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Health Indicators

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Objectives

By the end of this lecture, students should be able to:
1. Explain the need to use "indicators" to measure "health" status
2. State the characteristics of health indicators
3. List the uses of health indicators
4. State with examples the types of health indicators

{1} Health Indicators: Definitions, Characteristics, Uses and Types

What is an indicator?

- An indicator 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?

- An indicator is an indication of a given situation and a measurable variable

Health Indicators: 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 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: Characteristics of an **IDEAL** Indicator

Valid

measures what it is supposed to measure.

Reliable

provides same information under different observations & conditions

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** cause health is **Multidimensional**

Health Indicators: Uses (Why we need indicators?)

1. <u>Measure health status</u> in a community.

2. <u>Compare health status</u> between countries or over time.

3. Assessment of <u>health care needs</u>.

4. Allocation of <u>resources</u> according to needs.

5. <u>Monitoring and evaluation</u> of health services.

Types of Health Indicators

Types of Health Indicators

Mortality indicators

Morbidity indicators

Disability indicators

Nutritional status indicators

Health care delivery indicators

Utilization rates

Social and mental health indicators

Environmental indicators

Socioeconomic indicators

Health policy indicators

Indicators of quality of life

Other indicator

Health Indicators

Morbidity

Mortality

Incidence	Prevalence

Point-prevalence	Period-prevalence

Crude death rate	Specific mortality rates	Maternal & Child mortality (ratios, rates)	**Proportion-ate mortality**	Case Fatality Rate

Group-specific	Cause-specific	Social Determinant-specific

Indicators are <u>Measurements</u>

{ 2.1 Health Indicators Concepts:

Tools of Measurements

Health Indicators Concepts: Tools of Measurements

- Indicators are <u>measurements of disease magnitude.</u>

- Indicators are <u>expressed in terms</u> of:
  - Ratio
  - Proportion
  - Rate

- Clear understanding of the above terms is a **<u>MUST</u>** for <u>interpretation of indicators.</u>

"We had 400 deaths from Road Traffic Injuries in Riyadh in 2010" So What?!

Tool of Measurement	Ratio (simple ratio)	Proportion	Rate
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	Out of the 400 death, 300 were males and 100 were female. 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	Out of the 400 deaths, 300 were males. i.e the proportion of males who died from RTI is (300/400 X100) = 75%.	In 2010 population of Riyadh 1,000,000. The mortality rate from RTI in 2010 is (400/1,000,000 X100,000)= 40 deaths per 100,000 population in 2010.

{ 2.2 Health Indicators Concepts:

Numerator and Denominator }

Health Indicators Concepts: **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.

  - The numerator is **ALWAYS** a components of (included in) the denominator of **proportions and rates**

  - The numerator is **NOT** a component of (included in the denominator of **ratios**.

- **Denominator**:

  - Denominators are specially 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?

{ 2.3 Health Indicators Concepts:

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

Health Indicators Concepts: 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 <u>how often something occurred </u>per 1000 population or per 100,000 population
  - <u>Decrease the use of minute decimal fractions</u>. e.g a mortality rate of 0.000071, huh?
  - <u>Increase data comprehension </u>(how well we understand the presented data)

- In certain rates, rather than specifying a multiplier such as 1000 or 100,000, <u>you can use 10^n </u>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: 8.3 per 1000 population

Using a multiplier of 10,000: 82.6 per 10,000 population

{3 Health Indicators:

Morbidity Indicators

Health Indicators

Morbidity

Incidence	Prevalence

Point-prevalence	Period-prevalence

Mortality

Crude death rate	Specific mortality rates	Maternal & Child mortality (ratios, rates)	Proportion-ate mortality	Case Fatality Rate

Group-specific	Cause-specific	Social Determinant-specific

{ 3.1 Health Indicators – Morbidity:

Incidence }

Incidence

Definition	Number of <u>NEW</u> cases occurring in a <u>DEFINED POPULATION</u> during a <u>SPECIFIED PERIOD OF TIME.</u>
Tool of Measurement	Rate
Numerator	Number of <u>NEW</u> cases of specific disease during a given time period
Denominator	<u>Population at risk</u> during that given time 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
Formula	$$\text{Incidence} = \frac{\text{Number of new cases of specific disease during a given time period}}{\text{Population at-risk during that period}} \times 1000$$

<u>Example:</u> 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.

- Calculate:

$$\text{Incidence} = \frac{\text{Number of new cases of specific disease during a given time period}}{\text{Population at-risk during that period}} \times 1000$$

= 5000 / 3000000 x 1000

= 1.67 per 1000 per year

3.2 Health Indicators – Morbidity:

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.**

Point-Prevalence

Definition	Number of all current cases NEW & OLD occurring in a DEFINED POPULATION at **ONE POINT OF TIME (a day, days, or few weeks)**
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
Denominator	Estimated population at the same given POINT 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
Formula	$$\text{Incidence} = \frac{\text{Number of new cases of specific disease during a given time period}}{\text{Population at-risk during that period}} \times 1000$$

Period-Prevalence (less common than point-prevalence)

Definition	Number of all current cases <u>NEW & OLD</u> occurring in a <u>DEFINED POPULATION</u> 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 <u>NEW & OLD</u> at a **a DEFINED PERIOD of TIME**
Denominator	<u>Estimated population</u> at the same **a DEFINED PERIOD of TIME**
10n	per 100 (always expressed as percentage)
Time frame	Given point of time
Uses	Estimate the magnitude of health, disease and high risk populations
Formula	$$Incidence = \frac{Number\ of\ new\ cases\ of\ specific\ disease\ during\ a\ given\ time\ period}{Population\ at\text{-}risk\ during\ that\ period} \times 1000$$

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.

- Calculate:

$$= \frac{\text{Number of existing cases (old and new) of a specified disease during a given period of time interval}}{\text{Estimated mid-interval population at-risk}} \times 100$$
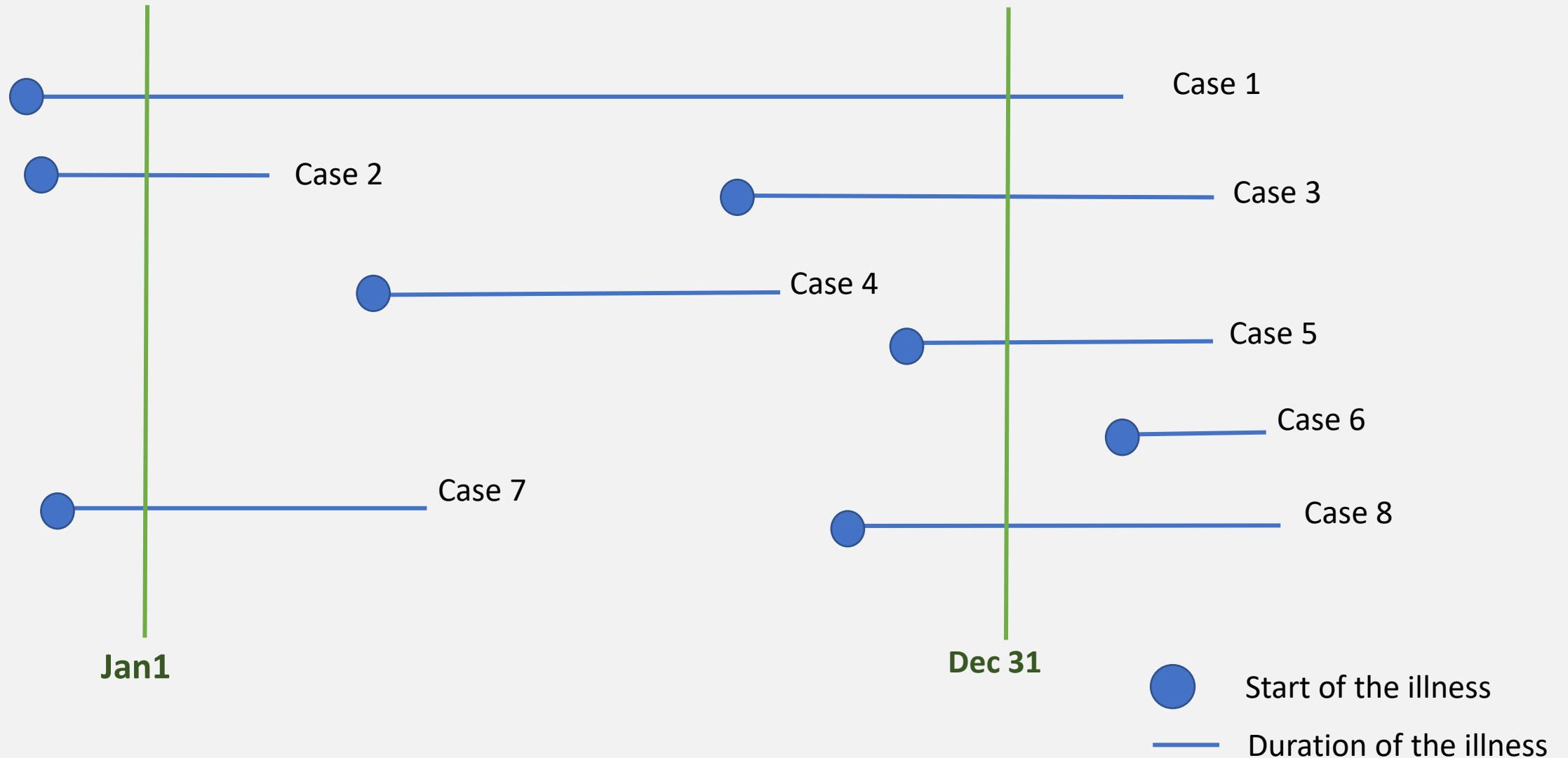
= 468 / 1150 x 100

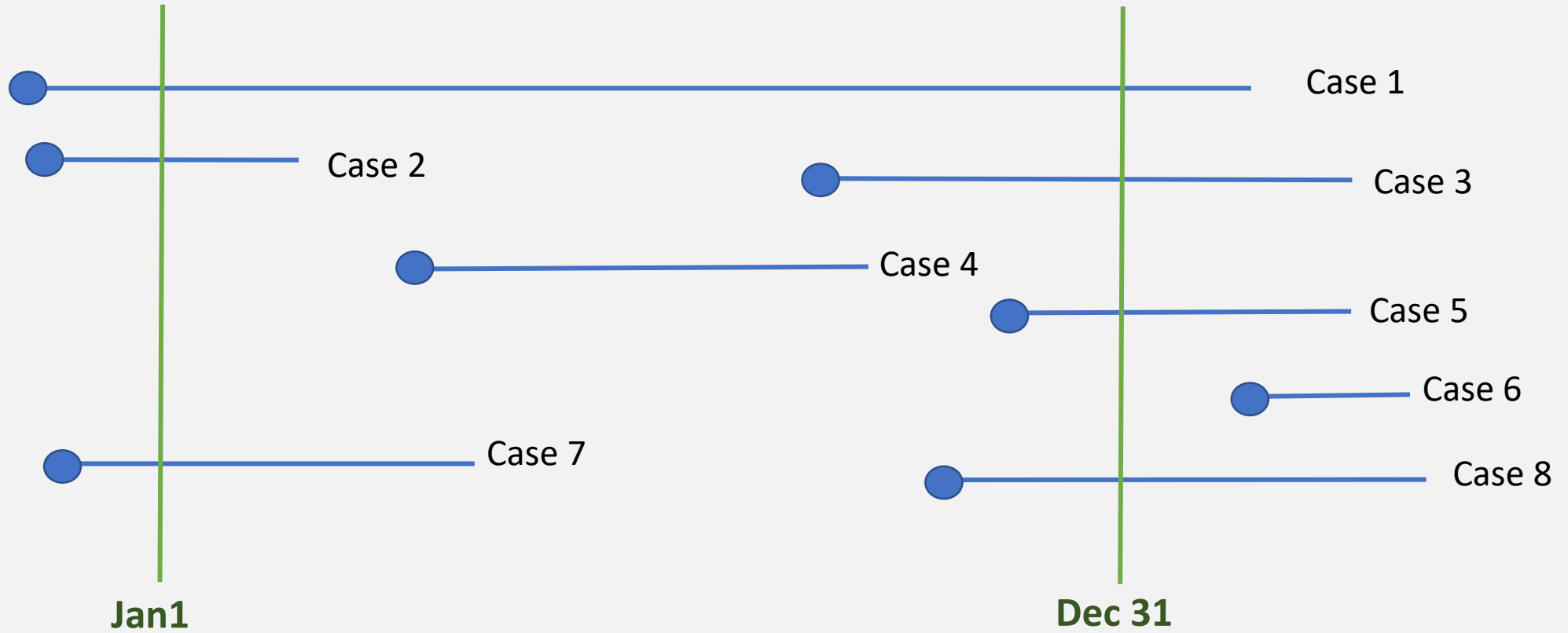= 40.7 %

Prevalence is a snapshot of the population!

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

Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Case 8

Jan1
Dec 31

Start of the illness
Duration of the illness

- Incidence: 3, 4, 5, 8
- Point prevalence Dec 31: 1, 3, 5, 8
- Point prevalence Jan1: 1, 2, 7
- Period prevalence: 1, 2, 3, 4, 5, 7, 8

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** so:
    - the more water that is in the tub the more disease prevalence is there.
    - the less water that is in the tub the less disease prevalence there.

- The **prevalence represents burden of disease = how many people have the disease**
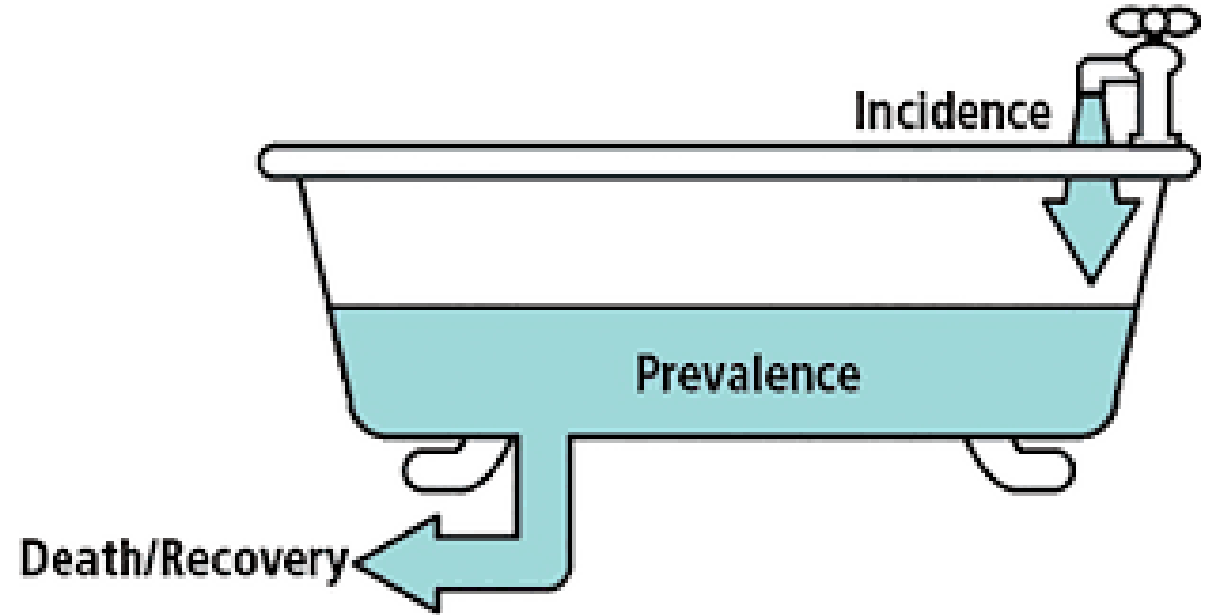
The Epidemiologist Bathtub!

- So we can get rid of the water from the tub by **draining it** so we can **lower the prevalence!**

- How can we drain the tub? **TWO WAYS** to get rid of people who have the disease:
  - They can be **CURED**
  - They can **DIE**

- How can we get water 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**

Incidence

Prevalence

Death/Recovery
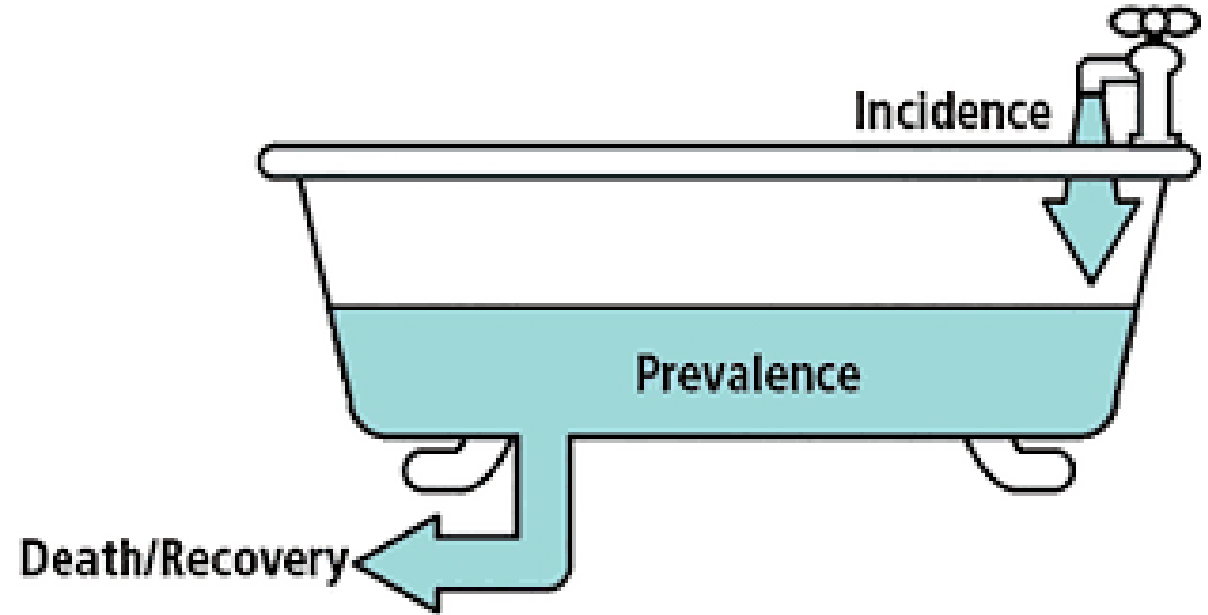
Prevalence = Incidence X Duration of Disease

{4 Health Indicators:

Mortality Indicators

Health Indicators

Morbidity

Incidence	Prevalence

Point-prevalence	Period-prevalence

Mortality

Crude death rate	Specific mortality rates	Maternal & Child mortality (ratios, rates)	Proportion-ate mortality	Case Fatality Rate

Group-specific	Cause-specific	Social Determinant-specific

{ 4.1 Health Indicators – Mortality:

Crude Death Rate

Crude Death Rate

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

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.

$$\frac{\text{Number of deaths during the year}}{\text{Mid-year population}} \times 1000$$

= 119,157 / 33,099,147 x 1000

= 3.6 per 1000 people

Major Disadvantage of CDR!

Popula-tion	Crude death rate
A	15.2
B	9.9

- At first, population B appears to be healthier than A
- When we check the composition by age (age specific mortality rates) ➜ B has higher mortality rates in all age groups! Huh?!
- Why? cause the higher crude death rate in population A is due to more OLDER population in comparison to B with relatively younger population.

<u>Lack of comparability</u> for communities with populations that <u>differ</u> by age, gender, race, etc

4.2 Health Indicators – Mortality:
Specific Mortality Rates

Specific Mortality Rates

Definition	Number of deaths from/in <u>SPECIFIC (CAUSE, GROUP, SOCIAL DETERMINANT)</u> occurring in <u>ESTIMATED MID-YEAR POPULATION</u> during a <u>ONE YEAR in a GIVEN PLACE.</u>
Tool of Measurement	Rate
Numerator	Number of deaths from <u>SPECIFIC (CAUSE, GROUP, SOCIAL DETERMINANT)</u> during the YEAR
Denominator	Cause-specifc: <u>MID-YEAR POPULATION</u> / Group, Social determinant: <u>MID-YEAR POPULATION</u> 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, 2) They allow comparison between different causes within the same population
Formula	1. Specific death rate due to tuberculosis $= \dfrac{\text{Number of deaths from tuberculosis during a calendar year}}{\text{Mid-year population}} \times 1,000$ 2. Specific death rate for males $= \dfrac{\text{Number of deaths among males during a calendar year}}{\text{Mid-year population of males}} \times 1,000$ 3. Specific death rate in age group 15-20 years $= \dfrac{\text{Number of deaths of persons aged 15–20 during a calendar year}}{\text{Mid-year population of persons aged 15–20}} \times 1,000$

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

RTI mortality rate (males)

    = (# RTI deaths among males ∕ male population) × 100,000

    = 15,555 ∕ 139,813,000 × 100,000

    = 11.1 RTI deaths per 100,000 population among males

RTI mortality rate (females)

    = (# RTI deaths among females ∕ female population) × 100,000

    = 4,753 ∕ 144,984,000 × 100,000

    = 3.3 RTI deaths per 100,000 population among females

{ **4.3** Health Indicators – Mortality:

Proportionate Mortality }

Proportionate Mortality

Definition	Number of deaths due to a <u>PARTICULAR CAUSE (OR IN A SPECIFIC AGE GROUP)</u> per 100 <u>TOTAL DEATHS</u>
Tool of Measurement	Proportion
Numerator	Number of deaths from <u>SPECIFIC CASUSE OR AGE GROUP</u> during the YEAR
Denominator	TOTAL <u>deaths</u> from <u>ALL CAUSES</u> (**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	$$= \frac{\text{Number of deaths from the specific disease in a year}}{\text{Total deaths from all causes in that year}} \times 100$$

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.

    - Proportionate mortality for heart disease, 25–44 years
        = (# deaths from heart disease∕# deaths from all causes) × 100
        = 16,283∕128,294 × 100
        = 12.6%

    - Proportionate mortality for cancer, 25–44 years
        = (# deaths from cancer∕# deaths from all causes) × 100
        = 7,367∕128,924 × 100
        = 5.7%

{ **4.4** Health Indicators – Mortality:

Case Fatality Rate }

Case Fatality Rate

Definition	Number of deaths due to a <u>PARTICULAR CAUSE (DISEASE)</u> per 100 <u>TOTAL CASES</u>
Tool of Measurement	Proportion **(although it is called rate!, called also: Deaths to Cases Ratio)**
Numerator	Number of deaths due to a <u>PARTICULAR CAUSE (DISEASE)</u>
Denominator	TOTAL number of number of <u>CASES</u> (**not the POPULATION in which the cases occurred)**
10n	per 100 (percentage %)
Time frame	Not specified
Uses	Reflects THE KILLING POWER OF A DISEASE. Used mainly in ACUTE INFECTIOUS Diseases.
Formula	$= \dfrac{\text{Total number of deaths due to a particular disease}}{\text{Total number of cases due to the same disease}} \times 100$

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.

Case fatality rate = (3∕555) × 100 = 0.5%

Let's recap!

By the end of this lecture, we have:

- ✓ Explained the need to use "indicators" to measure "health" status

- ✓ Stated the characteristics of health indicators

- ✓ Listed the uses of health indicators

- ✓ Stated with examples the types of health indicators

Thank you!

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References:

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