

EPIDEMIOLOGICAL STUDY DESIGNS

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Definition of Epidemiology

"Epidemiology is the study of the **distribution** and **determinants** of health related states or events in specified populations, and the application of this study to **control** of health problems. "

- Last's Dictionary of Epidemiology

USES OF EPIDEMIOLOGIC RESEARCH METHODS

1. Measure the disease **frequency** and the **pattern** of disease occurrence
2. Identification of disease **determinants**
3. Evaluate **validity** of diagnostic screening tests
4. Determining the **natural history** of the disease and clinical course
5. Determining the **prognostic factors**
6. **Testing** new treatments

Epidemiological studies can be classified into:

I. Descriptive studies which can be classified into:

- 1. Studies conducted on population (Correlation studies)**
- 2. Studies conducted on individuals:**
 - a- Case report**
 - b- Case series**
 - c- Cross sectional surveys**

Epidemiological studies can be
classified into:

II. Analytic studies which can be classified
into:

1. Observational analytic studies:

A-Case control studies

B-Cohort studies

2. Interventional studies (Clinical trials)

Epidemiological Studies

Descriptive studies

Analytic studies

Individuals

Population

Intervention studies

Observation Studies

- Case Report
- Case series
- Cross Section Studies

Correlation Studies

Experimental studies (clinical trials)

- Case Control Studies
- Cohort studies

The Five W's of Journalism / Epidemiology

- **What** = **Diagnosis** (the disease or condition being investigated)
- **Who** = **Person** (who is getting the disease, who is at risk)
- **Where** = **Place** (residence, work, school, etc.)
- **When** = **Time** (date and/or time of onset of disease, time of exposure)
- **Why / How** = **Cause, mode of transmission, risk factors**

The Five W's of Journalism / Epidemiology

• What	Clinical	} Descriptive Epidemiology (Distribution)
• Who	Person	
• Where	Place Time	
<hr/>		
• When	Cause, mode of transmission, risk factors	} Analytic Epidemiology (Determinants)
• Why / How		

DESCRIPTIVE STUDIES

Advantages:

- They use already *available data*
- They are *less expensive* and less time consuming
- They describe the *pattern* of disease occurrence
- They *formulate* research hypothesis

DESCRIPTIVE STUDIES

These studies are essential for:

1. Public health administrators:

- To determine which population or subgroup of the population are most or least affected.
- To decide on efficient allocation of resources and preventive programs.

2. Epidemiologist:

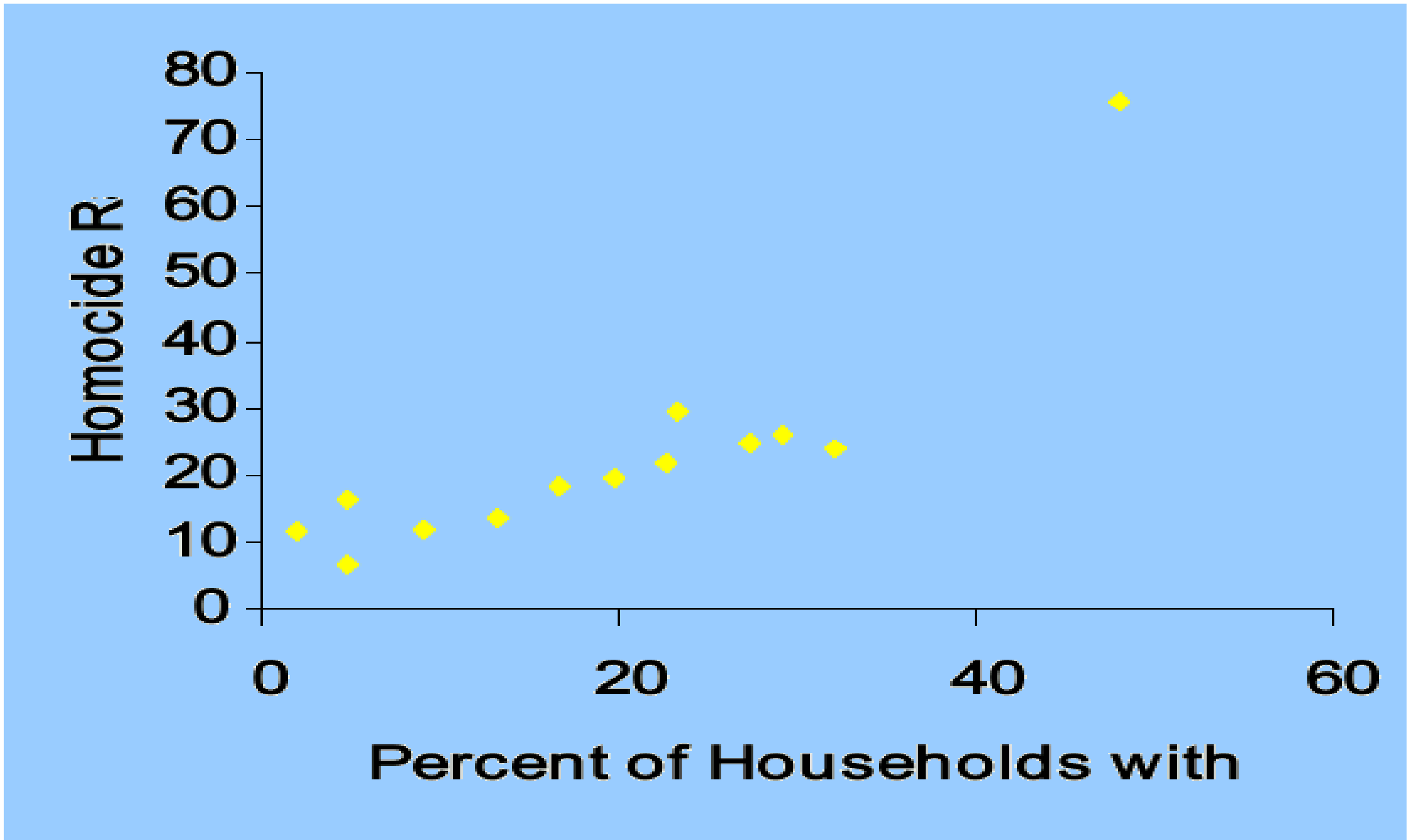
- To identify risk factors

I. Correlation or Ecological Studies

Based on aggregate measures of exposure and outcome from several populations.

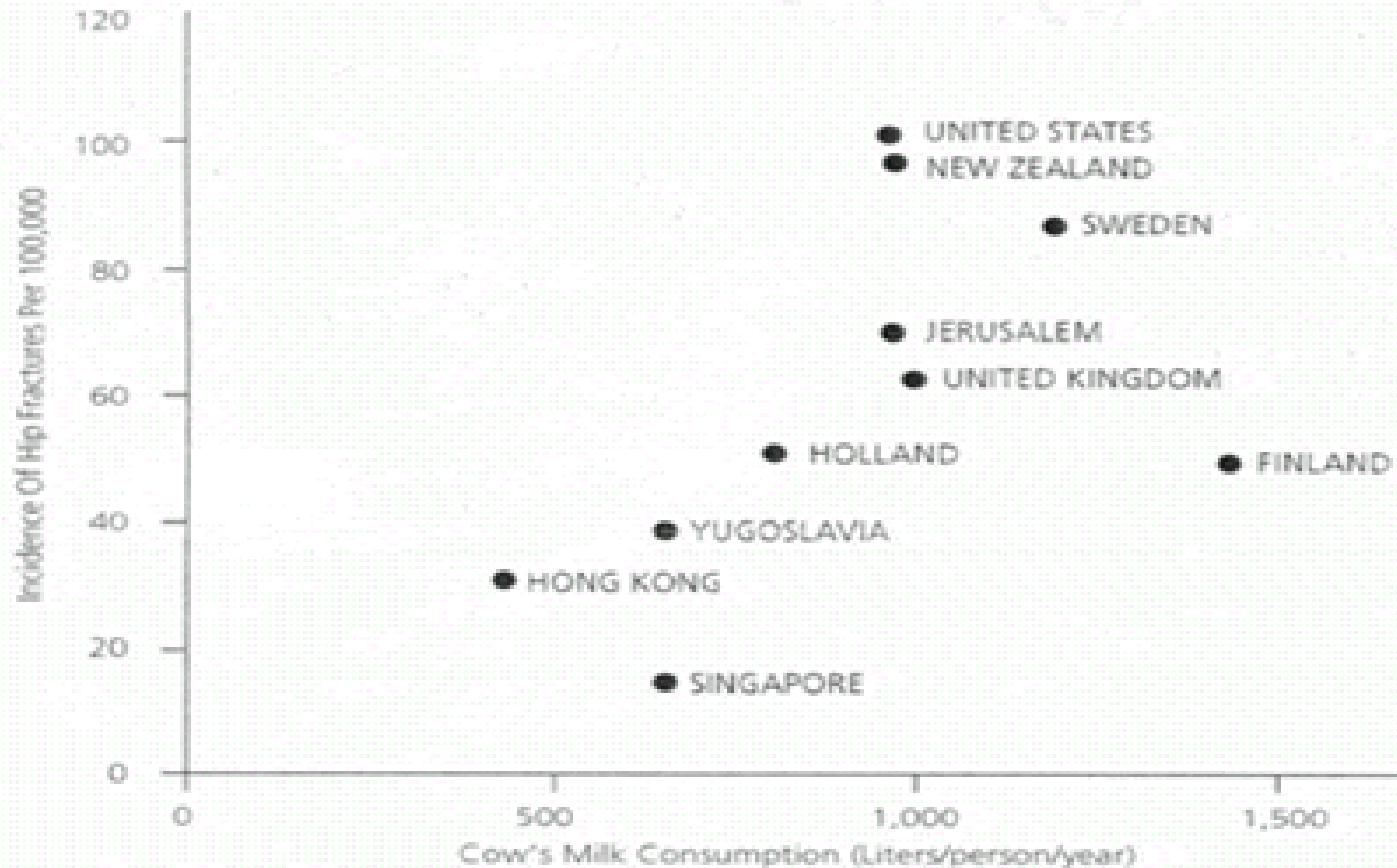
The **population** is the unit of observation available for study.

Ecological Study of Homicide Rate by Percentage of Households with a Gun in 13 Countries, 1990



*per million person-years

CHART 10.3: ASSOCIATION OF RATES OF HIP FRACTURES WITH CALCIUM INTAKE FOR DIFFERENT COUNTRIES



I. Correlation Studies

Advantages:

1. Describe the disease in the entire population in relation to factor of interest.
2. Use the Correlation Coefficient (r) to measure the association between the two variables of interest.
3. Easy to do, inexpensive, and can be conducted quickly
4. Represent the first step in searching for exposure disease relationship (Generate hypotheses)
5. Use available data ("administrative " or other aggregate data)

Correlational or Ecological Studies

Exposures:

- What percent of a population smokes?
- What percent of 1-year old children are vaccinated against measles?
- What percent of a population has piped water?

Outcome:

- What percentage of a population died from MI?
- What percentage of children had measles last year?
- What percentage of population had episodes of diarrhea?

Correlational or Ecological Studies

Disadvantages

- Correlation data represent average exposure level rather than actual individual values. Data on exposure and data on outcome are collected independently
- No assurance that persons with exposure (risk factor) of interest are the same ones with the outcome (disease) of interest

Disadvantages

- Inability to link exposure with disease in a particular individual. Association at the aggregate level may not reflect association at the individual level - the **ecologic fallacy**
- Unable to adjust for potential confounding factors.

II. Case report and case series

- The **individual** is the unit of observation.
- They describe the experience of a **single patient** or a **small number** of patients with a similar diagnosis reflecting **unusual** features of a disease.
- They help in:
 - ∅ formulation of a hypothesis on etiological association
 - ∅ represent the first clues in identification of new disease or epidemic.

Case reports

Clinical case with **“unusual”** clinical picture
(e.g. 40 y.o. female, pulmonary embolism
and no history of CVD, recent use of OC)

Case series

First case report may stimulate compilation of additional case reports....a case series

(e.g. occurrence of *Pneumocystis carinii* among a group of young, homosexual men with no history of immune deficiency)

Case reports or Case series

Advantages:

- Ø Use available clinical data
- Ø Detailed individual data
- Ø Suggest need for investigation
(hypothesis generation)

Disadvantages:

May reflect experience of one person or one clinician

No explicit comparison group

III. Cross sectional surveys

- Collection of data on **several individuals** at **one point** "in time.
- Determines **prevalence** at a point in time
- Therefore, CS is a prevalence study
- The exposure and disease status are assessed simultaneously among individuals in a well defined population.
- Snapshot in time
 - e.g. - cholesterol measurement and ECG measured at same time

- Cross sectional studies can be used to formulate a hypothesis but not to test it **EXCEPT** if the exposure is present since birth as blood group, race, eye colour,

Cross-sectional Surveys

Examples: national census, community survey, survey of a particular group of persons (e.g., occupational group, school children)

III. Cross sectional surveys

Advantages:

- Provide information on frequency and characteristics of the disease.
- Determine prevalence of disease or any health phenomenon.
- Standardized data collection tool.

Advantages:

- Able to focus data collection in specific locations or specific groups of persons.
- Can make comparisons among study participants.
- Relatively quick to do.
- Can be repeated to get data on trends.

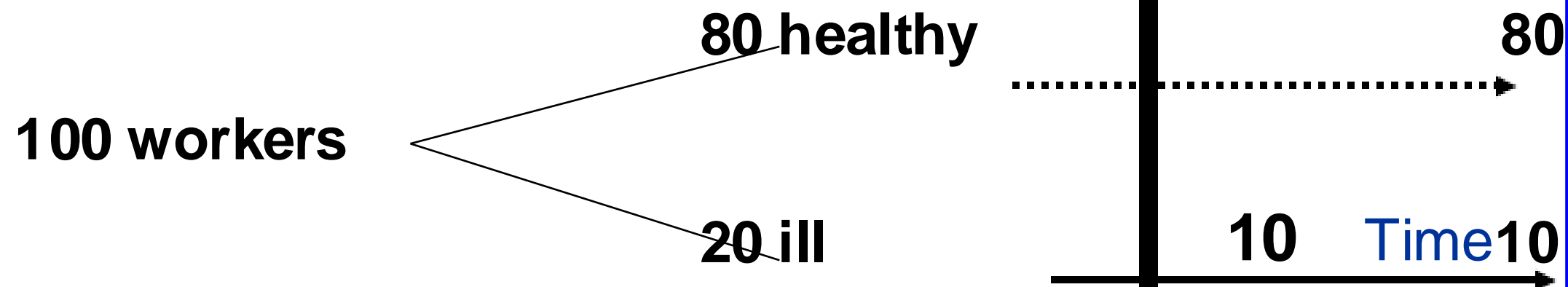
III. Cross sectional surveys

Limitations:

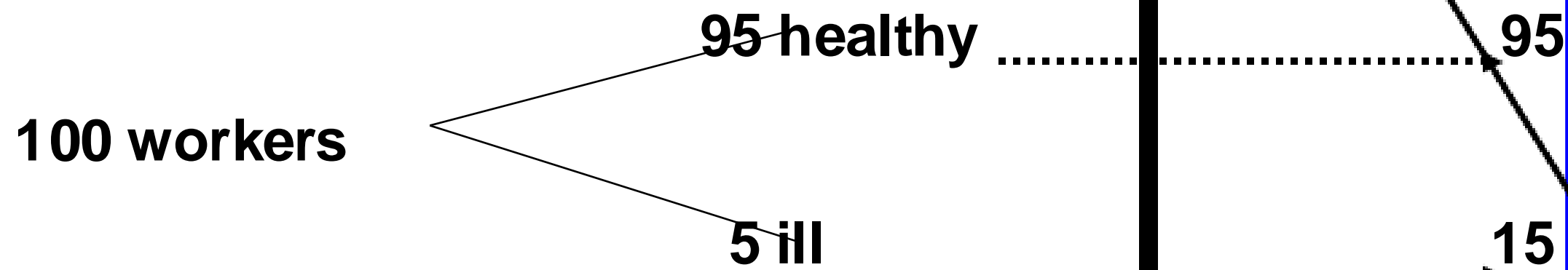
- Inability to determine the **temporal relationship** between exposure and disease.
- May be biased by lack of participation
- Reflects prevalent, not incident cases and thus results may be related to duration of disease, or survival with disease (e.g., “healthy worker effect”)

Cross-sectional Studies

Job A (hazardous)



Job B (non-hazardous)



Prevalence ill job A: $20/100 = 20\%$?


Prevalence ill job B: $5/100 = 5\%$?

Prevalence ratio: 4 ?

How to conduct a Cross-Sectional Study

1. Clear definition of study question. i.e.:
Exposure and outcome

2. Identification of study population:

Small population  All are included

Large population  Sampling

How to conduct a Cross-Sectional Study

3. Data collection: Exposure and outcome
4. Data analysis: Subdivision of the population to suspected factor and compare the prevalence of the outcome in each subgroup
5. Interpretation: is there a relation between exposure and outcome?

Design of a C-S Study

