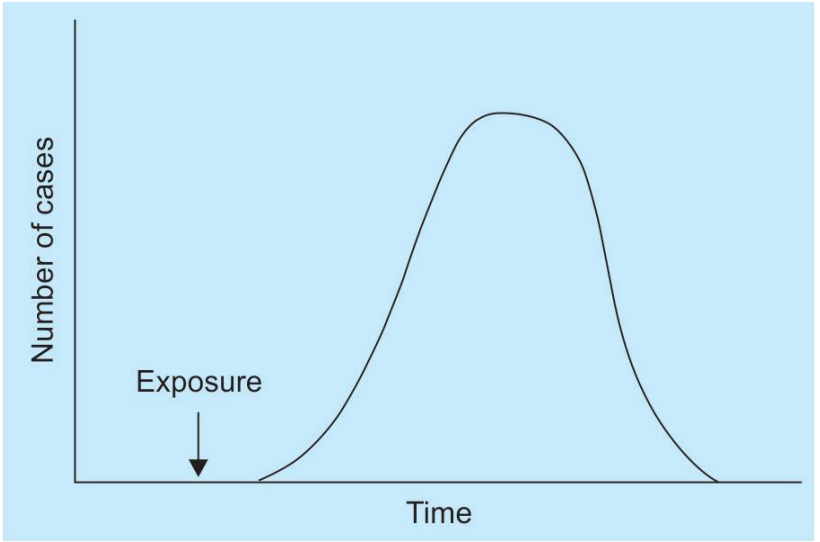
- CFR represents *'killing power of a disease'*
  - It is *'closely related to virulence of organism'*
- *CFR is a Proportion*: Always expressed in percentage
- CFR is the *'complement of Survival Rate'*
  - CFR = 1 – Survival Rate
- *Limitations of CFR*:
  - *Time interval is not specified*
  - Usefulness of CFR is limited for chronic diseases

$$\text{CFR} = \frac{\text{Total no. of deaths due to a disease}}{\text{Total no. of cases due to a disease}} \times 100$$

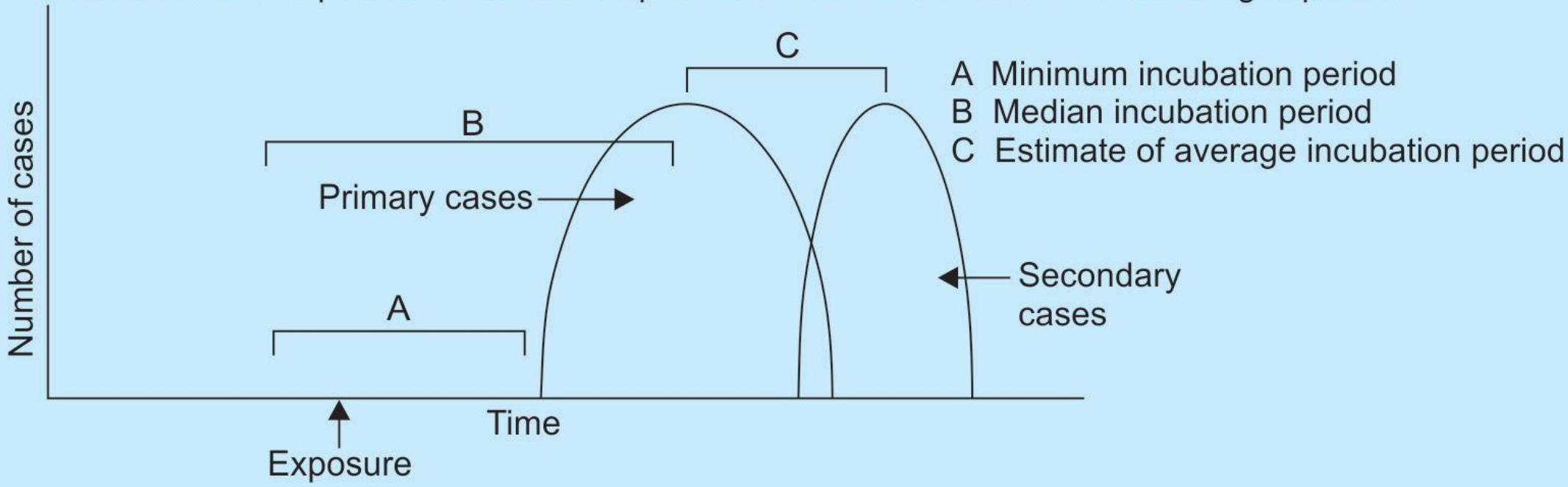
Point Source Epidemic

Single exposure common vehicle outbreak: Also known as '*Point Source Epidemic*', where exposure to disease agent is brief and essentially simultaneous

– Epidemic Curve rises and falls rapidly, with no secondary waves
– Explosive: Clustering of cases within a narrow interval of time
– All cases develop within one incubation period of disease



- Median incubation period: Is the time required for 50% of cases to occur following exposure



Disease	Secondary Attack Rate (SAR)
Small pox	30 – 45%
Measles Q	> 80%
Chicken pox Q	~90%
Mumps Q	~86%
Pertussis	~90%

LIFE EXPECTANCY

"Number of years expected to be lived by those borne into the population if the current age specific mortality rate persists"

Life expectancy at birth

- Best global indicator of health status
- Affected by infant mortality

Life expectancy at 5 years

- Not affected by infant mortality

Demographic Indicators

Source: CD of S&I

Indicator		Year
Estimated population	28.376.355	2011
Crude birth rate/1000 pop	22.9	2011
Population Growth Rate		
Total	3.19	Between 2004 & 2010
Saudi	2.21	
Non Saudi	5.61	
Population Under 5 Years %	11.22	2011
Population Under 15 Years %	31.14	2011
Population 15-64 years%	65.37	2011
Population from 65 & above %	2.86	2011
Total fertility rate	2.93	2011
Life expectancy at birth	73.8	2011
Male	72.8	2011
Female	75.1	2011

http://www.moh.gov.sa/en/Ministry/Statistics/Indicator/Pages/Indicator-2013-06-19-001.aspx

Health Resources Indicators

Indicator Rates per 10000 Pop		Year
Physicians	24.4	2011
Dentists	3.5	2011
Pharmacists	5.1	2011
Nurses	47.4	2011
Allied health personnel	27.8	2011
Hospital beds, KSA	20.7	2011
Health care centers	0.74	2011
Governmental hospital beds rate	16	2011
Private hospital beds rate	4.7	2011

Health Indicators A – Morbidity Indicator

Indicator		Year
Low birth weight %	7.45	2009
Incidence Rates / 100000 Pop.		
Poliomyelitis	0.00	2011
Whooping Cough	0.04	2011
Measles	1.28	2011
Tetanus		
All ages	0.04	2011
Neonatal / 1000 Live birth	0.03	2011
TB	9.31	2011

B – Mortality Indicators

Indicator		Year
Crude Death rate / 1000 pop.	3.9	2011
Infants Mortality Rate / 1000 Saudi live birth	16.5	2011
Under 5 Mortality Rate / 1000 live birth	19.1	2011
Maternal Mortality Rate / 10000 live birth	1.4	2011

Application – mortality indicators

1. In the year 2011 the following data were provided for a certain village

• Midyear population	200,000
• Live births	7500
• Deaths	3000
• Infant deaths(< one year)	750
• Neonatal deaths (0- 28 days)	150
• Post neonatal deaths (28 days- < one year)	600
• Maternal deaths	100

Calculate and interpret the following rates

Crude death rate
Infant mortality rate
Neonatal mortality rate
Post neonatal mortality rate
Maternal mortality ratio

2. In village x, the estimated midyear population for the year 2011 was 200 000. In the same year 7500 births and 3000 deaths were recorded. 100 died from maternal causes. Number of deaths below the age of 1year was 750 of whom 150 died in the first 28 days.

Calculate all possible indicators of mortality and indicate what these indicators reflect.

3. Data of city (A) during the year 2014 shows that the midyear population was 100,000 individuals (45,000 males and 55,000 females). Number of deaths from all causes was 1000 (600 males and 400 females). There were 50 cases (40 males and 10 females) of lung cancer of which 45 died (36 males and 9 females). Calculate all possible indicators of mortality and indicate what these indicators reflect.

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