Summer Institute for Public Health Practice
Public Health Today: New Strategies. New Tools.

Basic Epidemiology: Study Types

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Learning Objectives

At the end of this presentation, participants will be able to:

- Define some key concepts in epidemiology
- Describe the differences between descriptive and analytical epidemiology
- Describe some types of commonly used epidemiologic studies

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The Five Ws of Epidemiology

What	= Clinical		
Who	= Person	or	**Descriptive Epidemiology (Distribution)**
Where	= Place		
When	= Time		
Why / How	= Cause, risk factors, modes of transmission		**Analytic Epidemiology (Determinants)**

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What Is Descriptive Epidemiology?

- Describes the pattern of disease occurrence in terms of time, place, person

- Defines the relationship of disease to the population at risk

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Five Ws: Clinical

- Symptoms
- Signs
- Laboratory findings
- Hospitalizations
- Deaths

Five Ws: Person

- Age
- Sex
- Occupation
- Immunization status
- Underlying disease
- Medications
- Nutritional status
- Socioeconomic status

- Marital status
- Religion
- Travel
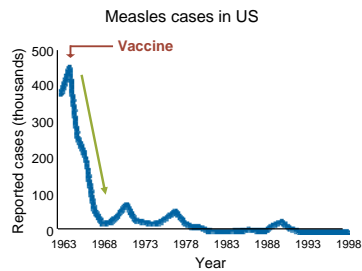- Pets
- Hobbies
- Personal habits
- Genetics

Five Ws: Place

Geographic Area	Example
Illness begins	Home — patient ill
Contact occurred between agent and host	Restaurant — food eaten
Source became infected	Farm — eggs infected

Five Ws: Describing Time

Secular trends

- Change over time
- Long-term

Measles cases in US

Five Ws: Describing Time (cont.)

- Seasonal patterns and trends
  - Cyclical trends
  - Seen over several years
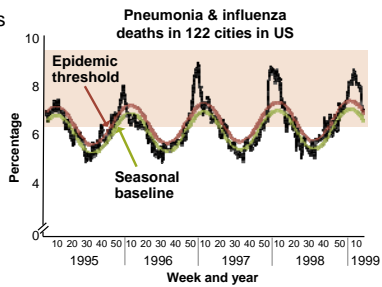
Pneumonia & influenza deaths in 122 cities in US

Five Ws: Describing Time (cont.)

- Epidemic trends
  - Increased occurrences above the expected number
  - May involve a single case, depending on the expected number
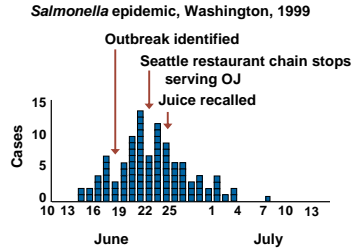
Salmonella epidemic, Washington, 1999

Outbreak identified

Seattle restaurant chain stops serving OJ

Juice recalled

(chart: Cases vs. dates June 10–13 to July 13)

Descriptive Epidemiology

- Why is it important to perform descriptive epidemiology?
  - Describe clinical characteristics of the illness
  - Describe demographic characteristics of those affected
  - Identify or infer population at risk
  - Provide clues to etiology, modes of transmission
  - Guide interventions

Descriptive Studies: Overview

- Display patterns of occurrence
- Focus on person, place, time
- Useful if little is known
- Used for
  - Program planning
  - Generating hypotheses

Descriptive Study Types

Epidemiologic Studies

Descriptive
- case report
- case series
- incidence

- Case report describes person, place, and time information about **a specific case**.
  - Usually about unexpected symptoms or events
- Case series describes person, place, and time information about **a group of cases**.
  - Can be retrospective or prospective
  - Data may be used in analytic studies
- Incidence studies describe the **number of new cases** of a disease during **a specific time** in **a specific population**.
  - Allow calculation of true rates of occurrence

Descriptive Studies Compared

Case report
- Individual case data

Case series
- Individual data on a group of cases

Incidence study
- New cases during a specific time

State	Encephalitis/ Meningitis	Fever	Clinical/ Unspecified	Total
Alaska	0	0	0	0
Idaho	10	2	1	13
Oregon	3	0	2	5

Cases/100,000/year
- 0 cases
- 1 – 5 cases
- 6 – 20 cases

Overview of Analytic Studies

- Analytic studies used in research are frequently larger and more complex than descriptive studies
- Assess **determinants** of diseases
- Focus on **risk factors** and causes
- Analyze **distribution** of exposures and diseases
- Key feature: use comparison groups
- Used to:
  - **Test** hypotheses
  - Look for and **measure** associations

For additional information, see Measuring Risk in Epidemiology on the NWCPHP Web site.

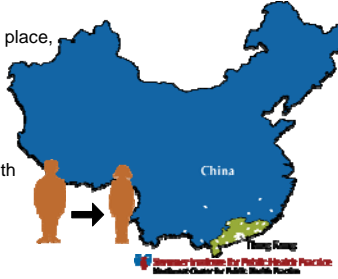## Descriptive & Analytic Studies Compared

Ways to study severe acute respiratory syndrome (SARS)

- **Descriptive study**
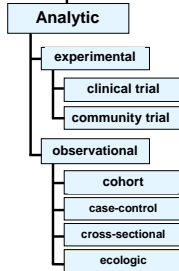 - Case series: person, place, time, of first 100 patients with SARS
- **Analytic study**
  - Measure risk factors for SARS (contact with animals, infected people)

China

Hong Kong

Types of Analytic Studies

Epidemiologic Studies

- Clinical trial: study a new drug
- Community trial: study effectiveness of a drug in preventing flu in a community
- Cohort: study who received flu vaccine and how many become ill
- Case-control: study of who has flu and if they were vaccinated
- Cross-sectional: survey how many cases of flu in different occupations
- Ecologic: compare rate of flu cases and immunization levels in counties

Analytic

- **experimental**
  - **clinical trial**
  - **community trial**
- **observational**
  - **cohort**
  - **case-control**
  - **cross-sectional**
  - **ecologic**

Experimental Studies

- Assign exposures randomly, follow over time, and monitor for disease
- Types
  - Clinical trial: Data from individuals
  - Community trial: Data from entire community
- Considered most scientific study type
- Expensive and time consuming
- Ethical concerns

New drug

No improvement

Improvement

Old drug

No improvement

Improvement

Observational Studies

Researcher does not determine who is exposed. Observes participant outcomes.

- **Cohort studies**
  - Determine exposure
  - Observe if illness occurs
- **Case-control studies**
  - Identify ill cases and comparison group
  - Compare exposures
- **Cross-sectional studies***
  - Survey both exposure and disease
- **Ecologic studies***
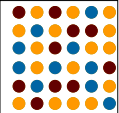 - Compare populations rather than individuals

> * For additional information, see **Study Types in Epidemiology** on the NWCPHP Web site.

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Cohorts and Cohort Studies

Groups of people who share similar characteristics

General population

Cohort

Exposed

Disease

No disease

Unexposed

Disease

No disease

More useful when:
- Population is well defined
- Exposure is uncommon
- Several possible outcomes

Can be prospective or retrospective

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Cohort Study Types

| past | Retrospective → | present | Prospective → | future |

Exposure | **Outcome** | **Exposure** | **Outcome**

Vaccine

Influenza

No influenza

No vaccine

Influenza

No influenza

Vaccine

Influenza

No influenza

No vaccine

Influenza

No influenza

Case-Control Studies

1. Identify **cases** of disease or condition of concern
2. Identify similar non-diseased comparison group (**controls**)
3. Document exposures among cases and controls

E. coli O157:H7 outbreak

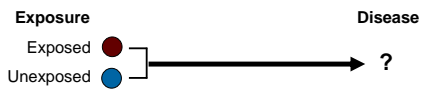| Exposure	# cases	# controls
Restaurant A	12/16	0/16

More useful when:
- Population is not well defined
- Disease is relatively rare
- Many possible exposures

Always retrospective

Comparing Cohort & Case-Control Studies

Cohort Study: Classifies a group according to **exposure**. Can be prospective or retrospective.

Exposure

Exposed

Unexposed

Disease

?

Case-Control Study: Identifies group of people with a **disease**. Selects control group without the disease. Only retrospective.

Exposure

?

Disease

Yes (case)

No (control)