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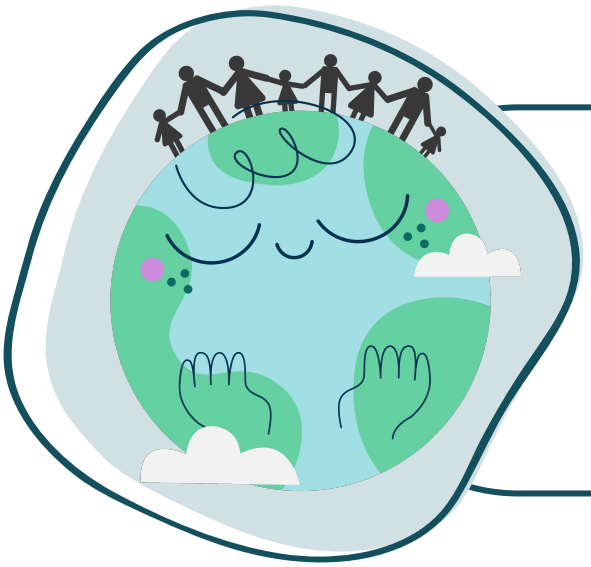


# Health Indicators

## Objectives

- By the end of this lecture, students should be able to:
  - Explain the need to use “indicators” to measure “health” status
  - State the characteristics of health indicators
  - List the uses of health indicators
  - State with examples the types of health indicators

## Color Index

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

Editing File

# 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.

## Health Indicators: Definition

- 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 groups 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: 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.

1. It cannot be measured directly because health is a spectrum and it's a relative concept

# 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] عبئ المرض


**Mortality** الوفيات

- Incidence
- Prevalence
  - Point Prevalence
  - Period Prevalence
- Crude death rate
- 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
2. Measure the burden of disease not the disability
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

# 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 term is a **MUST** for interpretation of indicators.

| Tool of Measurement | Ratio (simple ratio) | Proportion | 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. | 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**

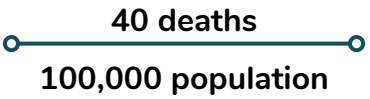
The male to female ratio is 300/100 or 300:100 or 3:1 i.e. there are 3 male deaths for every female death

**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

# 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 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, 1000, 100,000)

- 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** 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)<br>2. Control disease (outbreak)<br>3. Research for etiology and pathogenesis<br>4. Efficacy of therapeutic and preventive measures |
| **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.

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

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

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,<br>2) Administrative and planning e.g. hospital beds | Estimate the magnitude of health, disease and high risk populations |
| **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.

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

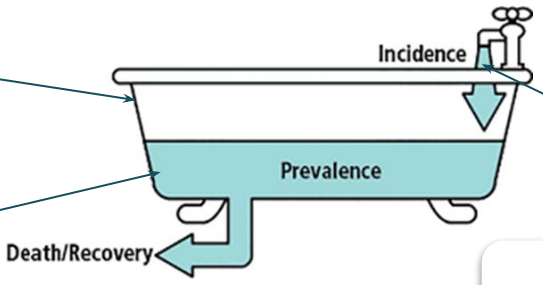
$$\text{Period Prevalence} = \frac{468}{1150} \times 100 = 40.7\ \%$$

# Health Indicators: Epidemiologist Bathtub

## The Epidemiologist Bathtub!

The bathtub represents **community**.

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




Water from the faucet represent **Incidence**

**Prevalence =**
**Incidence x Duration of Disease**

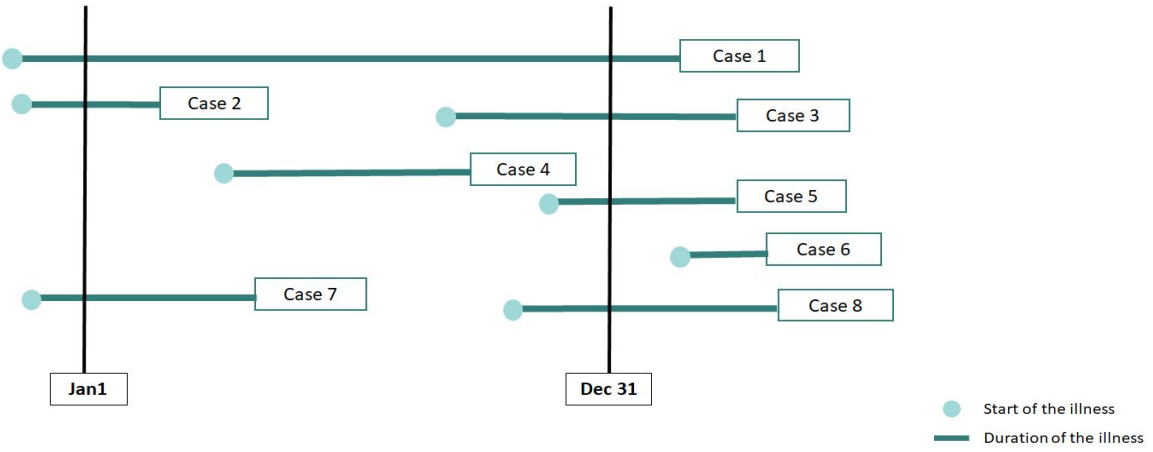
- The **more\less** water that is in the tub the **more \less** disease prevalence is there.
- The prevalence represents burden of disease = how many people have the disease

**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 way , 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 = HIGH INCIDENCE , Almost closed = LOW INCIDENCE

### Exercise

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




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

Here population B appears to be healthier than A

- 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 |
|---|---|
| A | 15.2 |
| B | 9.9 |

| 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 |

**Example**

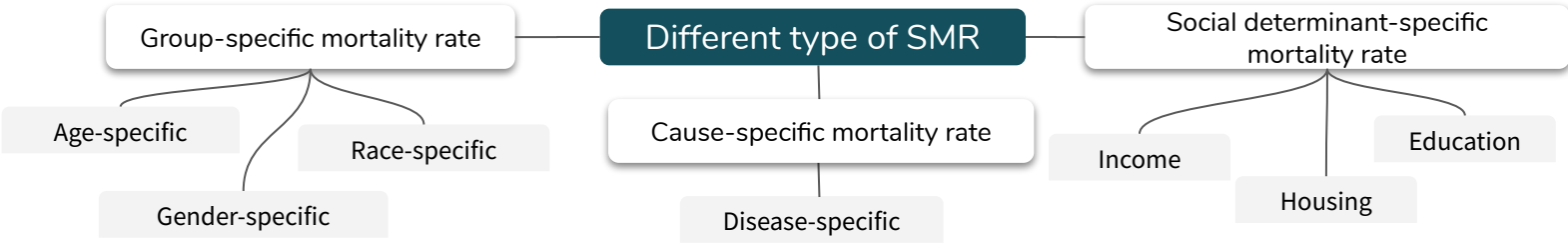
- In Saudi Arabia in 2017, a total of 119,157 deaths occurred. The estimated population was 33,099,147. Calculate crude death for Saudi Arabia in 2017

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

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 |
| **10n** | per 1000 or per 100,000 |
| **Time frame** | One year |
| **Uses** | 1. Identify at risk groups for preventive action,<br>2. They allow comparison between different causes within the same population |
| **Formula** | 1. Specific death rate due to tuberculosis = $\frac{\text{Number of deaths from tuberculosis during a calendar year}}{\text{Mid-year population}} \times 1{,}000$<br>2. Specific death rate for males = $\frac{\text{Number of deaths among males during a calendar year}}{\text{Mid-year population of males}} \times 1{,}000$<br>3. Specific death rate in age group 15-20 years = $\frac{\text{Number of deaths of persons aged 15–20 during a calendar year}}{\text{Mid-year population of persons aged 15–20}} \times 1{,}000$ |

## Example

- 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?**

$$\frac{\text{RTI deaths among Male\female}}{\text{Male\female population}} \times 100{,}000$$

$$\text{Male} = \frac{15{,}555}{139{,}813{,}000} \times 100{,}000$$

**= 11.1 RTI deaths per 100,000 population among males**

$$\text{Female} = \frac{4{,}753}{144{,}984{,}000} \times 100{,}000$$

**= 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 CAUSES (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)<br>2. Specific diseases of public health importance (e.g Cancer) |
| **Formula** | $= \frac{\text{Number of deaths from the specific disease in a year}}{\text{Total deaths from all causes in that year}} \times 100$ |

## Example

- 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.

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

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

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

# 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.<br>2. Used mainly in acute infectious diseases. |
| **Formula** | $= \frac{\text{Total number of deaths due to a particular disease}}{\text{Total number of cases due to the same disease}} \times 100$ |

## Example

- 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**

$$\text{Case Fatality Rate} = \frac{\text{Total number of death of Specific disease}}{\text{Total number of Cases of Specific disease}} \times 100$$

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

# Quiz

## MCQ

1. In a population of 500,000 people, 18,000 have been diagnosed with diabetes. What is diabetes prevalence rate per 100,000 people?

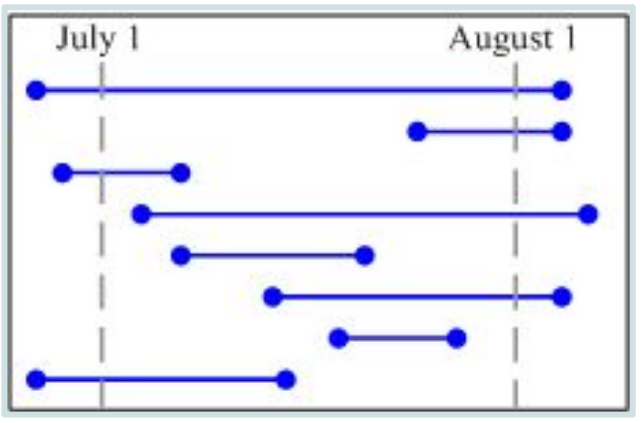
A. 0.036 B. 0.18 C. 18,000 D. 3,600

2. In a state that did not require varicella vaccination, a boarding school experienced a prolonged outbreak of varicella among its students that began in September and continued through December. To calculate the probability or risk of illness (incidence) among the students, which denominator would you use?

A. Number of susceptible students at the ending of the period (i.e., June)
B. Number of susceptible students at the midpoint of the period (late October/early November)
C. Number of susceptible students at the beginning of the period (i.e., September)
D. Average number of susceptible students during outbreak

Using the following diagram ,Assume that the horizontal lines in the diagram represent duration of illness in 8 different people, out of a community of 700.

3. What is the prevalence of disease during July?




A. 3/700
B. 4/700
C. 5/700
D. 8/700

4. What is the incidence of disease during July?

A. 3/700
B. 4/700
C. 5/700
D. 8/700

5. In 2020, a total of 10,000 deaths occurred among males from cancer and 7,859 deaths occurred among females. The estimated 2020 midyear populations for males and females were 140,812, and 149,000, respectively. Calculate Cause-specific mortality rates using a multiplier of 1000

A. 61.6 cancer deaths per 1000 population
B. 616.2 cancer deaths per 1000 population
C. Males: 71, Female: 52 (cancer deaths per 1000 population)
D. Males: 710, Female: 520 (cancer deaths per 1000 population)

## Answers

| Q1 | Q2 | Q3 | Q4 | Q5 |
|---|---|---|---|---|
| D | C | D | C | A |

# Thank You and Good Luck

Community Medicine
438

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