Topic 1: Introduction & Measures of Health

By the end of Topic 1 you should be able to:

- Define **public health** and **epidemiology**.
- Explain that epidemiology studies **populations**, not individuals.
- Describe disease by **person, place, and time**.
- Explain what **determinants (risk factors)** are.
- Distinguish **endemic** from **epidemic**.
- Explain the **epidemiological transition** from infectious to chronic disease.
- Describe the major **aims of epidemiology**.
- Explain how epidemiology underpins **evidence-based public health policy**.
- Understand that **association does not equal causation**.
- Appreciate that prevention often requires decisions despite incomplete evidence.
- Recognise the three core measures of disease occurrence—**risk, incidence rate, and prevalence**—which will be developed further in subsequent lectures.

LO 1: Define the terms "public health" and "epidemiology"

Public Health

"The art and science of preventing disease, prolonging life and promoting health through the organised efforts of society."

Rather than treating individual patients, public health aims to improve the health of entire populations.

Public health activities include:

- disease prevention
- health promotion
- health protection
- disease surveillance
- screening programs
- vaccination
- environmental health
- health policy
- health service planning

Public health is multidisciplinary, incorporating medicine, epidemiology, statistics, behavioural sciences, environmental sciences and policy. Epidemiological evidence underpins public health decisions.

Epidemiology

The study of the occurrence and distribution of health-related events in populations, the factors (determinants) that influence them, and the application of this knowledge to improve health.

Breaking down the definition:

Study

- surveillance
- observation
- hypothesis testing
- analytical research
- experiments

Occurrence & Distribution

- Who is affected?
- Where does it occur?
- When does it occur?

Determinants

Factors influencing health, including:

- biological
- environmental
- behavioural
- social
- cultural
- occupational

Application

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Knowledge gained is used to:

- prevent disease
- improve health
- evaluate interventions
- guide health policy

Unlike clinical medicine, epidemiology focuses on **populations**, not individual patients.

The Four Fundamental Questions of Epidemiology

Descriptive epidemiology asks:

Who?

- age
- sex
- ethnicity
- occupation
- socioeconomic status

Where?

- country
- region
- rural vs urban
- workplace

When?

- season
- year
- trends over time
- before vs after interventions

Analytical epidemiology then asks:

Why?

- What factors (determinants/risk factors) explain disease occurrence?

Functions of epidemiology

1. Describe health status

- incidence
- prevalence
- mortality
- disease trends

2. Identify causes

Determine:

- risk factors
- determinants
- causal pathways

3. Evaluate interventions

Assess effectiveness of:

- treatments
- screening
- vaccination
- prevention programs
- public health policies

4. Understand natural history and prognosis

Study:

- disease progression
- survival
- recovery
- complications

These four functions provide a useful framework for understanding the role of epidemiology.

Epidemiology is More Than Disease

Modern epidemiology studies:

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Diseases
- infectious
- chronic

Health behaviours
- smoking
- alcohol
- exercise

Health outcomes
- survival
- disability
- quality of life

Health services
- screening
- vaccination
- healthcare utilisation

Public health interventions

Epidemiology process

The textbook repeatedly compares epidemiologists to detectives.
The process is:

1. Observe an unusual health event.
2. Collect data.
3. Compare groups.
4. Identify possible causes.
5. Test hypotheses.
6. Recommend interventions.

Example:
- food poisoning outbreak
- cholera outbreak
- disease cluster

Food Poisoning Example

The opening chapter uses a food poisoning outbreak to introduce epidemiological thinking.
Important lessons:
- Raw numbers can be misleading.
- Compare **proportions**, not counts.
- Calculate attack rates.
- Compare exposed vs unexposed groups.
- Calculate relative risk.
- Identify the most likely source.

The example concludes that **cold chicken** was responsible because it had the highest attack rate (77%) and highest relative risk (3.8), despite not having the largest number of cases.

Relationship between Epidemiology and Public Health

Epidemiology is the scientific foundation of public health. Public health decisions should be based on epidemiological evidence.
Public health asks:
"What should we do?"
Epidemiology answers:
"What does the evidence show?"
Examples:
- smoking legislation
- vaccination schedules
- cancer screening programs
- road safety legislation
- infectious disease surveillance

The classic example is smoking. Epidemiological studies by Doll and Hill demonstrated the association between smoking and disease, ultimately leading to tobacco control legislation.

WHO definition of health

The textbook reminds us that epidemiology studies **health**, not just disease.

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The WHO (1948) defined health as:

> **"A state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity."**

Historically, epidemiology measured disease because it was easier to quantify, but modern epidemiology increasingly measures broader aspects of health such as:

- quality of life
- disability
- healthy life expectancy (HALE)
- disability-adjusted life years (DALYs)

Historical Development of Epidemiology

Early epidemiology

Initially focused almost exclusively on infectious diseases:

- plague
- cholera
- smallpox
- tuberculosis

The prevailing model was:

One disease → One cause

Epidemiological Transition

As sanitation, vaccination and antibiotics improved health:
↓ infectious diseases
↑ chronic diseases
Current major causes of mortality include:

- cardiovascular disease
- cancer
- diabetes
- chronic respiratory disease

This shift is called the **epidemiological transition**.
The distinction is not absolute:
Examples:

- HPV causes cervical cancer
- Hepatitis B/C causes liver cancer
- HIV is now managed as a chronic disease

Endemic vs Epidemic

Endemic

- disease occurs at a relatively constant expected level

Examples:

- malaria in some countries

Epidemic

- disease occurs above expected levels

Examples:

- measles outbreak
- COVID wave

The textbook illustrates this as a stable baseline (endemic) with a sudden increase (epidemic).

Aims of Epidemiology

Epidemiology aims to:

- describe disease frequency
- describe disease distribution
- identify disease causes
- identify prognostic factors
- evaluate treatments
- evaluate prevention
- evaluate health services
- guide public health policy

Epidemiology for Prevention (Wall 1995)

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The second reading focuses on the role of epidemiology in improving public health.
Main ideas:
Epidemiology should move beyond observation
It should:

- identify problems
- evaluate interventions
- influence policy
- improve health

Prevention is the ultimate goal.

Disease is Multifactorial

Most diseases arise through interactions between:

- genetics
- biology
- behaviour
- environment
- society
- economics
- politics

The traditional "one disease–one cause" model is insufficient for most chronic diseases.

Association ≠ Causation

One of the most important principles in epidemiology.
Finding an association does **not** automatically prove one factor causes another.
Examples discussed:

- alcohol and cardiovascular disease
- cholesterol and heart disease

These examples illustrate why epidemiological findings must be interpreted critically.

Prevention Requires Decisions Despite Uncertainty

Scientific evidence is rarely perfect.
Public health policy often requires action despite:

- conflicting evidence
- incomplete knowledge
- imperfect studies

Waiting for perfect evidence may delay important preventive action.

Types of Epidemiological Studies

Descriptive studies
Describe disease distribution.
Person
Place
Time

Analytical studies
Compare groups to identify causes.
Examples:

- cohort studies
- case-control studies

Intervention studies
Investigate whether changing an exposure changes disease.
Examples:

- randomised controlled trials
- vaccination studies

These will be covered in more detail later in the course.

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