Health Indicators

Objectives:

- **Explain the need to use “indicators” to measure “health” status**
- **State the characteristics of health indicators.**
- **Lists the uses of health indicators.**
- **State with examples and types of health indicators.**

Color index:

- Main text
- Males slides
- Females slides
- Doctor notes
- Golden notes
- Important
- Extra

Health Indicators: Definitions and Uses

What is an indicator

- An indicator is an indication of a given situation and a measurable variable.
- Basically it acts like a red **flag that** draws your attention to something that is going on and makes you ask questions such as:

What does this number mean?
Why did we get this result?
Are we getting better or worse over time?
Are we providing the right care?
How are we doing in comparison to other countries, institutions, groups, etc?

- Example of indicator : vital signs.

Health Indicators: Definition

- Health Indicators are a measure that can be used to help describe a situation that exists and to measure changes or trends over a period of time. Most health indicators are quantitative in nature but some are more qualitative.
- Variables that **measure indirectly**[1] a health status which can not be measured directly
- They are an indication of a given situation.
- They are used to **compare** between areas or population[2] groups at a certain time.
- They are used to **measure changes** over a period of time.
- Health indicators **quantify** [3] health of the population.

Health Indicators: Uses

- Measure health status in a community
- Compare health status between countries over time
- Assessment of health care needs
- Allocation of resources according to needs [4]
- Monitoring and evaluation of health services.

1-It cannot be measured directly because health is a spectrum and it's a relative concept
2-Population indicators cover such factors as age , sex , geographical area
3- ex, size , amount
4- Allocate resources : like when you have a clinic and you need to defend your budget (ex : 2 or 3 ambulance cars are needed

Health Indicators: Characteristics and Types

Characteristics of an IDEAL Indicator

Valid
measures what it is supposed to measure.

Reliable
provides same information under different observations & Conditions (consistent)

Sensitive
sensitive to changes in the situation

Specific
reflects changes only in that situation

Relevant
relevant to the community needs & problems.

Feasible
the ability to obtain data when needed

Ideal indicators are **RARE** because health is Multidimensional [1]

Major types of Health Indicators

Morbidity [2] عبء المرض

- Incidence — New cases
- Prevalence — New and old cases
  - Point Prevalence [5]
  - Period Prevalence

Mortality الوفيات

- Crude death rate — معدل الوفيات الخام
- Specific mortality rates
  - Group Specific
  - Cause Specific
  - Social Determinants Specific
- Maternal & Child mortality (ratios, rates) [3]
- Proportionate mortality [4]
- Case Fatality Rate

Other types of Health Indicators

- Disability indicators ((QALYs (Quality-Adjusted Life Year) ,DALYs (Disability-Adjusted Life Year)).
- Nutritional status indicators (anthropometric measurements,...)
- Health care delivery indicators (doctor-population ratio, population-bed ratio,.....)
- Utilization rates (bed turnover ratio, vaccine coverage ratio,...)
- Social and mental health indicators (tobacco use, substance Abuse,....)
- Environmental indicators (Environmental Quality)
- Socioeconomic indicators (rate of population increase, dependency ratio, literacy rate,....)
- Health policy indicators (GNP spent on healthcare,...)
- Indicators of quality of life

1-There is no indicator of choice when choosing between health indicators.
1-Health is Multidimensional, which is determined by Political, Socioeconomic, Cultural Environmental, Philosophical, Vocational and Nutritional factors. This means that health is a wide aspect covering almost every aspect of individual.
2-Measure the burden of disease not the disability , Morbidity indicators are generally based on the disease-specific incidence or prevalence rates for the common and severe diseases, such as malaria.
3-Infant mortality rate is very important health indicator for **development and the health system performance.**
4-Usually divided into broad groups (communicable diseases, non-communicable diseases, injuries and others.
5- Not more than 3 months.

Health Indicators Concepts: Tools of Measurements

1 Tools of Measurements

Indicators are measurements of disease magnitude, Which is expressed in terms of: **Ratio, Proportion and Rate**. Clear understanding of these terms is a **MUST** for interpretation of indicators.

Tool of Measurement	Ratio (simple ratio) [1]	Proportion [2]	Rate[1]
Definition	the relationship in size of one measure/variable to another	**A specific type of ratio** that relates a part to a whole	**A special type of proportion** that measures the occurrence of an event in a population during a **given time**.
Use	size of two **different variables** or quantities	magnitude of the part of a whole	to allow comparisons
Differentiating element	The numerator is **NOT** a component of the denominator. البسط مختلف عن المقام	The numerator is **ALWAYS** a component of / INCLUDED in the denominator.	There **must** be a time dimension and a multiplier (per 1000, per 100,000)

Example

- We had 400 deaths from Road Traffic Injuries (RTI) in Riyadh in 2010, Out of the 400 death, 300 were males and 100 were female.
- In 2010, the population of Riyadh was 1,000,000.

Ratio

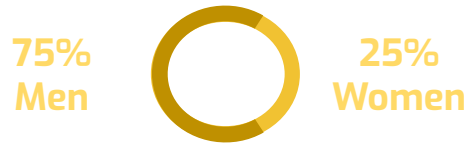
The male to female ratio is 300/100 or 300:100 or 3:1
i.e. there are 3 male deaths for every female death
Use Two different variables to compare between them

Proportion

Out of the 400 deaths, 300 were males. i.e the proportion of males who died from RTI is (300/400 X100) = 75%.

Rate

The mortality rate from RTI in 2010 is (400/1,000,000 X 100,000)= 40 deaths per 100,000 population in 2010.



1. A rate allows you to compare between different populations easily
2-the number or amount of group or part of something when compared to the whole

Health Indicators Concepts: Numerator and Denominator and Multipliers

2 Numerator and Denominator

Numerator

- Number of times an event (e.g. death, sickness, births, etc) has occurred in a population during a specified time period.
- it is **ALWAYS** a included in the denominator of proportions and rates.
- Numerators are **NOT** a component of the denominator in ratios.

VS

Denominator

- Denominators are especially important for **RATES**.
- It might be related to:
  - The population such as mid-year population(Population at risk) in a given year
  - OR total events where it's more relevant than than total population.
- For example, case fatality rate from car injuries, it's more meaningful to have the denominator of 'number of vehicles'. Why?[1]

3 Multipliers (10^n / per 100. 100, 1000,000)

- Majority of formulae include a multiplier of 100 and most often a multiplier of 1000, 10,000 or even 100,000.
- A multiplier is used to:
  - Indicate how often something occurred per 1000 population or per 100,000 population
  - Decrease the use of minute decimal fractions. e.g a mortality rate of 0.000071
  - Increase data comprehension (how well we understand the presented data)

In certain rates, rather than specifying a multiplier such as 1000 or 100,000, **you can use 10^n** so the most appropriate **multiplier can be selected to facilitate the data interpretation.**

Example

A rate with a numerator of 190,000 and a denominator of 23,000,000 results in a value of 0.00826.

Using a multiplier of 1000:

=1000 x 0.00826 = 8.3
So 8.3 per 1000 population

Using a multiplier of 10,000:

= 10,000 x 0.00826 = 82.6
So 82.6 per 10,000 population

1-Taking number of vehicles as the total population will be a more useful denominator than the total population, because many of the target population may not be using vehicles.

Health Indicators: Morbidity Indicators:

1 Incidence

Definition	Number of **NEW cases** occurring in a DEFINED POPULATION during a **SPECIFIED PERIOD OF TIME**.
Tool of Measurement	**Rate**
Numerator	Number of **NEW cases** of specific disease during a given time period
Denominator	**Population at risk (not yet diseased)** during that given time period at the start of the period
10n	per 1000
Time frame	per year (usually a year unless otherwise specified)
Uses	1. Taking action (outbreak) 2. Control disease (outbreak) 3. Research for etiology and pathogenesis 4. Efficacy of therapeutic and preventive measures 5. Cohort studies
Formula	$\text{Incidence} = \frac{\text{Number of new cases of specific disease during a given time period}}{\text{Population at-risk during that period}} \times 1000$

Example

In 2010, the number of new cases of influenza in Riyadh region was 5000. The midyear population of Riyadh region during the same year was 3 million.

Incidence = $\frac{\text{Number of New cases}}{\text{Population at risk}^{1}} \times 1000$

Incidence = $\frac{5000}{3{,}000{,}000} \times 1000 = 1.67$

Incidence = 1.67 **per** 1000 **per** year (or there are 1.67 new cases of influenza for each 1000 of population in Riyadh 2010)

1-Part of the population who are free of the disease but are susceptible (have risk factors) of getting the disease

Health Indicators: Morbidity Indicators:

2 Prevalence

Disease Prevalence refers to all cases **(NEW & OLD)** existing at a given **POINT** in time OR over a **PERIOD** of time in a given **POPULATION**.

Type	Point-Prevalence	Period-Prevalence (less common)
Definition	Number of all current cases NEW & OLD occurring in a DEFINED POPULATION at **ONE POINT** OF TIME (a day, days, or few weeks)	Number of all current cases NEW & OLD occurring in a DEFINED POPULATION at a **DEFINED PERIOD of TIME** (over months or annual)
Tool of Measurement	**Proportion** (BE CAREFUL! It is a proportion even when it is called rate)	
Numerator	Number of all current cases NEW & OLD at a given POINT of TIME	Number of all current cases NEW & OLD at a a DEFINED PERIOD of TIME
Denominator	Estimated population at the same given POINT of TIME	Estimated population at the same a DEFINED PERIOD of TIME
10n	per 100 (always expressed as percentage)	
Time frame	Given point of time	
Uses	1) Estimate the magnitude of health, disease and high risk populations, 2) Administrative and planning e.g. hospital beds	Estimate the magnitude of health, disease and high risk populations
	Cross sectional study	
Formula	$= \frac{\text{Number of all current cases (old and new) of a specified disease existing at a given point in time}}{\text{Estimated population at the same point in time}} \times 100$	$= \frac{\text{Number of existing cases (old and new) of a specified disease during a given period of time interval}}{\text{Estimated mid-interval population at-risk}} \times 100$

Example

In a survey of 1,150 medical students in Riyadh in 2018, a total of 468 reported symptoms of seasonal allergies during the the first week of September. Calculate the prevalence of seasonal allergies in this group.

$$\text{Period Prevalence} = \frac{\text{Number of existing cases}}{\text{Mid- interval Population}} \times 100$$

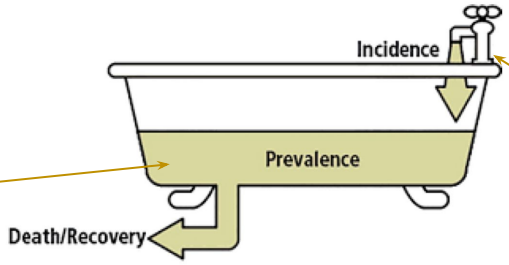
$$\text{Period Prevalence} = \frac{468}{1150} \times 100 = 40.7\ \%$$

What is the relationship between the morbidity indicators: Incidence and Prevalence?

The Epidemiologist Bathtub!

The bathtub represents **community**.

Water in the tub represents **prevalence** of disease



Water from the faucet represent **Incidence**

- The **more\less** water that is in the tub the **more \less** disease prevalence is there.
- The **prevalence represents burden of disease = how many people have the disease**

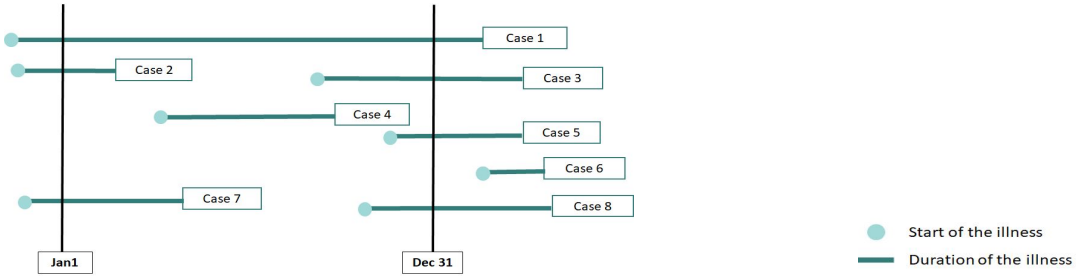
So, how can we decrease this burden?

- So we can get rid of the water **(prevalence)** from the tub **(Community)** by draining it so we can lower the prevalence!
- To drain the tub **(lower the prevalence)** we have to get rid of people who have the disease: by two ways: they can be **CURED** or **DIE**
- How can we get water **(Incidence)** in the tub? Obviously through the faucet
  - Open the faucet all the way **(fast running water) = HIGH INCIDENCE**
  - Almost **closed (low running water) = LOW INCIDENCE**

Prevalence = Incidence x Duration of Disease

Exercise

What cases will be included in the **Incidence**, **Point Prevalence** and **Period Prevalence** during the below period of time?



- **Incidence**: 3, 4, 5, 8
- **Point prevalence (Jan 1):** Cases : 1, 2, 7
- **Point prevalence (Dec 31):** Cases : 1, 3, 5, 8
- **Period prevalence:** 1, 2, 3, 4, 5, 7, 8

Health Indicators – Mortality: Crude Death Rate

1 Crude Death Rate (CDR)

Definition	Number of **deaths** from **ALL CAUSES** occurring in **ESTIMATED MID-YEAR POPULATION** during ONE YEAR in a GIVEN PLACE.
Tool of Measurement	Rate
Numerator	Number of **deaths from ALL CAUSES** during the YEAR
Denominator	**Mid-year population**
10n	per 1000
Time frame	One year
Uses	Gives an impression of mortality in a single figure!
Formula	$\frac{\text{Number of deaths during the year}}{\text{Mid-year population}} \times 1000$

- A Major **Disadvantage** of CDR is Lack of comparability [1] for communities with populations that differ by age, gender, race, etc. HOW?

Team 438

Here population B appears to be healthier than A

Popula –tion	Crude death rate
A	15.2
B	9.9

- But when we check the composition by age (age specific mortality rates)
- B has **higher** mortality rates in all age groups. Why?
- Because the higher CDR in population A is due to more OLDER population in comparison to B with relatively younger population.

Popula –tion	Crude death rate	Age-specific death rates per 1000 population					
		0–1	1–4	5–7	8–44	45–64	65+
A	15.2	13.5	0.6	0.4	1.5	10.7	59.7
B	9.9	22.6	1.0	0.5	3.6	18.8	61.1

Exercise

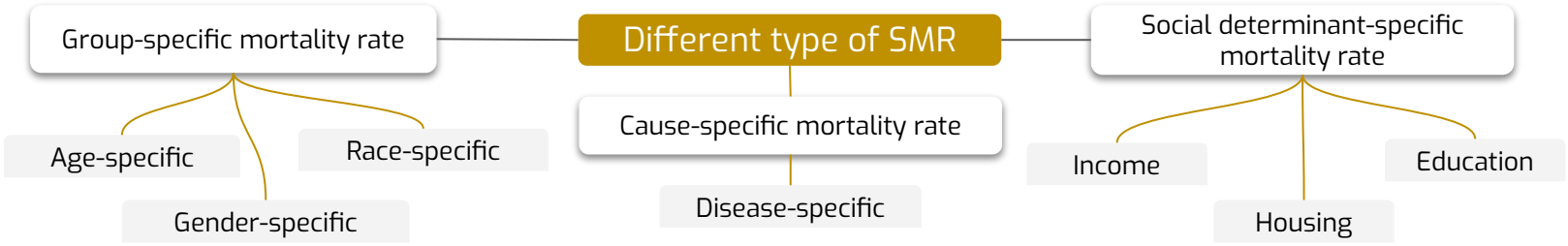
In Saudi Arabia in 2017, a total of 119,157 deaths occurred. The estimated population was 33,099,147. **Calculate crude death for Saudi Arabia in 2017**

CDR = $\frac{\text{Number of deaths during the year}}{\text{Mid-year population}} \times 1000$ $\frac{119{,}157}{33{,}099{,}147}$ X 1000 = 3.6 per 1000 people

1. So it can't be used to compare between two regions, we can use it only as an indicator for mortality status in a single region

Health Indicators – Mortality: Specific Mortality Rates

2 Specific Mortality Rates (SMR)



Definition	Number of deaths from/in **SPECIFIC (CAUSE, GROUP, SOCIAL DETERMINANT)** occurring in **ESTIMATED MID-YEAR POPULATION** during a **ONE YEAR in a GIVEN PLACE.**
Tool of Measurement	Rate
Numerator	Number of deaths from **specific (cause, group, social determinant)** during the year
Denominator [1]	Cause-specific: **mid-year population**. group, social determinant: **mid-year population of specific group, social determinant** measuring mortality relate can include more than one specific ex , calculate Gender , cause specific mortality rate
10n	per 1000 or per 100,000
Time frame	One year
Uses	1. Identify at risk groups for preventive action, 2. They allow comparison between different causes within the same population
Formula	1. Specific death rate due to tuberculosis = $\frac{\text{Number of deaths from tuberculosis during a calendar year}}{\text{Mid-year population}} \times 1{,}000$ 2. Specific death rate for males = $\frac{\text{Number of deaths among males during a calendar year}}{\text{Mid-year population of males}} \times 1{,}000$ 3. Specific death rate in age group 15-20 years = $\frac{\text{Number of deaths of persons aged 15–20 during a calendar year}}{\text{Mid-year population of persons aged 15–20}} \times 1{,}000$

Exercise

In 2001, a total of 15,555 deaths from Road Traffic Injuries occurred among males and 4,753 deaths occurred among females. The estimated 2001 midyear populations for males and females were 139,813,000 and 144,984,000, respectively. **Calculate Gender-specific mortality rates?**

$$\frac{\textbf{RTI deaths among Male\female}}{\textbf{Male\female population}} \textbf{ X 100,000}$$

not whole population be aware of question

Male= $\frac{15{,}555}{139{,}813{,}000}$ X 100,000 = **11.1 RTI deaths per 100,000 population among males**

Female= $\frac{4{,}753}{144{,}984{,}000}$ X 100,000 = **3.3 RTI deaths per 100,000 population among females**

1. Example: when we measure the number of cancer deaths (Cause-specific) in Saudi Arabia the denominator should be the mid year of **whole** population, while when we measure the number cancer deaths in female (Group-specific) in saudi arabia the denominator should be the mid year of population of female **ONLY**

Health Indicators – Mortality: Proportionate Mortality

3 Proportionate Mortality

Definition	Number of deaths due to a **particular cause (or in a specific age group)** per 100 **total deaths**
Tool of Measurement	Proportion
Numerator	Number of deaths from **SPECIFIC CAUSE OR AGE GROUP** during the YEAR
Denominator	TOTAL **deaths** **from ALL CAUSE**S (not the POPULATION in which the deaths occurred)
10n	per 100 (percentage %)
Time frame	One year
Uses	1. Used in broad disease groups (e.g. communicable, non-communicable, injuries) 2. Specific diseases of public health importance (e.g Cancer)
Formula	$= \frac{\text{Number of deaths from the specific disease in a year}}{\text{Total deaths from all causes in that year}} \times 100$

Exercise

In 2003, a total of 128,294 deaths occurred among 24-44 years old. 16,283 deaths were due to heart disease and 7,367 were due to cancer. **Calculate Proportionate mortality for heart disease and cancer among 25–44 years.**

Proportionate mortality = $\frac{\text{deaths from Specific disease}}{\text{deaths from all causes}}$ **X 100**

Proportionate mortality for heart disease, 25–44 years = $\frac{16{,}283}{128{,}294}$ X 100 = 12.6%

Proportionate mortality for cancer, 25–44 years = $\frac{7{,}367}{128{,}294}$ X 100 = 5.7%

Health Indicators – Mortality: Case Fatality Rate

4 Case Fatality Rate

Definition	Number of deaths due to a **PARTICULAR CAUSE (DISEASE)** per 100 **TOTAL CASES**
Tool of Measurement	Proportion **(although it is called rate!, called also: Deaths to Cases Ratio)**
Numerator	Number of deaths due to a **PARTICULAR CAUSE (DISEASE)**
Denominator	TOTAL number of number of **CASES (not the POPULATION in which the cases occurred)**
10n	per 100 (percentage %)
Time frame	Not specified
Uses	1. Reflects the killing power of a disease. 2. Used mainly in acute infectious diseases.
Formula	$= \frac{\text{Total number of deaths due to a particular disease}}{\text{Total number of cases due to the same disease}} \times 100$

Exercise

In an epidemic of hepatitis A traced to green onions from a restaurant, 555 cases were identified. Three of the cases died as a result of their infections. **Calculate the case-fatality rate**

Case Fatality Rate = $\frac{\textbf{Total number of death of Specific disease}}{\textbf{Total number of Cases of Specific disease}}$ **X 100**

Case Fatality Rate = $\frac{3}{555}$ X 100 = 0.5%

Summary

Health indicator

Definition

- Variables that **measure indirectly** a health status which can not be measured directly.
- They are an indication of a given situation.
- They are used to **compare** between areas or population groups at a certain time.
- They are used to **measure changes** over a period of time.
- Health indicators **quantify** health of the population.

Uses

1. Measure health status in a community.
2. Compare health status between countries over time.
3. Assessment of health care needs.
4. Allocation of resources according to needs.
5. Monitoring and evaluation of health services.

Characteristics

- Valid
- Reliable
- Sensitive
- Specific
- Relevant
- Feasible

Major types

Morbidity

1- Incidence
2- Prevalence
2.1 - Point Prevalence
2.2- Period Prevalence

Mortality

1- Crude death rate
2- Specific mortality rates
2.1- Group specific
2.2- Cause specific
2.3- Social determinants specific
3- Maternal & Child mortality (ratios,rates).
4- Proportionate mortality
5- Case Fatality Rate

Tools of measurement

Ratio

- the relationship in size of one measure/variable to another.
- size of two **different variables** or quantities.
- The numerator is **NOT** a component of the denominator.

Proportionate

- **A specific type of ratio** that relates a part to a whole.

- magnitude of the part of a whole.

- The numerator is **ALWAYS** a component of / INCLUDED in the denominator.

Rate

- **A special type of proportion** that measures the occurrence of an event in a population during a **given time**.
- to allow comparisons
- There **must** be a time dimension and a multiplier (per 1000, per 100,000).

Numerator, Denominator, Multiplier.

Numerator

- Number of times an event (e.g. death, sickness, births, etc) has occurred in a population during a specified time period.
- it is **ALWAYS** a included in the denominator of proportions and rates.
- Numerators are **NOT** a component of the denominator in ratios

Denominator

- Denominators are especially important for **RATES**.
- It might be related to:
The population such as mid-year population in a given year,
OR total events where it's more relevant than than total population.

Multiplier

- Majority of formulae include a multiplier of 100 and most often a multiplier of 1000,

Summary

	Tool	Formula	Uses
Incidence	Rate —> x1000	$\frac{\text{New cases}}{\text{Population at risk (Mid-year population)}}$ X1000	1- Taking action (outbreak) 2- Control disease (outbreak) 3- Research for etiology and pathogenesis 4- Efficacy of therapeutic and preventive measures 5- Cohort studies
Prevalence	Proportion —> x100	**Point** $\frac{\text{New + old cases}}{\text{Population at the same point of time}}$ x 100	1- Estimate the magnitude of health, disease and high risk populations. 2- Administrative and planning e.g. hospital beds
		Period $\frac{\text{New + old cases}}{\text{Mid-interval population at risk}}$ x 100	1- Estimate the magnitude of health, disease and high risk populations.
Crude death rate	Rate —> x1000	$\frac{\text{All deaths}}{\text{Mid-year population}}$ x 1000	1- Gives an impression of mortality in a single figure!
Specific mortality rates	Rate —> x1000	$\frac{\text{Deaths from specific cause}}{\text{Population}}$ x 1000	1- Identify at risk groups for preventive action, 2- They allow comparison between different causes within the same population.
Proportionate morality	Proportion —> x100	$\frac{\text{Deaths from specific cause}}{\text{Deaths}}$ X100	1- Used in broad disease groups (e.g. communicable, non-communicable, injuries) 2- Specific diseases of public health importance (e.g Cancer)
Case fatality rate	Proportion —> x100	$\frac{\text{Deaths from specific cause}}{\text{cases due to the same disease}}$ X100	1- Reflects the killing power of a disease 2- Used mainly in acute infectious diseases.

Practice Questions

Q1: Number of times an event (e.g. death, sickness, births, etc) has occurred in a population during a specified time period is :

A. Denominators	B. Numerator	C. Incidence	D. Prevalence

Q2: Total population: 10007334, Mid year population: 9982709, Total deaths: 90000. Based on these measures, what is the estimated total crude death rate?

A. 1.68 deaths per 1000	B. 4.09 deaths per 1000	C. 9.02 deaths per 1000	D. 7.11 deaths per 1000

Q3: In 2005, a total of 132,307 deaths occurred among 25-45 years old. 20,543 deaths were due to road traffic guiles and 12,233 were due to cancer. Calculate Proportionate mortality for cancer among 25–45 years.

A. 9.2%	B. 8.7%	C. 12.6%	D. 10.9%

Q4: In a survey of 1,370 medical students in Riyadh in 2017, a total of 522 reported symptoms of seasonal allergies during the the first week of September. Calculate the prevalence of seasonal allergies in this group.

A. 22.5%	B. 38.1%	C. 33.2%	D. 41.7%

Q5: In an epidemic of hepatitis A traced to green onions from a restaurant, 444 cases were identified. Two of the cases died as a result of their infections. Calculate the case-fatality rate.

A. 0.7%	B. 0.2%	C. 0.92%	D. 0.45%

Q6: In 2020, from March to November, the number of new cases of Covid-19 in Saudi Arabia is 350,000. Mid year population of Saudi Arabia during the same year was 34,813,871, Calculate the incidence per 1000.

A. 10.05 per 1000 per 8 months	B. 15.22 per 1000 per 8 months	C. 17.45 per 1000 per 8 months	D. 19.14 per 1000 per 8 months

Answer key:

1 (B) , 2 (C) , 3 (A) , 4 (B) , 5 D) , 6 (A)

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"إذا كنت تريد النجاح...
فثمنه الوحيد سنوات طويلة من
الفكر والعرق والدموع"

د\غازي القصيبي (رحمه الله)