COMM 311

Health Indicators

Nurah Alamro, MD. MPH. DrPH.

Assistant Professor - Community Medicine Unit, Family & Community Medicine Department

nmalamro@ksu.edu.sa

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


643km
Draw the Line
10:34 AM
EFFICIENCY
BOOST
CHARGE
READY
MAX
e-tron
OFF
% POWER
478.0 km
+13.0°C
P
378.0km
10:28 AM
795km
km/h

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

- Incidence
- Prevalence
  - Point-prevalence
  - Period-prevalence

Mortality

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

Indicators are Measurements

2.1 Health Indicators Concepts:

Tools of Measurements

Health Indicators Concepts: Tools of Measurements

- Indicators are measurements of disease magnitude.

- Indicators are expressed in terms of:
  - Ratio
  - Proportion
  - Rate

- Clear understanding of the above terms is a **MUST** for interpretation of indicators.

“We had 400 deaths from Road Traffic Injuries in Riyadh in 2010” **So What?!**

Tool of Measurement	**Ratio (simple ratio)**
Definition	the relationship in size of one measure/variable to another
Use	size of two different variables or quantities
Differentiating element	The numerator is **NOT** a component of the denominator.
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

2.2 Health Indicators Concepts:

Numerator and Denominator

Health Indicators Concepts: **Numerator and Denominator**

- **<u>Numerator</u>**:
  - 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**.

- **<u>Denominator</u>**:
  - 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 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, huh?
  - 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: 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
  - Group-specific
  - Cause-specific
  - Social Determinant-specific
- Maternal & Child mortality (ratios, rates)
- **Proportion-ate mortality**
- Case Fatality Rate

3.1 Health Indicators – Morbidity: Incidence

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

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.

- 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	$= \frac{\text{Number of all current cases (old and new) of a specified disease existing at a given point in time}}{\text{Estimated population at the same point in time}} \times 100$

Period-Prevalence (less common than point-prevalence)

Definition	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 **a DEFINED PERIOD of TIME**
Denominator	Estimated population 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	$= \frac{\text{Number of existing cases (old and new) of a specified disease during a given period of time interval}}{\text{Estimated mid-interval population at-risk}} \times 100$

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.

- Calculate:

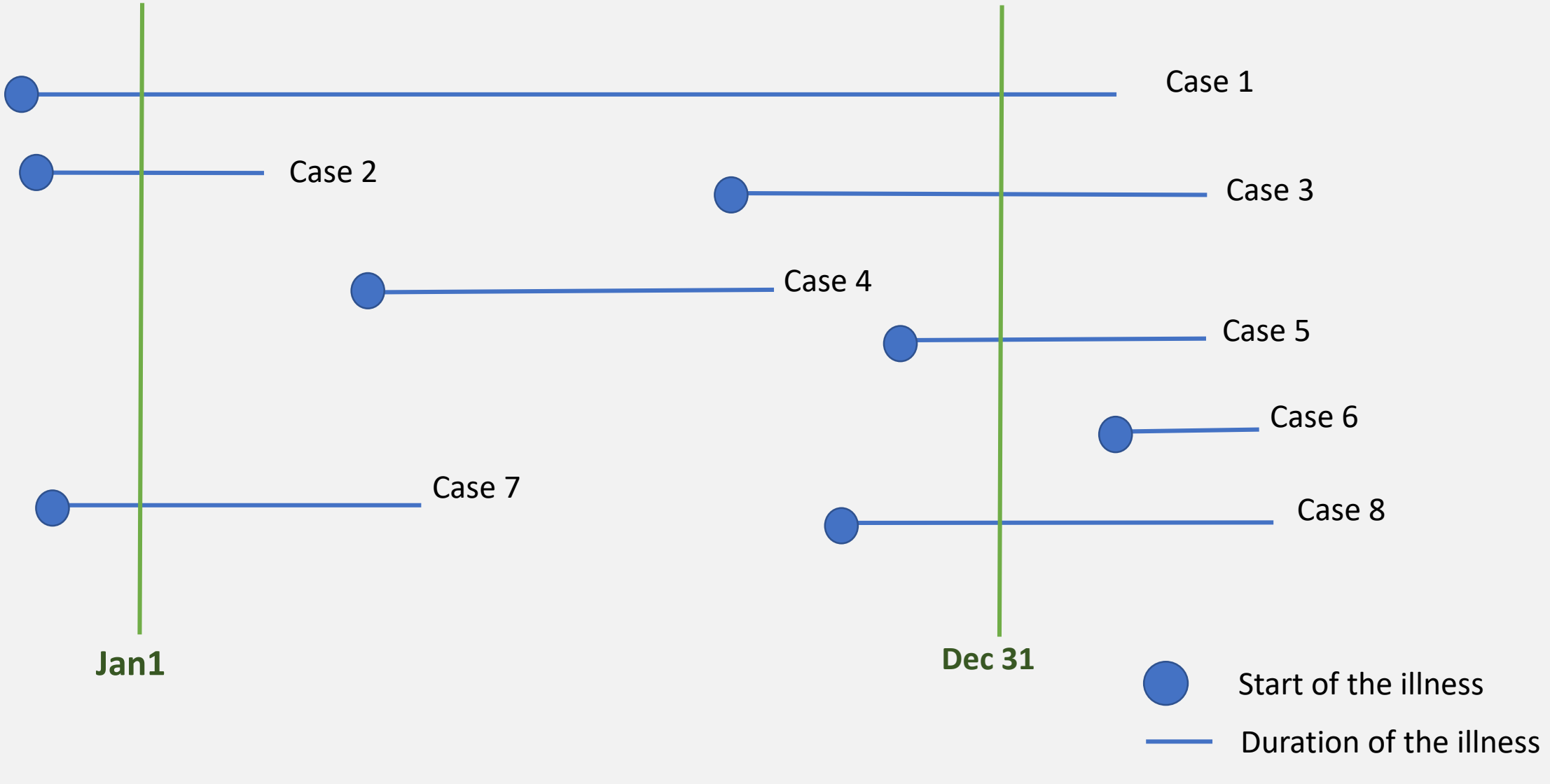
$$= \frac{\text{Number of existing cases (old and new) of a specified disease during a given period of time interval}}{\text{Estimated mid-interval population at-risk}} \times 100$$

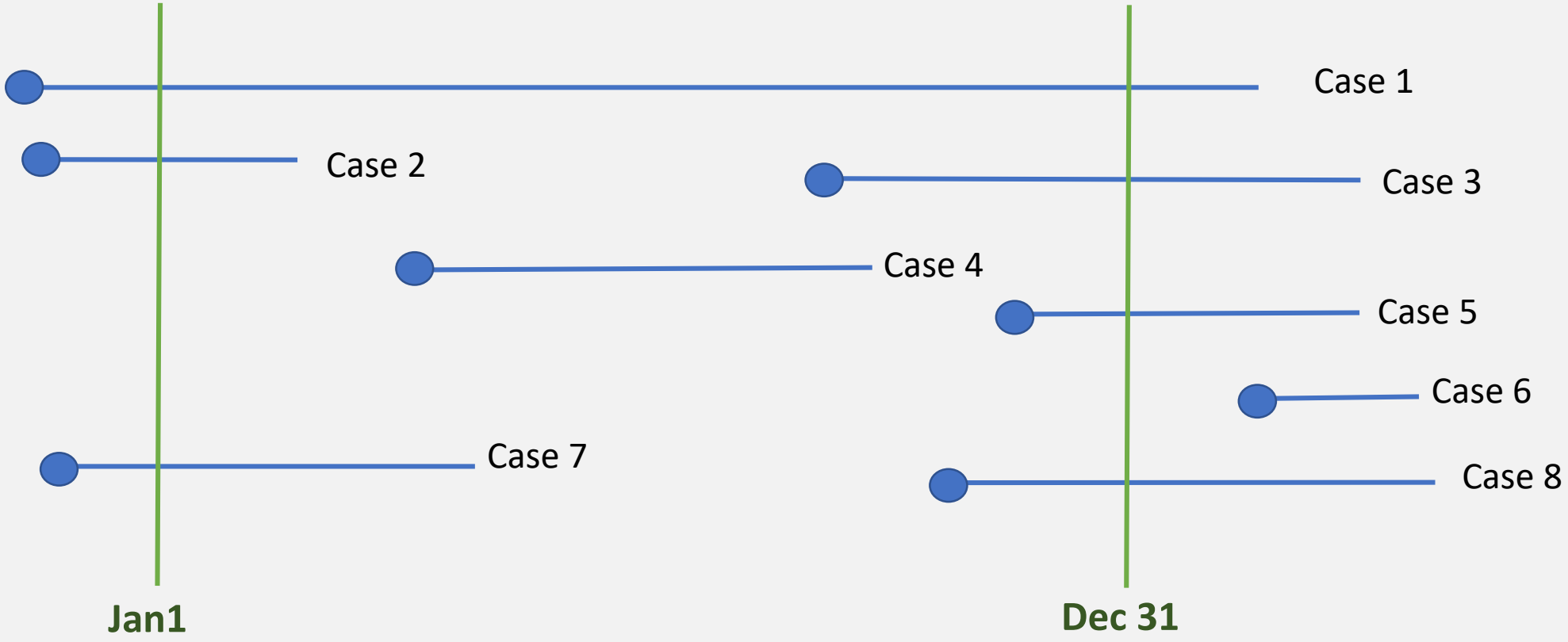
= 468 / 1150 x 100

= 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?





- 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

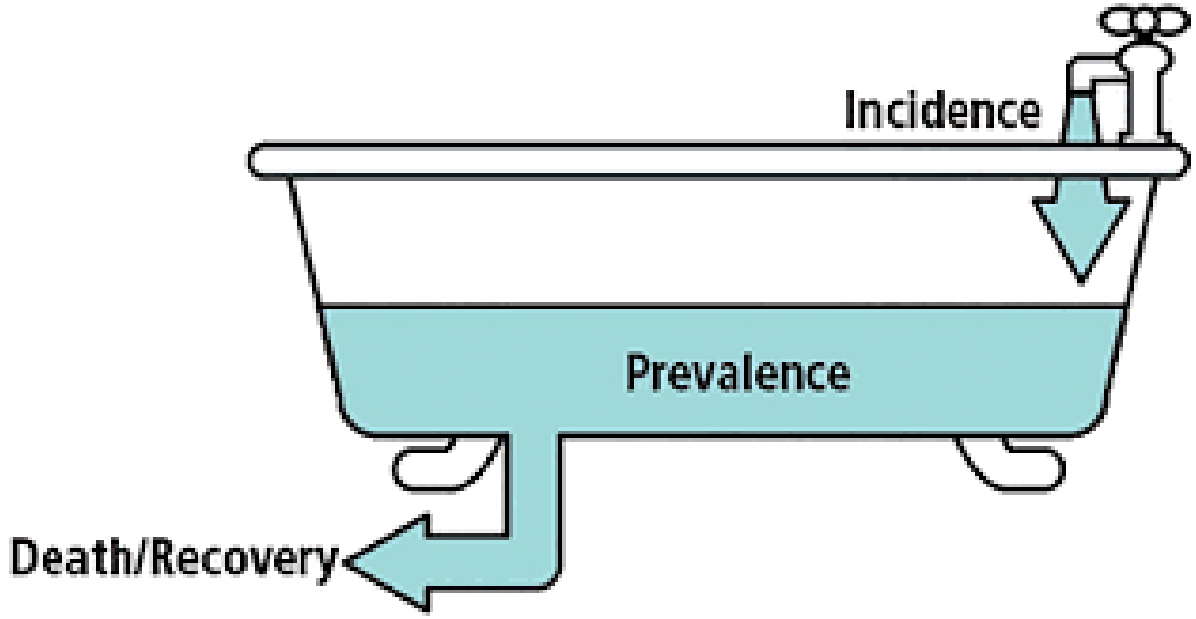
What is the relationship between the morbidity indicators: Incidence and Prevalence?

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**

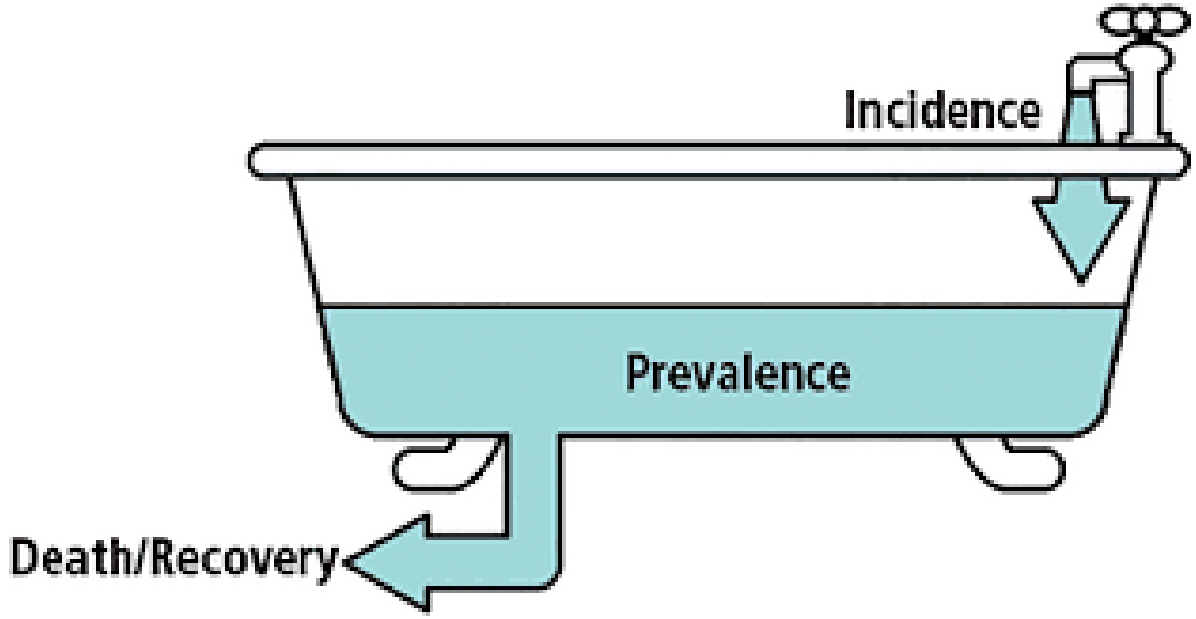


The Epidemiologist Bathtub!

- 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**



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
  - Group-specific
  - Cause-specific
  - Social Determinant-specific
- Maternal & Child mortality (ratios, rates)
- **Proportion-ate mortality**
- Case Fatality Rate

4.1 Health Indicators – Mortality:

Crude Death Rate

Crude Death Rate

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

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!

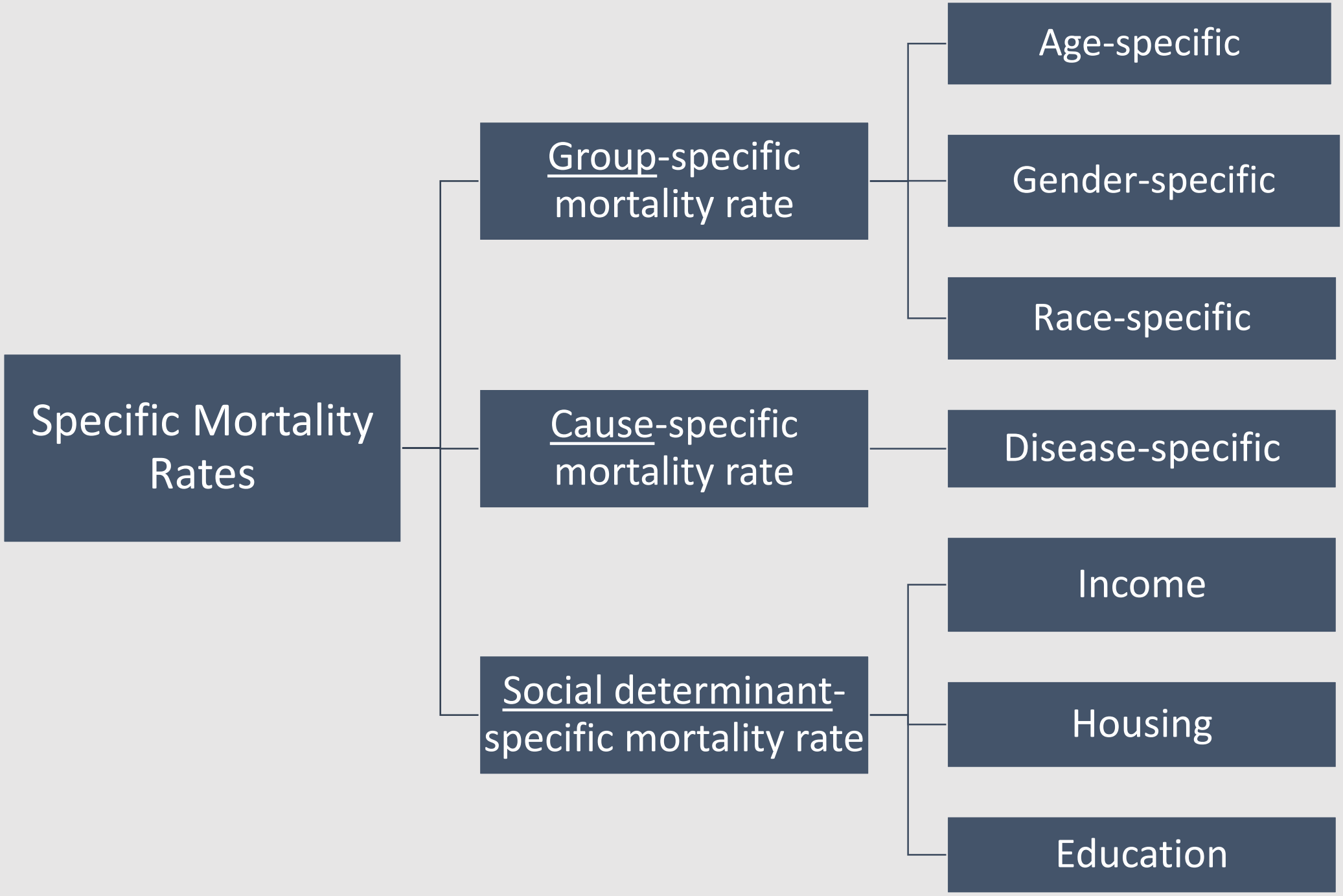
Popula –tion	Crude death rate
A	15.2
B	9.9

- 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.

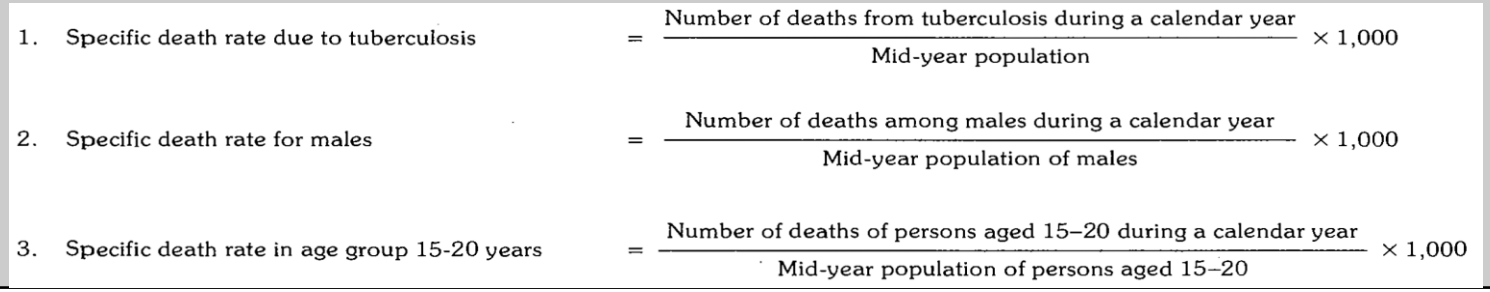
Lack of comparability for communities with populations that differ by age, gender, race, etc

4.2 Health Indicators – Mortality:

Specific Mortality Rates


Specific Mortality Rates
Group-specific mortality rate
Age-specific
Gender-specific
Race-specific
Cause-specific mortality rate
Disease-specific
Social determinant-specific mortality rate
Income
Housing
Education

Specific Mortality Rates

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	Cause-specifc: 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, 2) They allow comparison between different causes within the same population
Formula	

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 PARTICULAR CAUSE (OR IN A SPECIFIC AGE GROUP) per 100 TOTAL DEATHS
Tool of Measurement	Proportion
Numerator	Number of deaths from SPECIFIC CASUSE 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); 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 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	Reflects THE KILLING POWER OF A DISEASE. 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.

$$\text{Case fatality rate} = (3/555) \times 100 = 0.5\%$$

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!

Office Hours (by appointment via email):

Mondays & Wednesdays

11 AM – 1 PM

West Building

Level 1 - Office 4011034

---

nmalamro@ksu.edu.sa