

Introduction to Epidemiology

April 4 & 9, 2002



Overview:

- Define epidemiology
- Host-agent-environment triangle
- Basic concepts
- Study designs
- Establishing causality
- Class discussion: case studies



What is Epidemiology?

The study of the distribution and determinants of diseases and injuries in human populations.

Source: Mausner & Kramer, Epidemiology: An Introductory Text, 1985.



The Epidemiologist as “Disease Detective”

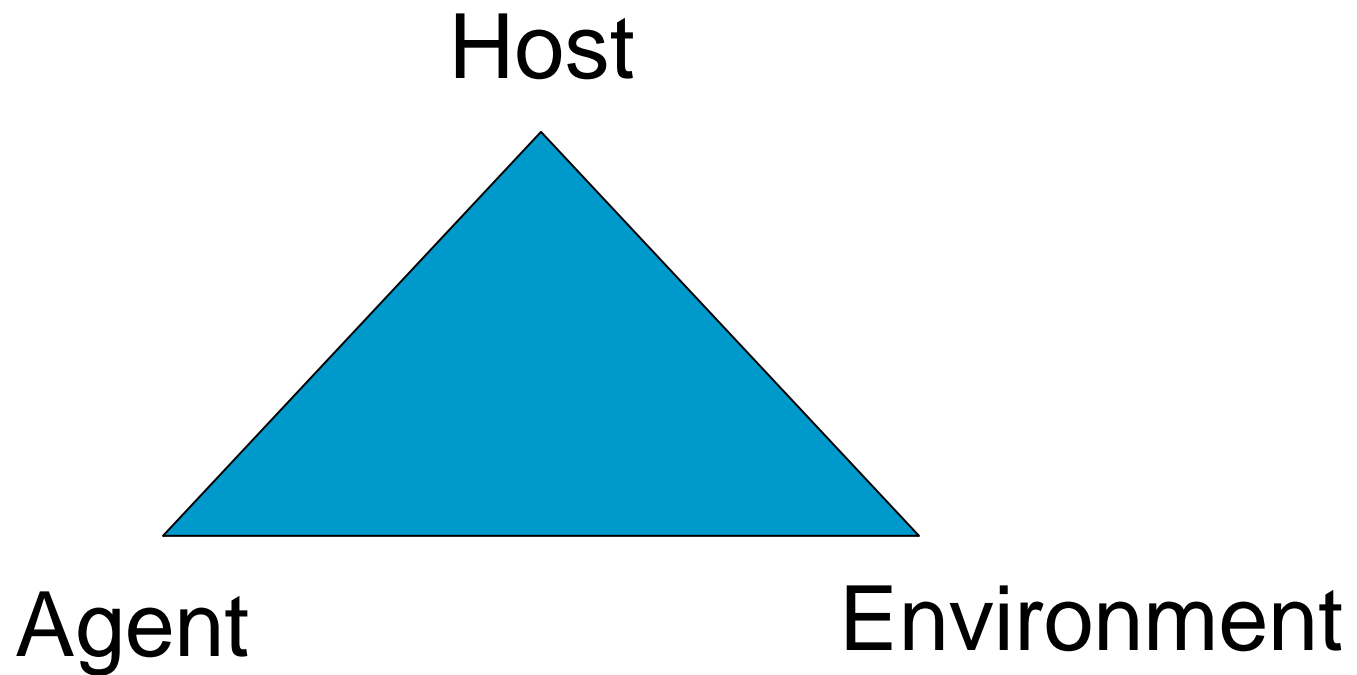
- Frequencies/patterns of disease.
- Etiology/cause of disease.
- Modes of transmission
- Factors of susceptibility, exposure, and risk.
- Environmental determinants.



Basic Methods of the Epidemiologist

- Makes inferences. Counts cases (events).
- Defines involved population.
- Determines rates/proportions.
- Compares rates.

Epidemiologic Triangle



Web of Causation

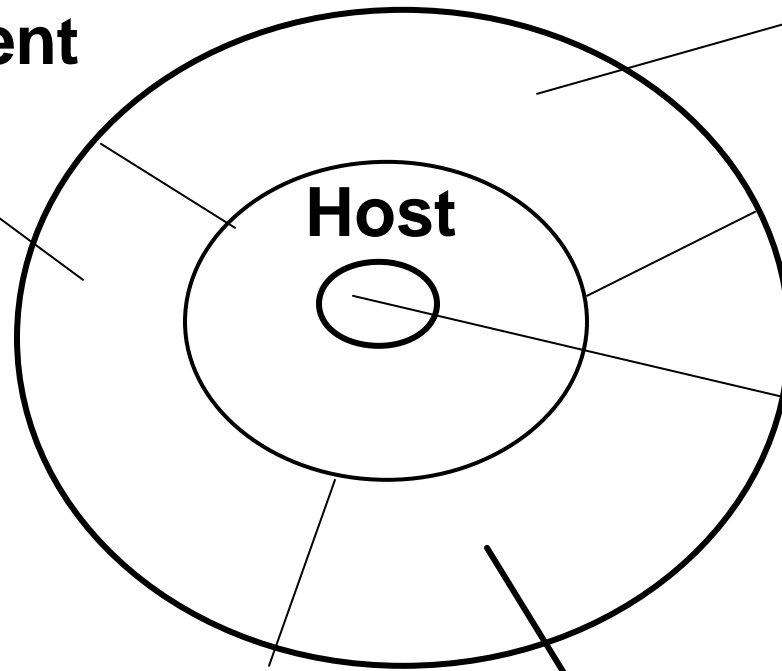
**Biologic
Environment**

**Social
Environment**

Host

Genetic Core

**Physical
Environment**





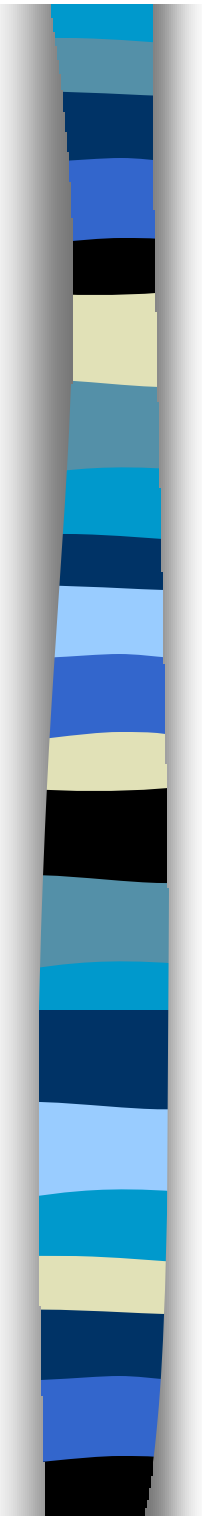
Chain of Transmission

- Agent
- Source for agent
- Portal of exit from host
- Suitable mode of transmission
- Portal of entry suitable to agent
- Susceptible host



Basic Concepts, part 1

- **Prevalence:** the number of cases that exist at one time.
- **Incidence:** the number of new cases that occur during a given period.



HIV Prevalence and incidence among men aged 15-22 who have had sex with men – seven cities, US, 1994-1998.

Age Group	No.	Prevalence (%)	Incidence (% per year)
15-19	1542	5.6	1.6
20-22	1906	8.6	3.5

Source: MMWR, 6/1/01



Basic Concepts, part 2

- **Rate:** number of events per population at risk.
- **Age-specific rate:** The incidence for a specific age group, divided by the total number of people in that age group.
- **Age-adjusted rate:** The total rate for a population adjusted to ignore the age distribution of the population by multiplying each of its age-specific rates by the proportion of a standard population in that age group, then adding up the products.

Diabetes rates among women admitted to the hospital for major CVD, U.S., 1997

Characteristics	No.	Rate
Age Group (yrs.)		
18-44	19,735	22.9
45-64	201,816	93.1
65-74	248,357	158.9
>=75	302,296	332.7
Unadjusted total	772,346	140.4
Age-adjusted total	-----	81.2

Source: Table 2 modified from MMWR, 11/2/01



Basic Concepts, part 3

- **Epidemic:** a widely and rapidly spreading disease.
- **Endemic:** a disease that persists within a geographic region.
- **Pandemic:** a widespread epidemic affecting more than one country, or worldwide.



Study Designs

- Experimental (clinical trials)
- Descriptive (cross sectional)
- Analytical
 - Case control study (retrospective)
 - Cohort (prospective)



Descriptive Studies

- Describe person, place, and time.
- Evaluate trends in health.
- Compare subgroups within a country or across countries.
- Generate hypotheses for further study



Descriptive Studies:

Cross sectional design or surveillance

- National

- National Health Interview Survey (NHIS)
- National Health and Nutrition Examination Survey (NHANES)

- State

- Behavioral Risk Factors Surveillance Survey
- California Health Interview Survey
- Hospital discharge data
- Mortality data

Analytical Studies - Schematic

PAST

PRESENT

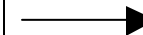
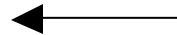
FUTURE

Past exposure
to factor in
cases &
controls

Select cases and
controls

Select cohort,
classify exposure

Follow to see
frequency of
disease





Retrospective studies

- Advantages:

- Relatively inexpensive
- Small sample size
- Quick results

- Disadvantages:

- Exposure measures difficult
- Recall bias
- Difficulty selecting a control group



Prospective Studies

■ Advantages

- Study precedes disease outcomes
- Can measure incidence
- Can measure multiple outcomes

■ Disadvantages

- Long follow-up period required
- Very expensive
- Attrition of study participants



Establishing Causation

- Strength of association
- Consistency with other studies
- Exposure precedes disease
- Biological plausibility
- Dose-response effect