

Welcome to the Training

Please Stand By



ARIZONA ADVISORY
COUNCIL ON INDIAN
HEALTH CARE

Epidemiology Training Part I

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Introduction

The Basic Epidemiology Training will be a brief introduction to the field of epidemiology. This training will include the definition of the field, as well as goals and applications of epidemiology. Using these foundations, we can apply them to the basic concepts as they relate to their statistical background. This will be illustrated through the basic calculations that are the core of epidemiology.

Learning Objectives

- Define epidemiology
- Describe basic terminology and concepts of epidemiology
- Identify types of data sources
- Identify basic methods of data collection and interpretation
- Identify applications of epidemiology
- Develop familiarity with basic statistical concepts as it pertains to epidemiology

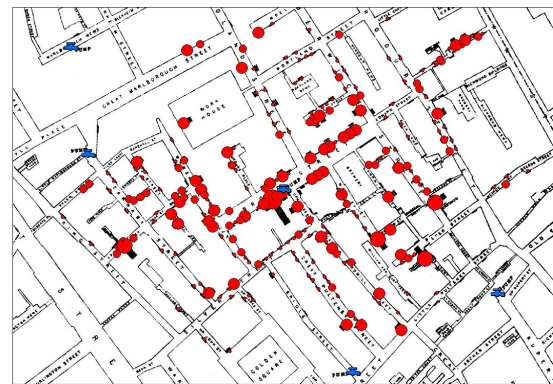
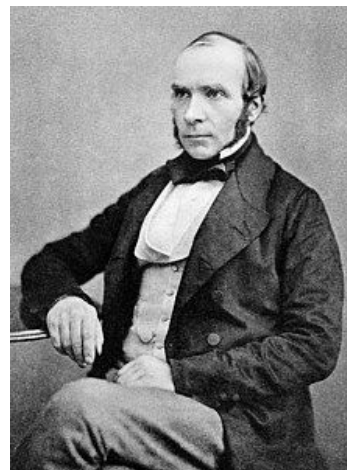
Goals of Epidemiology

- To identify cause of disease
- Discover the agent, host, and environmental factors that affect health
- To study the progression of the disease
- To evaluate preventive and therapeutic measures for a disease or condition
- Determine the relative importance of causes of illness, disability, and death
- Identify those segments of the population that have the greatest risk from specific causes of ill health
- Evaluate the effectiveness of health programs and services in improving population health

Founding: John Snow

John Snow is the recognized founder of public health and epidemiology. After a major outbreak of cholera in Soho, London, Snow was sent to investigate.

Snow was able to identify that all the sick residents had one thing common, they shared water from a pump located on **Broad Street**. This pump had been contaminated with sewage, and residents continued to become ill after using this local pump. After mapping out the pump, it was subsequently closed, and put an end to the outbreak.



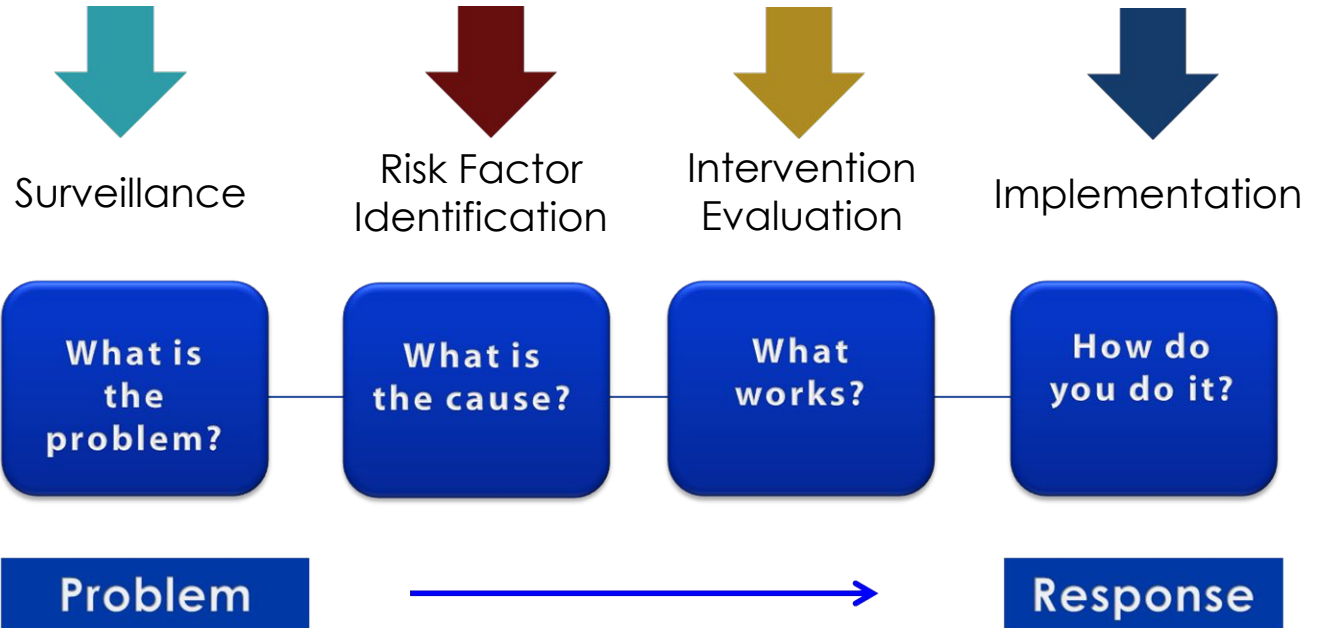


Knowledge Check

All of the following illustrate the purpose of epidemiology in public health, except

- A. identifying populations who are at risk for certain diseases.
- B. assessing the effectiveness of interventions.
- ✓ C. providing treatment for patients in clinical settings.
- D. determining the importance of causes of illness

A Public Health Approach



Example of the Public Health Approach

Step	Example
Define the Problem	Abusive head trauma (AHT), including Shaken Baby Syndrome (SBS) is a leading cause of child abuse deaths in the United States. According to a study of North Carolina AHT cases, as many as three to four children a day experience severe or fatal head injury from child abuse in the United States.
Identify Risk and Protective Factors	Caregiver frustration or anger resulting from inconsolable crying and limited social supports are primary risk factors for shaking a baby.
Develop and Test Prevention Strategies	A promising or model home visitation program.
Assure Widespread Adoption (Dissemination and Implementation)	Implementation of a home visitation program that includes a focus on specific parental behaviors and modifiable environmental conditions associated with adverse outcomes for children.

Epidemiology Key Terms

Epidemic or Outbreak: disease occurrence among a population that

is in excess of what is expected in a given time and place.

Cluster: group of cases in a specific time and place that might be more than expected.

Endemic: disease or condition present among a population at all times.

Pandemic: disease or condition that spreads across regions.

Rate: number of cases occurring during a specific period; always dependent on the size of the population during that period.



Knowledge Check

Match each term with the correct example.

A. endemic

B. pandemic

C. epidemic

A. endemic

1. Malaria is present in Africa at all times because of the presence of infected mosquitoes. Malaria is _____ in Africa.

C. epidemic

2. The Ebola virus in parts of Africa is in excess of what is expected for this region. This virus is a/an _____.

B. pandemic

3. HIV/AIDS is one of the worst global diseases in history. It is a/an _____.



Knowledge Check

Choose the correct answer.

A. distribution B. cluster C. determinant

In March 1981, an outbreak of measles occurred among employees at Factory X in Fort Worth, Texas.

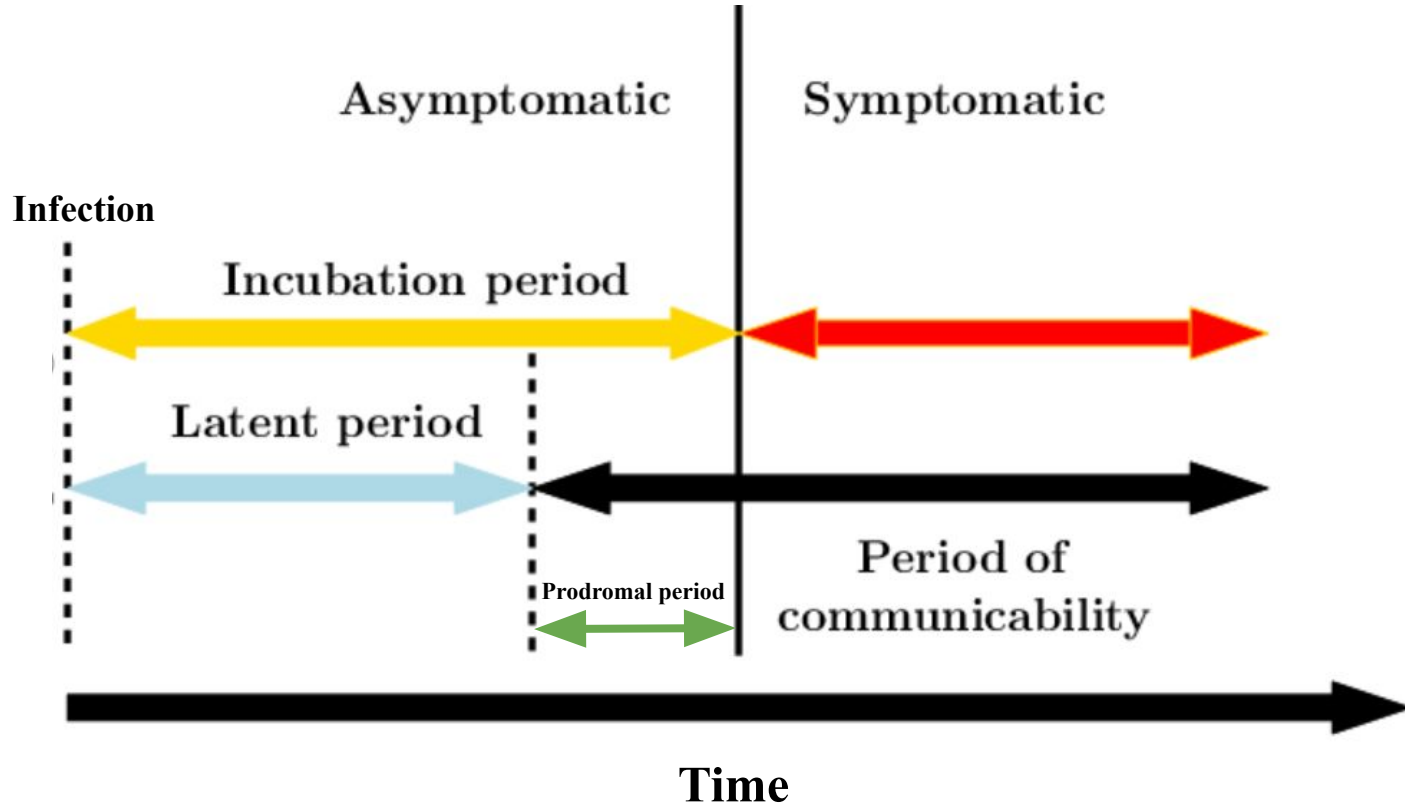
This group of cases in this specific time and place can be described as a cluster.



Measures of Infectivity, Pathogenicity, Mortality

- **Infectivity** – ability to invade a host (how fast can it spread)
- **Pathogenicity** - ability to cause disease (how often do hosts experience symptoms)
- **Virulence** – ability to cause death (severity)
- **Latent Period** – time interval from infection to development of infectious
- **Infectious Period** – time in which host can infect another host
- **Incubation Period** – time from infection to development of symptoms
- **Symptomatic Period** – period in which symptoms are present

Timeline of Infection and Disease



Comparing Population Characteristics



Rates help us compare health problems among different populations that include two or more groups who differ by a selected characteristic

Rate Formula

To calculate a rate, we first need to determine the frequency of disease, which includes

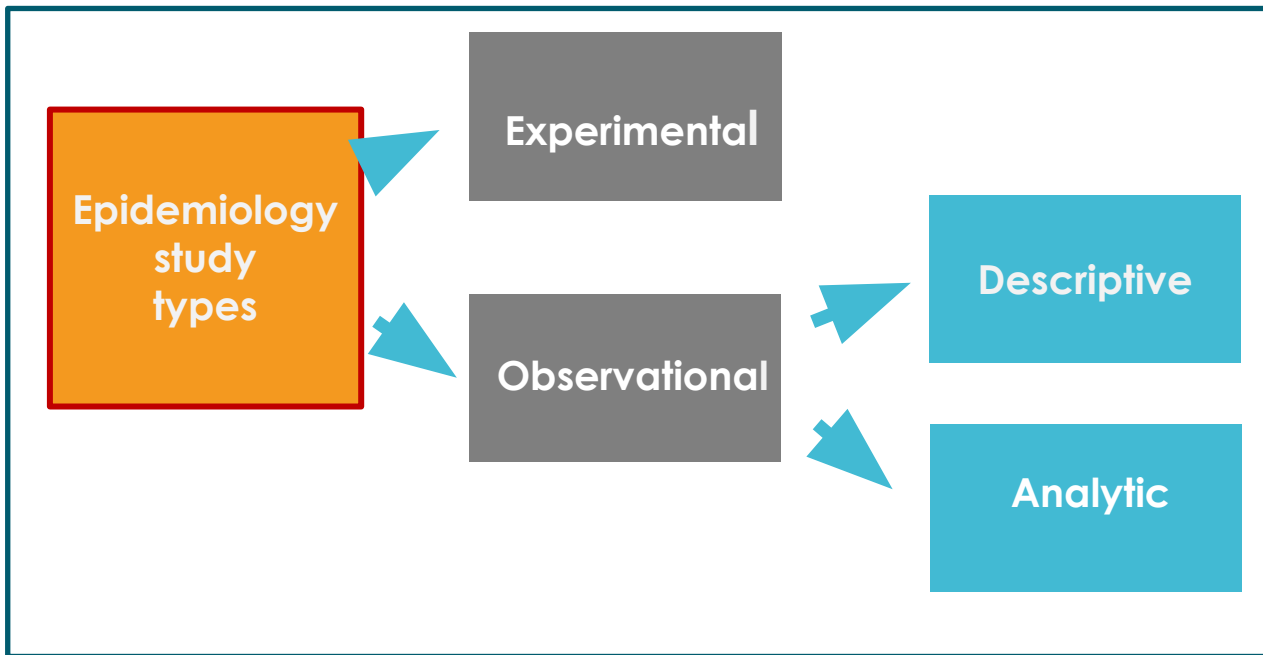
- the number of cases of the illness or condition
- the size of the population at risk
- the period during which we are calculating the rate

$$\text{Rate (\%)} = \frac{\text{number of cases}}{\text{population at risk}} \times 100$$

Relative Proportionality

- Showing the incidence rate per 10,000 or per 100,000 population provides additional valuable insight in addition to showing the number of new cases of the disease. This is especially true when comparing the incidence rate of the disease across different localities that have varying sizes in populations. In addition, looking at the incidence rate per population is essential when comparing that rate to a state or national average for that disease or comparing it to a benchmark or goal that is in the format of an incidence rate per population.
- Per 100,000 measurement to make results relative.
- We like to use 100,000 because we can relate that across the board. Not too big, not too small.
- This is immensely more helpful because now we don't have just one number. We can then deem how fast cases are moving in, in contrast to the size of the population.

Epidemiology Study Types





Breakdown of Studies

Time, place, and person is the mantra of the epidemiologist. Another way of comparing descriptive and analytic epidemiology is to say that, during the descriptive process, we are concerned with:

- When the population was affected
- Where they were affected
- Who specifically was affected

From the observations gathered during the descriptive process, a hypothesis is generated about the causes of observed patterns and the factors that increase risk for disease or injury.

To test a hypothesis, epidemiologists must use an analytic epidemiology process in which they ask how and why the population was affected



Knowledge Check

Choose the correct answer from the following choices:

A. Qualitative B. Experimental C. Observational

C. Observational An epidemiologist is doing a study on the sleep patterns of college students but does not provide any intervention. What type of study is this?



Knowledge Check

Match each term to the correct example below.

A. Descriptive

B. Analytic

B. Analytic

1. A study of heart disease comparing a group who eats healthy foods and exercises regularly with one who does not in an effort to test association

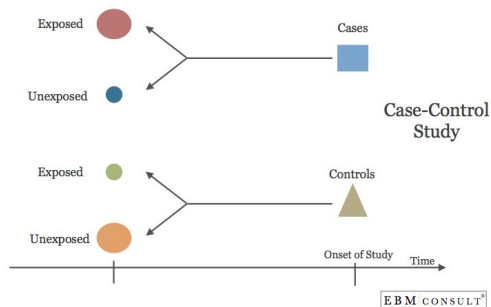
A. Descriptive

2. A study to describe the eating habits of adolescents aged 13–18 years in Community X



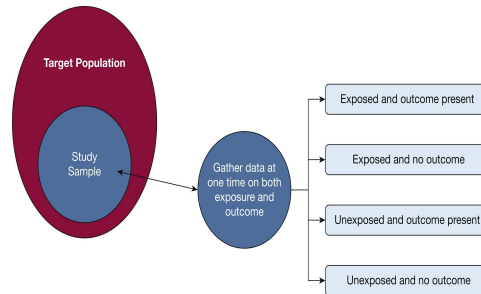
Case-Control

Subjects identified as having a disease or condition are compared with subjects without the same disease or condition



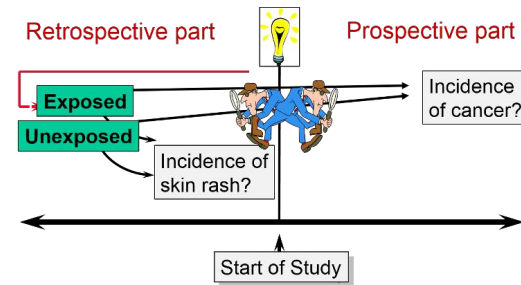
Study Design Cross-Sectional

Subjects are selected because they are members of a certain population subset at a certain time



Cohort

Subjects are categorized on the basis of their exposure to one or more risk factors





Knowledge Check

Match each study with the correct definition.

A. Cross-Sectional B. Cohort C. Case-Control

C. Case-Control

1. Subjects with diabetes are compared with subjects without diabetes.

A. Cross-Sectional

2. A study of women aged 50–60 years in a community located close to a nuclear power facility.

B. Cohort

3. Subjects who have received nutritional counseling and who have exercised twice a week are compared with subjects who have not.

Data Collection Methods

Source	Method	Example
Individual persons	<ul style="list-style-type: none">• Questionnaire• Survey	<ul style="list-style-type: none">• Foodborne illness outbreak• CDC's National Health and Nutrition Examination Survey• Health data on U.S. residents
Environment	<ul style="list-style-type: none">• Samples from the environment (river water, soil)• Sensors for environmental changes	<ul style="list-style-type: none">• Collection of water from area streams — check for chemical pollutants• Air-quality ratings
Health care providers	<ul style="list-style-type: none">• Notifications to health department if cases of certain diseases are observed	<ul style="list-style-type: none">• Report cases of meningitis to health department
Nonhealth-related sources (financial, legal)	<ul style="list-style-type: none">• Sales records• Court records	<ul style="list-style-type: none">• Cigarette sales• Intoxicated driver arrests

Surveys vs Questionnaires

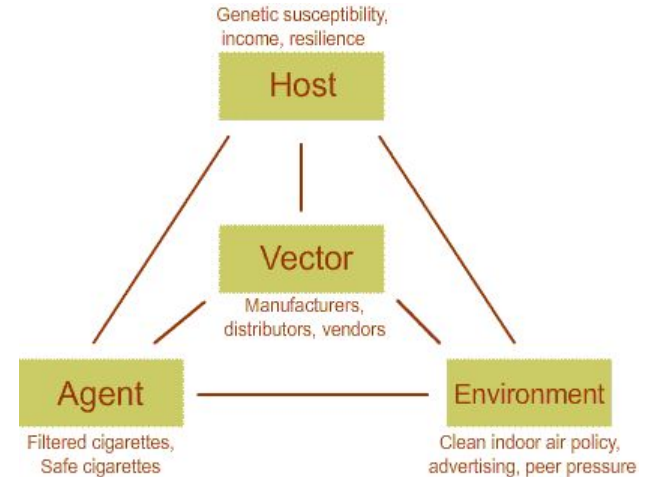
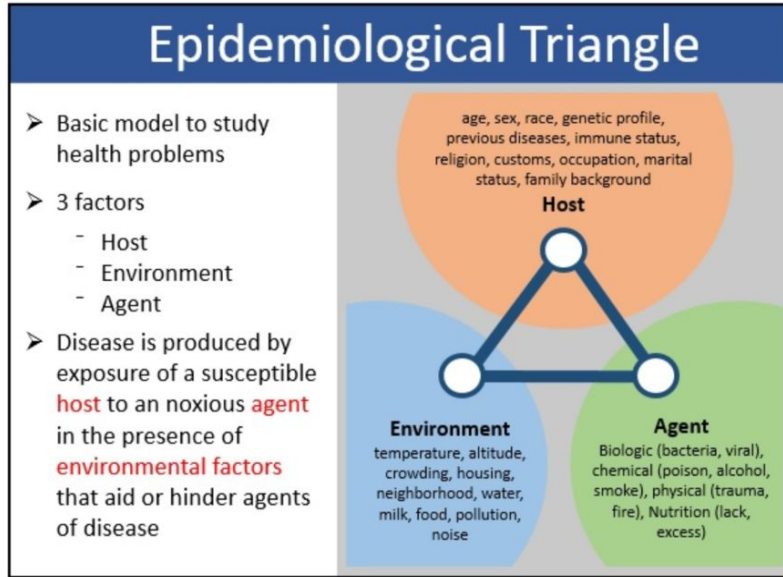
Surveys

- Large amount of data can be collected
- More detailed data
- Fewer incomplete forms
- Higher return rates
- Flexibility in sampling
- Fewer misunderstood questions

Questionnaires

- Economy
- Speed
- Lack of interviewer bias
- Anonymity & privacy

The Epidemiology Triangle





Knowledge Check

Epidemiologists use a model for studying infectious disease and its spread that involves the microbe that causes the disease, the organism that harbors the disease, and the external factors that cause or allow disease transmission. This is also known as

- A. host, vector, and transmission.
- B. transmission, host, and environment.
- ✓ C. host, agent, and environment.
- D. organism, transmission, and environment.

Applications

Disease Surveillance

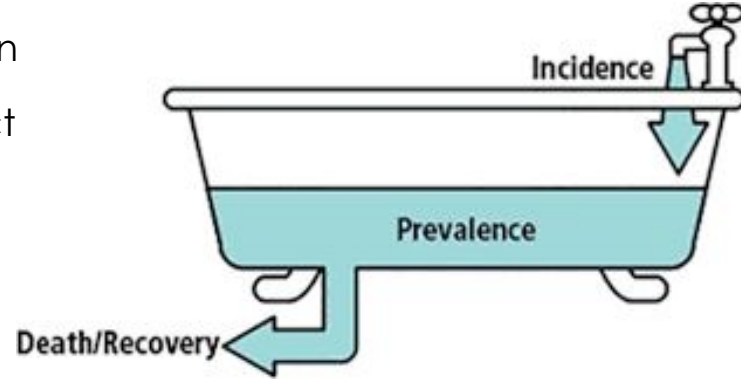
- Frequency of which disease occurs
- Definition of disease
- Items of the disease and population
- Environmental, occupational, infect

Incidence

- All new and incoming cases.

Prevalence

- How many total cases exist over time or over a population.





Knowledge Check

On Day 1 of a technology conference in San Diego, 15 presenters who were setting up for their sessions in Annex X became ill with flu-like symptoms. During the course of the conference, 20 participants who attended sessions in Annex X also became ill with the same symptoms.

To begin calculating the rate of this outbreak, investigators should first determine

- A. the size of the conference population.
- ✓ B. the number of cases of illness.
- C. the number of days the conference was held.
- D. the location of the conference.

Seatbelts, Well-Water, Wearing Helmets and Other Applications





End of Part I

- Part II will explore:
- The statistical concepts behind association analysis.
- More roles of the field of epidemiology.
- How different studies can be analyzed through different methods.
- Come back on August 13th for Part II!