Introduction to NCD Epidemiology

Presenter’s Name
Presenter’s Title

Title of Event
Date of Event
At the end of the training, participants will be able to describe how to use epidemiology to address a public health problem.
Lesson Overview

• Basic terminology
• Comparison of non-communicable diseases and communicable diseases
• Definition and approaches of epidemiology
• Public health management cycle
• Core functions of epidemiology
Non-Communicable Disease (NCD): Definition

Noncommunicable diseases (NCDs), also known as chronic diseases, are not passed from person to person. They are of long duration and generally slow progression.

(WHO, 2011)
Non-Communicable Disease (NCD): Definition (cont.)

- Chronic conditions are characterized by the following:
  - Do not result from an (acute) infectious process
  - Are “not communicable”
  - Cause premature morbidity, dysfunction, and reduced quality of life
  - Usually develop and progress over long periods
  - Often initially insidious
  - Once manifested there is usually a protracted period of impaired health
Non-Communicable Disease (NCD): Extended Definition

In some definitions, NCDs also include:

- Chronic mental illness
- Injuries, which have an acute onset, but may be followed by prolonged convalescence and impaired function
Types of NCDs

- Cardiovascular disease (Coronary heart disease, Stroke)
- Cancer
- Chronic lung disease
- Diabetes
- Chronic neurologic disorders (Alzheimer’s, dementias)
- Arthritis/Musculoskeletal diseases

## Leading Causes of Attributable Global Mortality and Burden of Disease, 2004

### Attributable Mortality

<table>
<thead>
<tr>
<th>Cause</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. High blood pressure</td>
<td>12.8</td>
</tr>
<tr>
<td>2. Tobacco use</td>
<td>8.7</td>
</tr>
<tr>
<td>3. High blood glucose</td>
<td>5.8</td>
</tr>
<tr>
<td>4. Physical inactivity</td>
<td>5.5</td>
</tr>
<tr>
<td>5. Overweight and obesity</td>
<td>4.8</td>
</tr>
<tr>
<td>6. High cholesterol</td>
<td>4.5</td>
</tr>
<tr>
<td>7. Unsafe sex</td>
<td>4.0</td>
</tr>
<tr>
<td>8. Alcohol use</td>
<td>3.8</td>
</tr>
<tr>
<td>9. Childhood underweight</td>
<td>3.8</td>
</tr>
<tr>
<td>10. Indoor smoke from solid fuels</td>
<td>3.3</td>
</tr>
</tbody>
</table>

59 million total global deaths in 2004

### Attributable DALYs

<table>
<thead>
<tr>
<th>Cause</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Childhood underweight</td>
<td>7.8</td>
</tr>
<tr>
<td>2. High blood pressure</td>
<td>7.5</td>
</tr>
<tr>
<td>3. Unsafe sex</td>
<td>6.6</td>
</tr>
<tr>
<td>4. Unsafe water, sanitation, hygiene</td>
<td>6.1</td>
</tr>
<tr>
<td>5. High blood glucose</td>
<td>4.9</td>
</tr>
<tr>
<td>6. Indoor smoke from solid fuels</td>
<td>4.8</td>
</tr>
<tr>
<td>7. Tobacco use</td>
<td>3.9</td>
</tr>
<tr>
<td>8. Physical inactivity</td>
<td>3.8</td>
</tr>
<tr>
<td>9. Suboptimal breastfeeding</td>
<td>3.7</td>
</tr>
<tr>
<td>10. High cholesterol</td>
<td>3.3</td>
</tr>
</tbody>
</table>

1.5 billion total global DALYs in 2004

Characteristics of NCDs

- Complex etiology (causes)
- Multiple risk factors
- Long latency period
- Non-contagious origin (non-communicable)
- Prolonged course of illness
- Functional impairment or disability
- Incurability
- Insidious onset
Risk Factor

“An aspect of personal behavior or lifestyle, an environmental exposure, or a hereditary characteristic that is associated with an increase in the occurrence of a particular disease, injury, or other health condition.”

(Principles of Epidemiology, CDC, 2006)
Modifiable Risk Factor

A risk factor that can be reduced or controlled by intervention, thereby reducing the probability of disease.

The WHO has prioritized the following four:

- Physical inactivity
- Tobacco use
- Alcohol use
- Unhealthy diets
Non-Modifiable Risk Factor

A risk factor that **cannot** be reduced or controlled by intervention, for example:

- Age
- Gender
- Race
- Family history (genetics)
# Common Risk Factors

## Noncommunicable Diseases

### 4 Diseases, 4 Modifiable Shared Risk Factors

<table>
<thead>
<tr>
<th></th>
<th>Tobacco Use</th>
<th>Unhealthy diets</th>
<th>Physical Inactivity</th>
<th>Harmful Use of Alcohol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular</td>
<td><img src="check.png" alt="Check" /></td>
<td><img src="check.png" alt="Check" /></td>
<td><img src="check.png" alt="Check" /></td>
<td><img src="check.png" alt="Check" /></td>
</tr>
<tr>
<td>Diabetes</td>
<td><img src="check.png" alt="Check" /></td>
<td><img src="check.png" alt="Check" /></td>
<td><img src="check.png" alt="Check" /></td>
<td><img src="check.png" alt="Check" /></td>
</tr>
<tr>
<td>Cancer</td>
<td><img src="check.png" alt="Check" /></td>
<td><img src="check.png" alt="Check" /></td>
<td><img src="check.png" alt="Check" /></td>
<td><img src="check.png" alt="Check" /></td>
</tr>
<tr>
<td>Chronic Respiratory</td>
<td><img src="check.png" alt="Check" /></td>
<td><img src="check.png" alt="Check" /></td>
<td><img src="check.png" alt="Check" /></td>
<td><img src="check.png" alt="Check" /></td>
</tr>
</tbody>
</table>
COMPARISON OF NCDS AND COMMUNICABLE DISEASES
Communicable Disease: Definition

- An infectious disease transmissible (as from person to person) by direct contact with an affected individual or the individual's discharges or by indirect means (as by a vector)
- Examples:
  - Measles
  - Dengue
  - Typhoid

Merriam-Webster Communicable Disease Definition Website
Non-Communicable Diseases vs. Communicable Diseases

- How do they differ regarding:
  - Infectiousness?
  - Risk of Disease?
DEFINITIONS AND APPROACHES OF EPIDEMIOLOGY
What is Epidemiology?
Epidemiology: CDC Definition

“The study of the distribution and determinants of health-related states in specified populations, and the application of this study to control health problems.”

Distribution
Determinants
Health-related States
specified Population
Application

(Last, 2001)
Epidemiology: CDC Definition

**Distribution:** Occurrence of cases by *time, place, and person*

**Example:** According to a study of deaths in *Country X* in 2008, 1,034 cervical cancer deaths occurred among women between the ages of 45-54.
Epidemiology: CDC Definition

Determinants: All the causes and risk factors for the occurrence of a disease, including physical, biological, social, cultural, and behavioral factors

Example: Smoking was a risk factor or determinant for the greater number of cancer deaths among women ages 45-54 in Country X.
Epidemiology: CDC Definition

**Health-Related States**

- Diagnosis of a specific disease or cause of death
- Health-related behavior (e.g., smoking, taking prenatal vitamins)
- Example: According to the 2008 study in Country X, 1,034 cervical cancer deaths occurred among women between the ages of 45-54.
Epidemiology: CDC Definition

Specified Population:

Specified Population: A measurable group, defined by location, time, demographics, and other characteristics

Epidemiology: CDC Definition

Application

• Analysis, conclusion, distribution, and timely use of epidemiologic information to protect the health of the population

• Example: As a result of the Country X Study, free cervical cancer screening programs were implemented. They targeted women living in remote areas in hopes of finding women with cervical cancer at an earlier stage of cancer in order to prevent death.
Purpose of Epidemiology

- To measure **frequency** of disease
  - Quantify disease
- To assess **distribution** of disease
  - Who is getting disease?
  - Where is disease occurring?
  - When is disease occurring?
- To form hypotheses about causes and preventive factors
- To identify **determinants** of disease
  - Hypotheses are tested using epidemiologic studies
Epidemiologic Assumptions

- Diseases and other health-related events do not occur at random
- Diseases and other health-related events usually have causal and preventive factors that can be found
## Approaches in Medicine vs. Epidemiology

<table>
<thead>
<tr>
<th>Approach/Consideration</th>
<th>Clinical Medicine</th>
<th>Epidemiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>Individuals</td>
<td></td>
</tr>
<tr>
<td>Main Goal</td>
<td>Diagnosis and treatment</td>
<td></td>
</tr>
<tr>
<td>Questions</td>
<td>What is wrong with this patient?</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>What treatment is appropriate for this patient?</td>
<td></td>
</tr>
<tr>
<td>Who is involved?</td>
<td>Physician, laboratorian, nurse, and others</td>
<td></td>
</tr>
</tbody>
</table>
## Approaches in Medicine vs. Epidemiology: Focus

<table>
<thead>
<tr>
<th>Approach/Consideration</th>
<th>Clinical Medicine</th>
<th>Epidemiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>Individuals</td>
<td>Populations</td>
</tr>
<tr>
<td>Main Goal</td>
<td>Diagnosis and treatment</td>
<td></td>
</tr>
<tr>
<td>Questions</td>
<td>What is wrong with this patient?</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>What treatment is appropriate?</td>
<td></td>
</tr>
<tr>
<td>Who is involved?</td>
<td>Physician, laboratorian, nurse, and others</td>
<td></td>
</tr>
</tbody>
</table>
# Approaches in Medicine vs. Epidemiology: Main Goal

<table>
<thead>
<tr>
<th>Approach/Consideration</th>
<th>Clinical Medicine</th>
<th>Epidemiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>Individuals</td>
<td>Populations</td>
</tr>
<tr>
<td>Main Goal</td>
<td>Diagnosis and treatment</td>
<td>Prevention and control</td>
</tr>
<tr>
<td>Questions</td>
<td>What is wrong with this patient?</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>What treatment is appropriate?</td>
<td></td>
</tr>
<tr>
<td>Who is involved?</td>
<td>Physician, laboratorian, nurse, and others</td>
<td></td>
</tr>
</tbody>
</table>
# Approaches in Medicine vs. Epidemiology: Questions

<table>
<thead>
<tr>
<th>Approach/Consideration</th>
<th>Clinical Medicine</th>
<th>Epidemiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>Individuals</td>
<td>Populations</td>
</tr>
<tr>
<td>Main Goal</td>
<td>Diagnosis and treatment</td>
<td>Prevention and control</td>
</tr>
<tr>
<td>Questions</td>
<td>What is wrong with this patient?</td>
<td>What are the leading causes of death or disability in this population? Risk factors?</td>
</tr>
<tr>
<td>Treatment</td>
<td>What treatment is appropriate?</td>
<td></td>
</tr>
<tr>
<td>Who is involved?</td>
<td>Physician, laboratorian, nurse, and others</td>
<td></td>
</tr>
</tbody>
</table>
# Approaches in Medicine vs. Epidemiology: Treatment

<table>
<thead>
<tr>
<th>Approach/Consideration</th>
<th>Clinical Medicine</th>
<th>Epidemiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>Individuals</td>
<td>Populations</td>
</tr>
<tr>
<td>Main Goal</td>
<td>Diagnosis and treatment</td>
<td>Prevention and control</td>
</tr>
<tr>
<td>Questions</td>
<td>What is wrong with this patient?</td>
<td>What are the leading causes of death or disability in this population? Risk factors?</td>
</tr>
<tr>
<td>Treatment</td>
<td>What treatment is appropriate?</td>
<td>What can be done to reduce or prevent disease or risk factors?</td>
</tr>
<tr>
<td>Who is involved?</td>
<td>Physician, laboratorian, nurse, and others</td>
<td></td>
</tr>
</tbody>
</table>
# Approaches in Medicine vs. Epidemiology: Who is Involved?

<table>
<thead>
<tr>
<th>Approach/Consideration</th>
<th>Clinical Medicine</th>
<th>Epidemiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>Individuals</td>
<td>Populations</td>
</tr>
<tr>
<td>Main Goal</td>
<td>Diagnosis and treatment</td>
<td>Prevention and control</td>
</tr>
<tr>
<td>Questions</td>
<td>What is wrong with this patient?</td>
<td>What are the leading causes of death or disability in this population? Risk factors?</td>
</tr>
<tr>
<td>Treatment</td>
<td>What treatment is appropriate?</td>
<td>What can be done to reduce or prevent disease or risk factors?</td>
</tr>
<tr>
<td>Who is involved?</td>
<td>Physician, laboratorian, nurse, and others</td>
<td>Epidemiologists, statisticians, and others from diverse disciplines</td>
</tr>
</tbody>
</table>
Approaches to Epidemiology

1. Descriptive Epidemiology

2. Analytic Epidemiology
Descriptive Epidemiology

• Studies the pattern of health events and their frequency in populations in terms of:
  – Person
  – Place
  – Time
• Purpose:
  – To identify problems for further study
  – To plan, provide, and evaluate health services
Analytic Epidemiology

• Studies the association between risk factors and disease

• Purpose:
  – To determine why disease rates are high (or low) in a particular group
PUBLIC HEALTH
MANAGEMENT CYCLE
Public Health Management Cycle

1. Form Objective
2. Implement Intervention
3. Measure Impact
4. Revise Program
Epidemiology in the Public Health Management Cycle

1. Form Objective
2. Implement Intervention
3. Measure Impact
4. Revise Program
FUNCTIONS OF EPIDEMIOLOGY
Functions of Epidemiology

Public Health Surveillance
Investigation
Data Analysis
Intervention
Evaluation
Communication
Management and Teamwork
Public Health Surveillance

Prevalence of smoking by year, United States, 1990-2010

% of Population

Year

Introduction to NCD Epidemiology
Public Health Surveillance: CDC Definition

Ongoing, systematic collection, analysis, and interpretation of health-related data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those responsible for prevention and control.
Investigation
Data Analysis

• Describe the distribution of a health condition or event in a community
• Create a hypothesis about what causes or protects against disease or injury
• Learn about factors thought to be associated with disease
• Assess associations between risk factors and disease, using statistical methods
• Interpret results and disseminate information
Intervention
Evaluation

Process

Outcome
Communication
Management and Teamwork

- Clinical Staff
- Public Health Officials
- Laboratory Technicians
- Sanitarians
- Epidemiologist
- Community

Introduction to NCD Epidemiology
Review: Functions of Epidemiology

Public Health Surveillance
Investigation
Data Analysis
Intervention
Evaluation
Communication
Management and Teamwork
REVIEW
Review: Questions 1-2

1. Name at least four types of NCDs

2. Name at least four characteristics of NCDs
Review: Answers 1-2

1. Name at least four types of NCDs.
   cardiovascular disease, cancer, diabetes, chronic lung disease, chronic neurologic disorders, arthritis, musculoskeletal disorders

2. Name at least four characteristics of NCDs
   complex etiology, multiple risk factors, long latency period, non-contagious origin, prolonged course of illness, functional impairment or disability, incurability
3. What are at least three examples of modifiable risk factors?

4. What are at least three examples of non-modifiable risk factors?
Review: Answers 3-4

3. What are at least three examples of modifiable risk factors? alcohol use, smoking, poor diet, physical inactivity, high blood pressure, high blood glucose

4. What are at least three examples of non-modifiable risk factors? age, race, gender, family history
Review: Question 5

5. How do NCDs and communicable diseases differ?
5. How do NCDs and communicable diseases differ?

a. *Communicable disease occurrence depends upon the presence / absence of disease already occurring in that population; For NCDs, all disease events are generally independent of one another.*

b. *For NCDs, the risk of disease largely depends on population characteristics and other health behaviors; Communicable disease can also be influenced by these characteristics, but they have properties that contribute to whether an exposed individual will become infected.*
Review: Questions 6-8

6. What questions does epidemiology answer?

7. What are two approaches of epidemiology?

8. What are the four main roles of epidemiology in the Public Health Management Cycle?
Review: Answers 6-8


7. What are two approaches of epidemiology? *descriptive and analytic epidemiology*

8. What are the four main roles of epidemiology in the Public Health Management Cycle? *form objectives, implement interventions, measure impact, revise programs*
Review: Question 9

9. What are the functions of epidemiology?
9. What are the functions of epidemiology?

1. Public health surveillance
2. Investigation
3. Data analysis
4. Intervention
5. Evaluation
6. Communication
7. Management and teamwork
Half-Truths and Misunderstandings

HALF-TRUTH
Everyone has to die of something
Half-Truths and Misunderstandings: Reality

Reality: death is inevitable but it does not need to be slow, painful, or premature
Skill Assessment

1. Work in small groups to complete the assessment

2. Discuss a local health problem and describe which functions of epidemiology to use to address the problem

3. Assign a member of your group to record your responses

4. Spend 20 minutes completing the assessment

5. Be prepared to share your work with the class
Centers for Disease Control and Prevention (CDC). Introduction to NCD Epidemiology. Atlanta, Georgia: Centers for Disease Control and Prevention (CDC); 2013.