

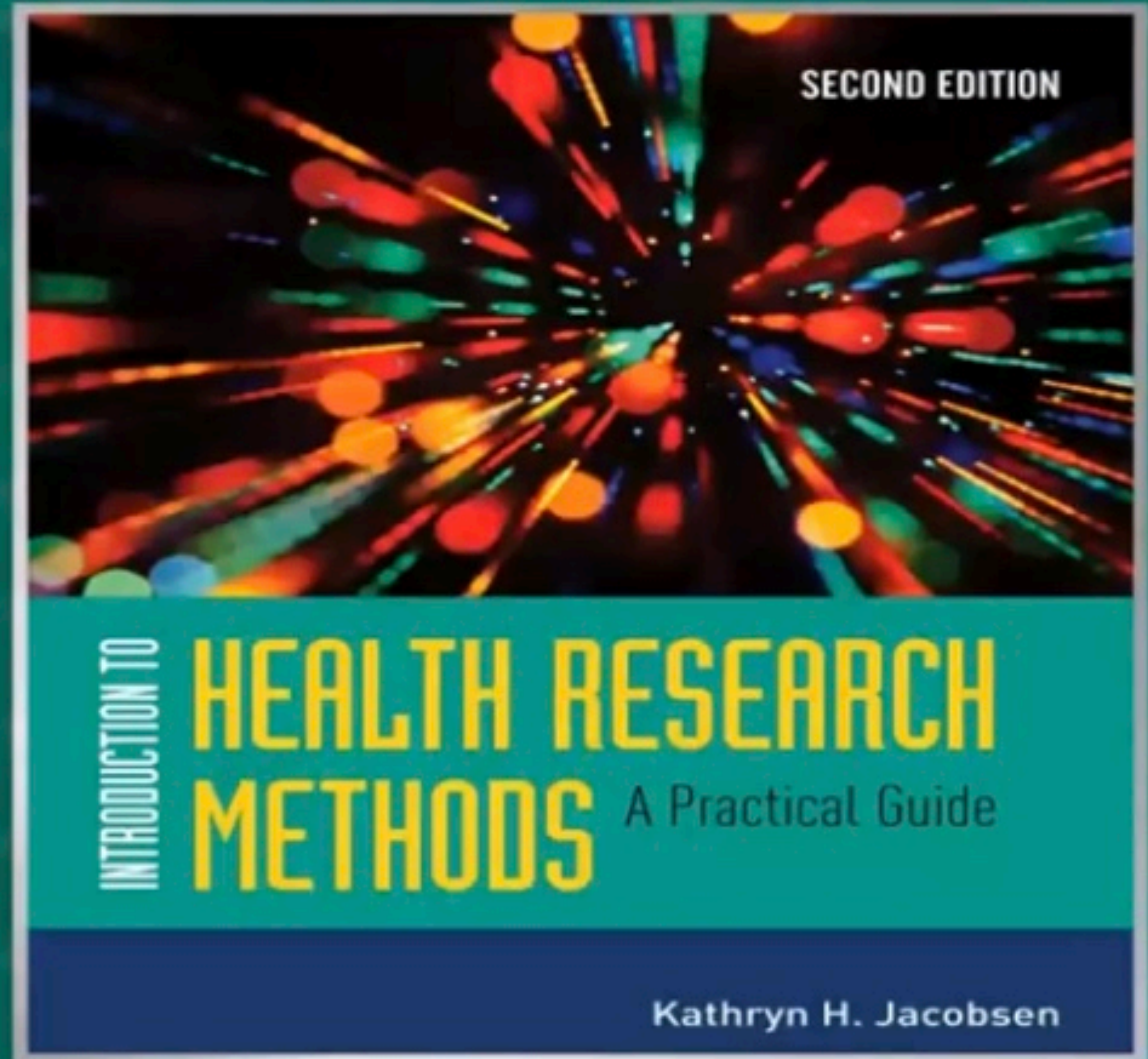
# Medical Research

## Week 3



# The Health Research Process

## Chapter 7





## 7.1 Types of Study Approaches

- There are many valid study approaches (Eight are highlighted in your book).
- The design selected must be appropriate to the study goals.



**FIGURE 7-1**     **Summary of Study Approaches**

<b>Study Approach</b>	<b>Goal</b>
Case series	Describe a group of individuals with a disease
Cross-sectional survey	Describe exposure and/or disease status in a population
Case-control study	Compare exposure histories in people with disease (cases) and people without diseases (controls)
Cohort study	Compare rates of new (incident) disease in people with different exposure histories or follow a population forward in time to look for incident diseases
Experimental study	Compare outcomes in participants assigned to an intervention or control group
Qualitative study	Seek to understand how individuals and communities perceive and make sense of the world and their experiences
Correlational (ecological) study	Compare average levels of exposure and disease in several populations
Review/meta-analysis	Synthesize existing knowledge

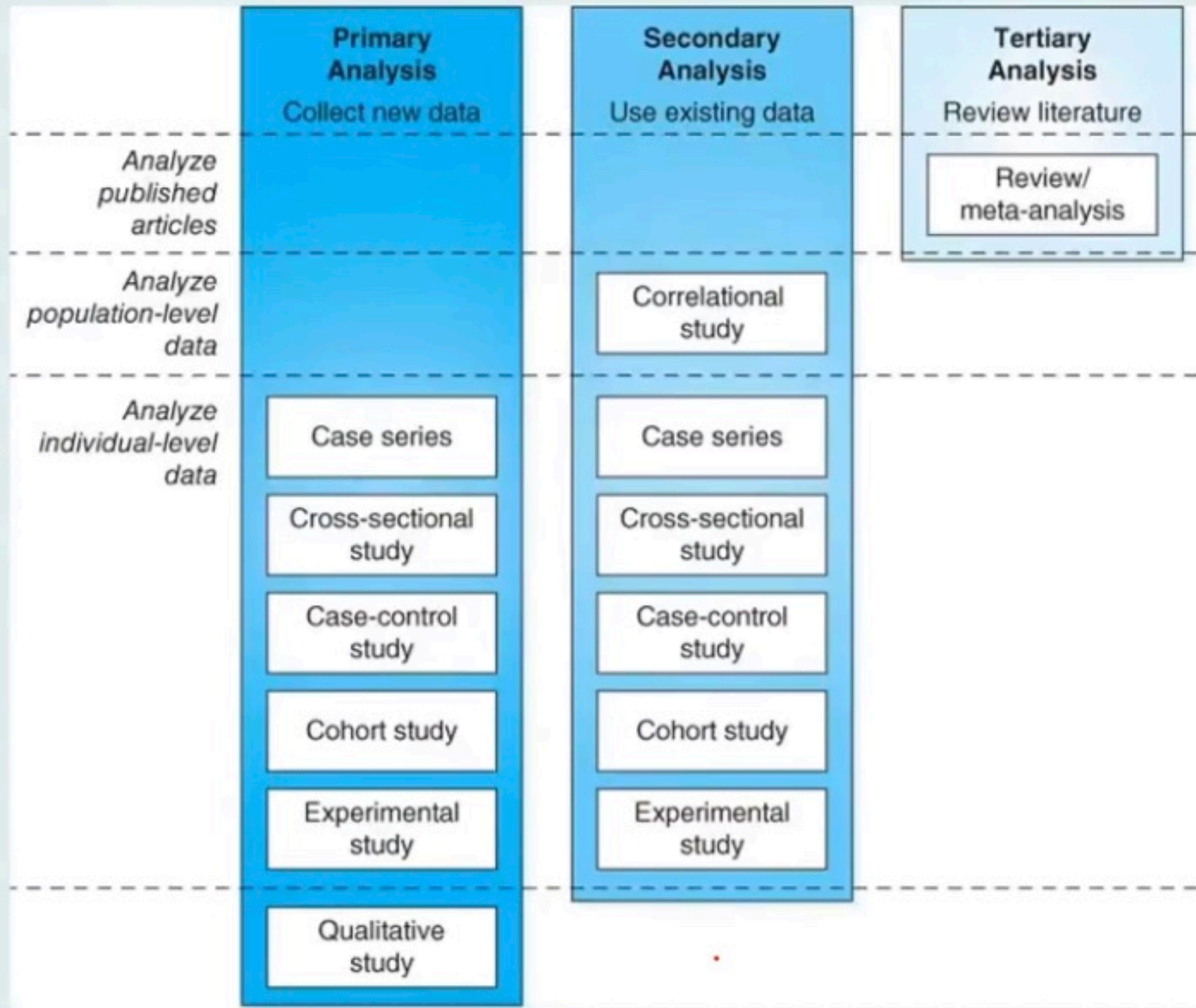


## 7.2 Primary, Secondary, & Tertiary Studies

- The first critical decision is whether to conduct a primary, secondary, or tertiary study.



Now, Let's put them together



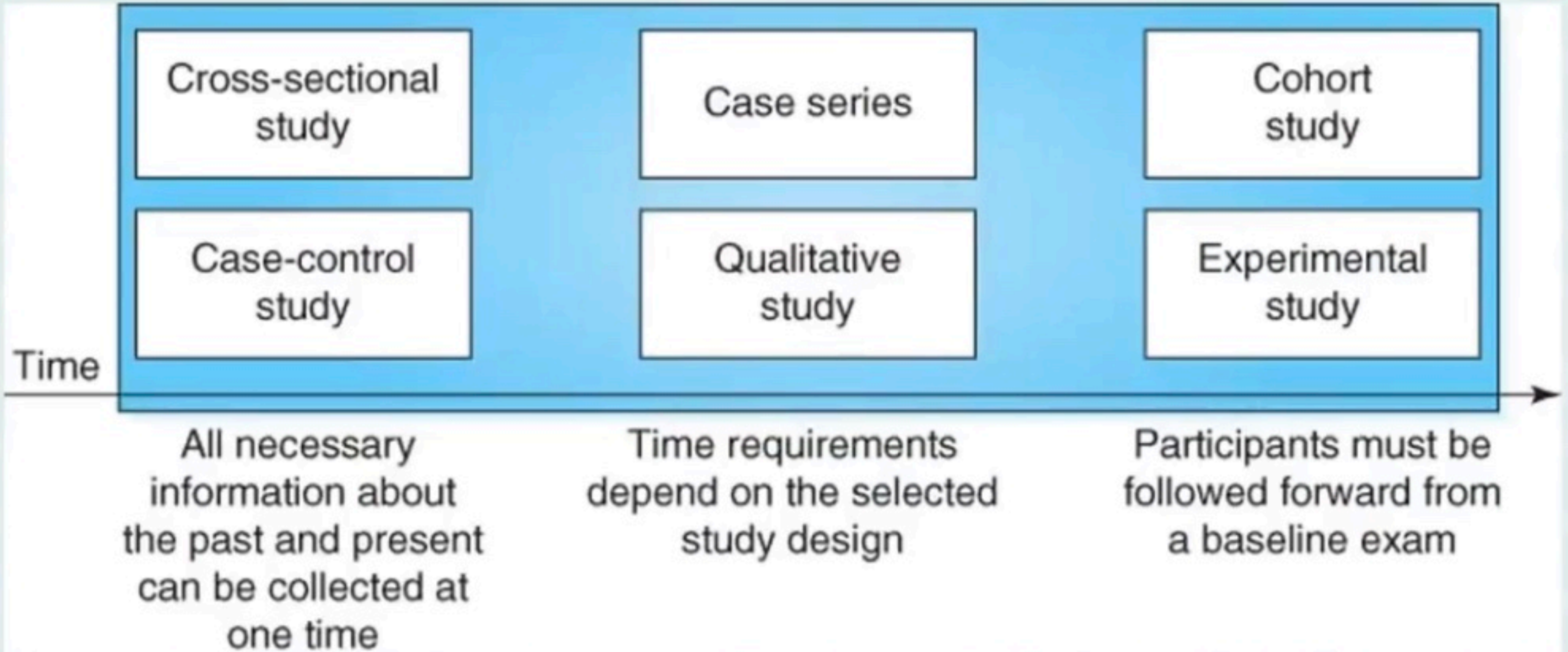


## 7.3 Study Duration

- Primary studies usually take longer than secondary or tertiary studies.



# Time Frame for Primary Data Collection



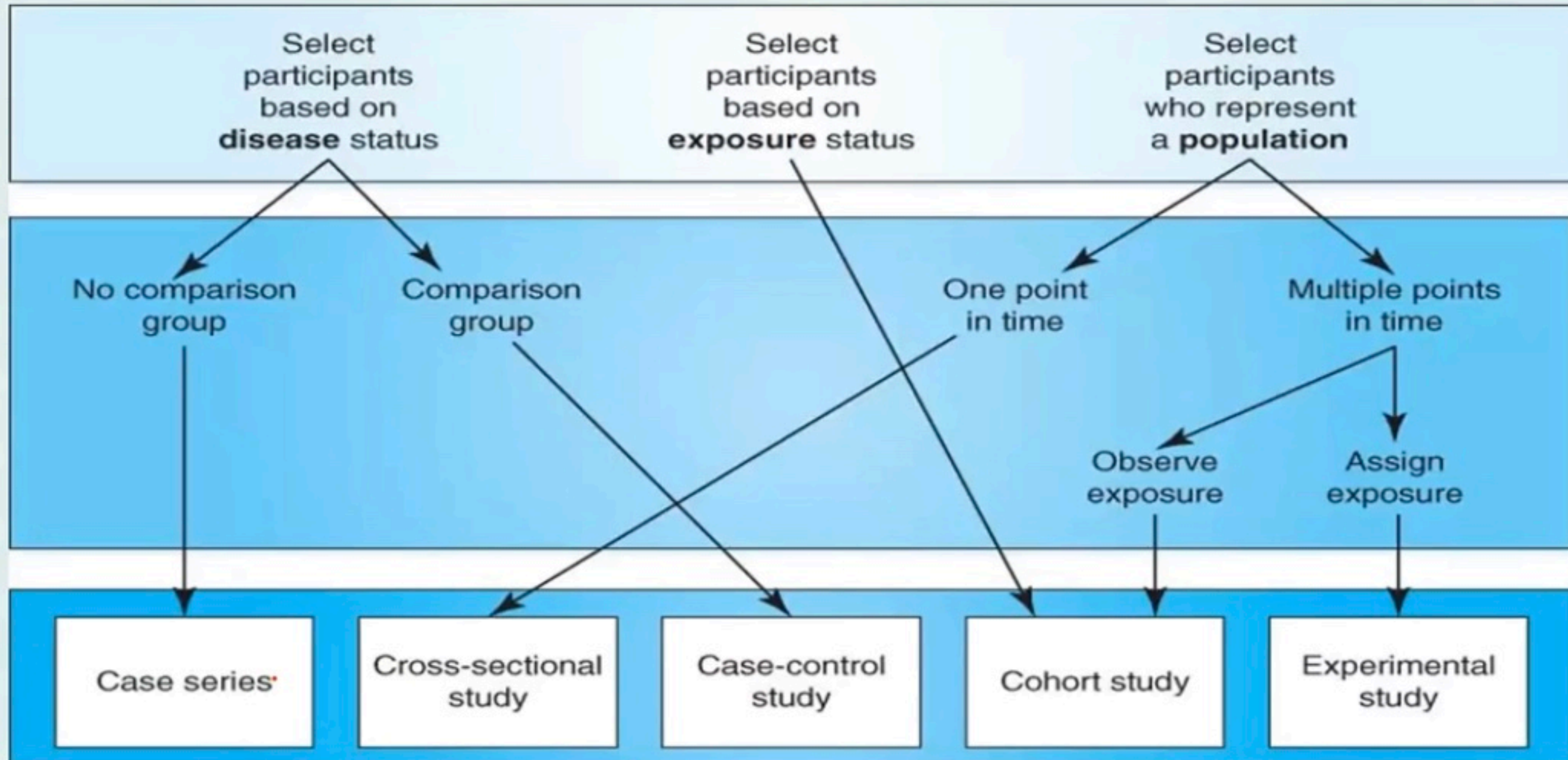


## 7.4 Primary Focus: Exposure, Disease, or Population?

- Primary study designs can be selected based on which EDP is the major motivation for the study.



# Population Selection for Each Study Approach





## 8.1 Overview

- A ***case report*** describes one patient.
- A ***case series*** describes a group of individuals with the same disease or who have undergone the same procedure.



## FIGURE 8-1 Key Characteristics of a Case Series

Objective	Describe a group of individuals with a disease
Primary study question	What are the key characteristics of the cases in this study population?
Population	All individuals in the study must have the same disease or be undergoing the same procedure.
When to use this approach	A source of cases is available, and no comparison group is required or available.
Requirement	An appropriate source of cases is available.
First steps	<ol style="list-style-type: none"><li>1. Specify what new and important information the analysis will provide.</li><li>2. Identify a source of cases.</li><li>3. Assign a case definition.</li><li>4. Select the characteristics of the study population that will be described.</li></ol>
What to watch out for	A lack of generalizability
Key statistical measure	Only descriptive statistics are required.



## 8.2 Case Definitions

- A clear ***case definition*** spells out inclusion & exclusion criteria.
- ***ICD codes*** can be helpful.
- Include person, place, and time (PPT) characteristics.



**FIGURE 8-2     Sample Case Definitions**

<b>Category</b>	<b>Example 1</b>	<b>Example 2</b>
Disease/ procedure Person	Whooping cough (ICD-10 code A37)  Any person with a confirmed case of whooping cough, defined as an acute cough of any duration with isolation of Bordatella pertussis from a clinical specimen or a cough lasting 2 or more weeks with paroxysms of coughing, inspiratory "whoop," or posttussive vomiting and contact with a laboratory-confirmed case of pertussis	Liver transplantation  Adult patients (ages 18 and older at the time of transplant), excluding those who were not receiving their first liver transplant and those who received multi-organ transplants
Place	Residents of Big City whose diagnoses were reported to the Big City Health Department (which requires notification of all diagnoses of pertussis)	Patients who had transplant surgery at the Oakville Regional University Medical Center
Time	First sought clinical care between January 1 and March 31, 2016	Recipients of liver transplants between January 1, 2006, and December 31, 2014, who were followed for a minimum of 2 years post-transplant



## 8.3 Special Considerations

- Use a “questionnaire” to extract information from medical charts.
- Remember that missing information does not mean that a symptom or sign was not present, just that it was not recorded in the file.
- Ethical approval is required, and great care must be taken to protect the identities of study subjects.
- Photographs can only be used with written permission from the patient.



## 8.4 Analysis

- Few numbers are required for most case series studies.
- Some may report percentages such as:
  - Case fatality rate.
  - Mortality rate.
  - Proportionate mortality rate.
- With sufficient sample size, comparisons can be made between subpopulations of cases



# Thank You



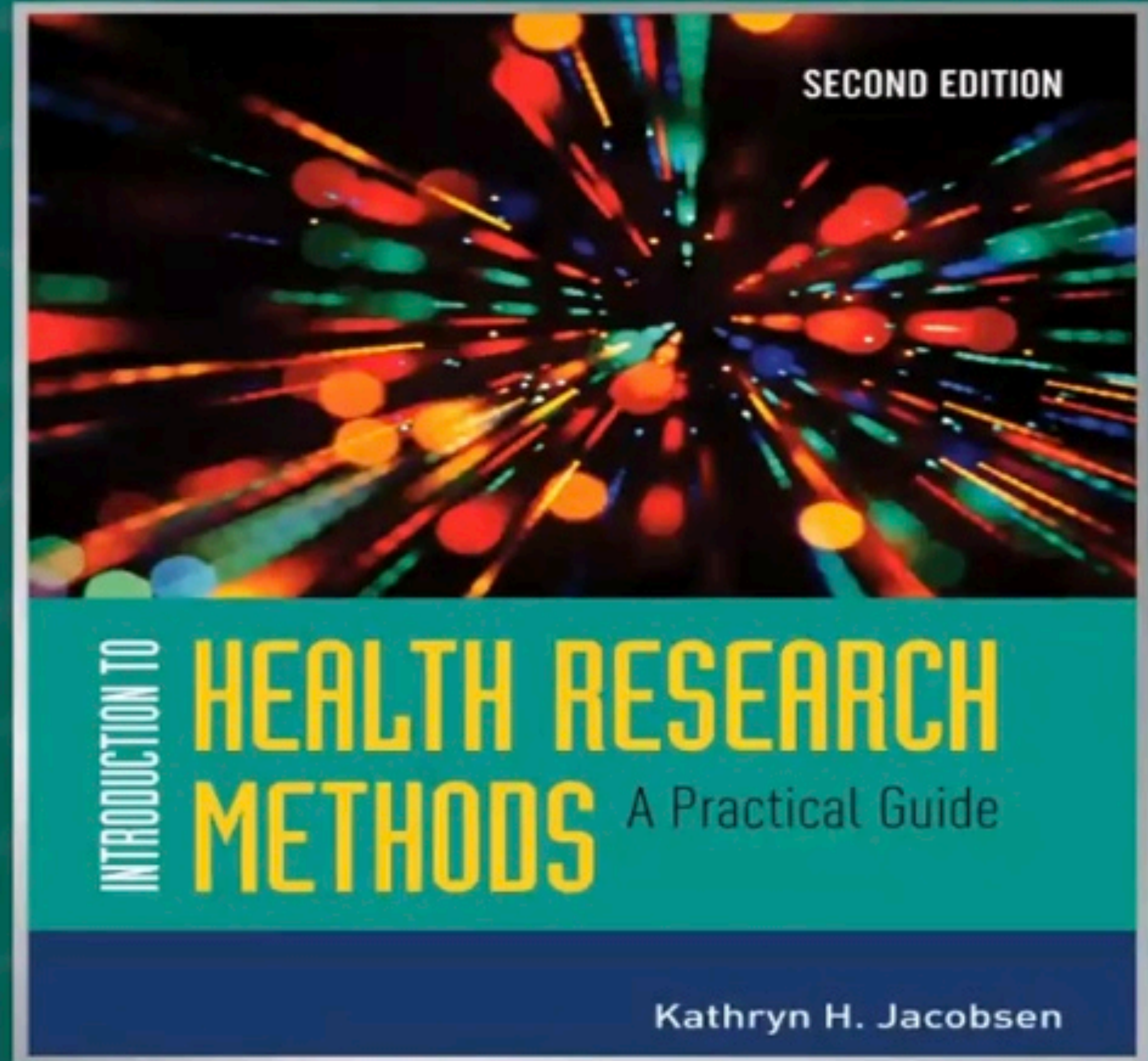
# Medical Research

## Week 4



# Cross-Sectional Surveys

## Chapter 9





## 9.1 Overview

- ***Cross-sectional survey = prevalence study***
- Measures the proportion of a population with a particular exposure or disease



## FIGURE 9-1 Key Characteristics of Cross-Sectional Surveys

Objective	Describe the exposure and/or disease status in a population
Primary study question	What is the prevalence of the exposure and/or disease in the population?
Population	The study participants must be representative of the population from which they were drawn.
When to use this approach	Time is limited and/or the budget is small.
Requirement	The exposures and outcomes are relatively common, and the researchers expect to be able to recruit several hundred participants.
First steps	<ol style="list-style-type: none"><li>1. Define a source population.</li><li>2. Develop a strategy for recruiting a representative sample.</li><li>3. Decide on the methods to be used for data collection.</li></ol>
What to watch out for	Non-representativeness of the study population
Key statistical measure	Prevalence



## 9.2 Representative Populations

- The participants must be reasonably **representative** of some larger population.
- **Example:** If the results are intended to reflect the profile of an entire town, then the study's sampling strategy must recruit a population that is as diverse as the town.



## 9.3 KAP Surveys

**A KAP survey asks participants about their:**

- *knowledge;*
- *attitudes (or beliefs or perceptions); and*
- *practices (or behaviors).*



## 9.4 Repeated Cross-Sectional Surveys

- A ***repeated cross-sectional study*** resamples & resurveys representatives from the same source population at two or more different time points.
- This type of study does not track the same individuals forward in time. **Rather, a** new set of participants is sampled from the source population each time a survey is conducted.



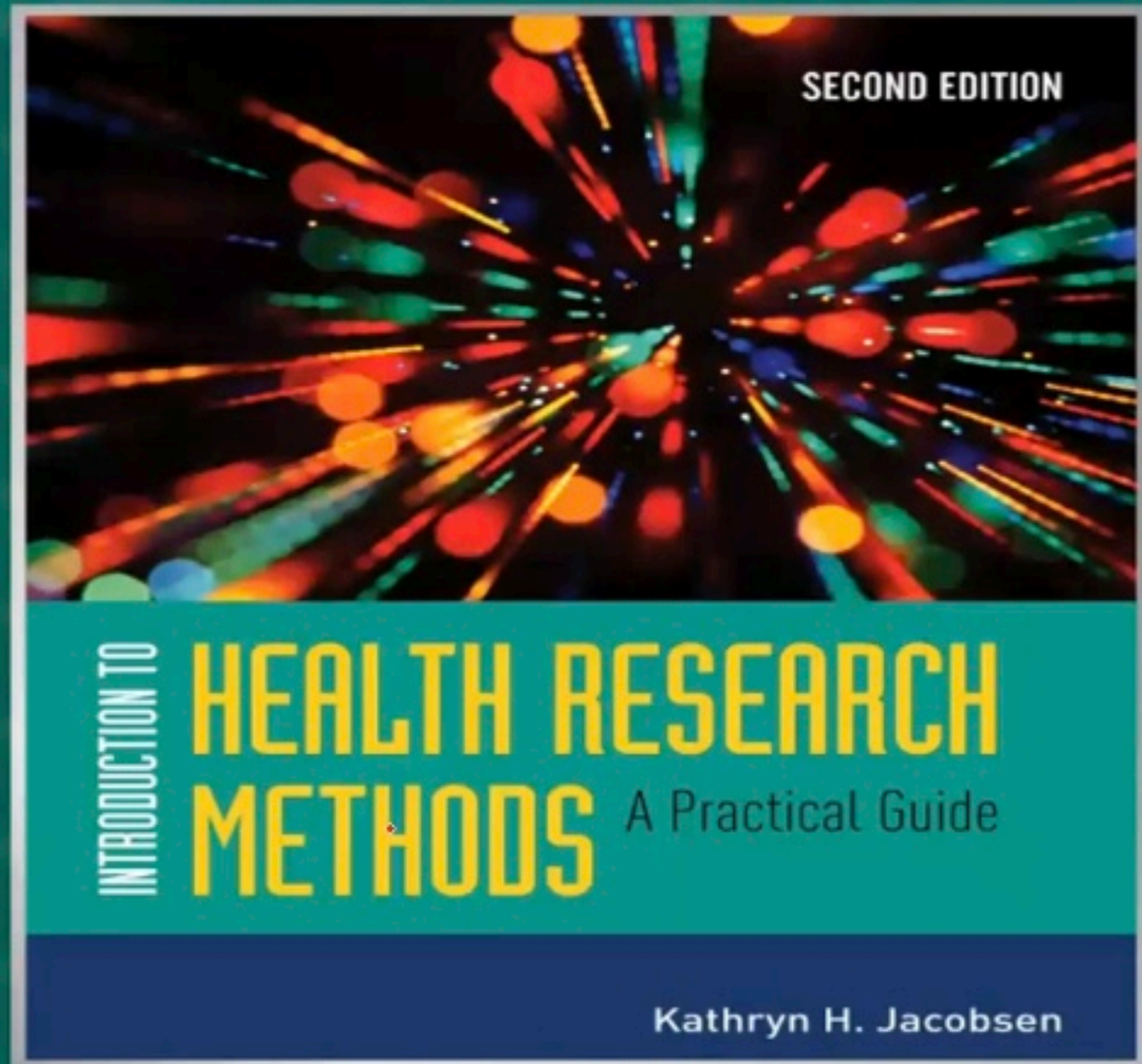
## 9.5 Analysis: Prevalence

- ***Prevalence rate***: the percentage of the population with a given trait at the time of the survey
- ***Prevalence rate ratios***: ratios that compare the prevalence of a characteristic in two population subgroups



# Case-Control Studies

## Chapter 10





## 10.1 Overview

- **Participants are recruited based on disease status.**
  - ***Cases***: participants with the disease of interest
  - ***Controls***: participants without the disease
- Both cases & controls are asked the same set of questions about past exposures.
- Case-control studies are good for studying uncommon diseases.

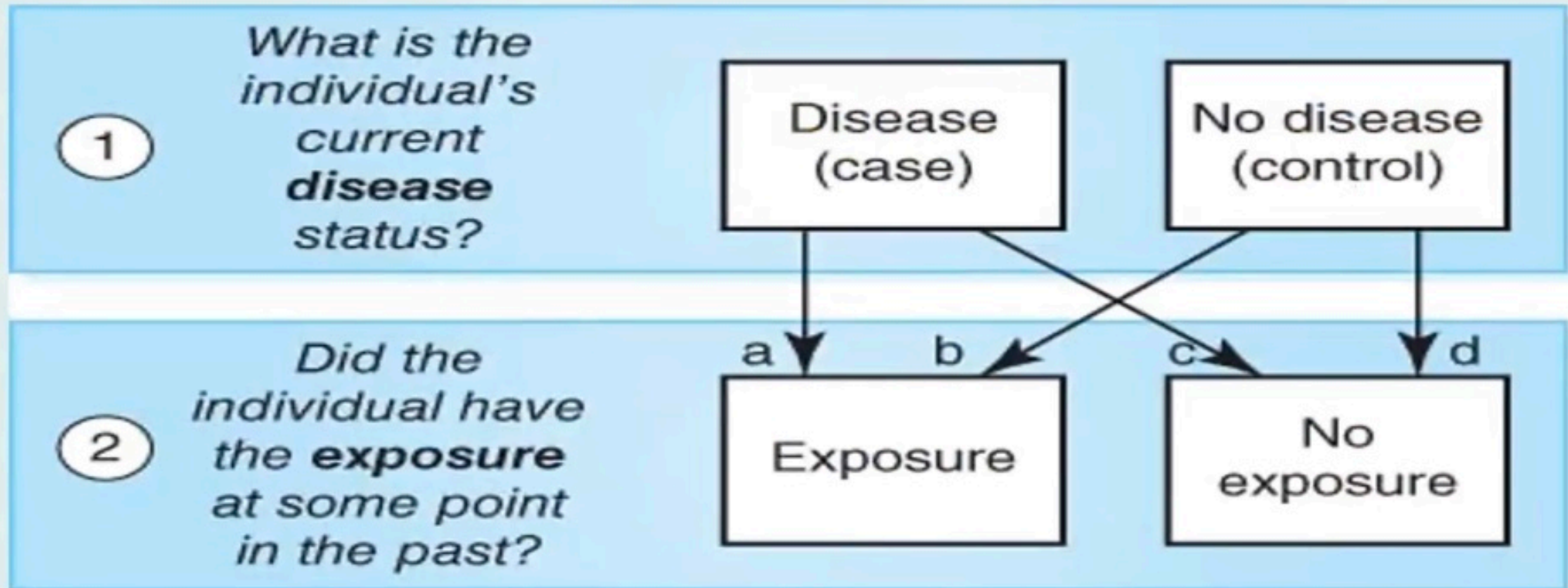


## FIGURE 10-1 Key Characteristics of Case-Control Studies

Objective	Compare exposure histories of people with a disease (cases) and people without that disease (controls)
Primary study question	Do cases and controls have different exposure histories?
Population	Cases and controls must be similar except for their disease status.
When to use this approach	The disease is relatively uncommon, but a source of cases is available.
Requirement	A source of cases is available.
First steps	<ol style="list-style-type: none"><li>1. Identify a source of cases.</li><li>2. Assign a case definition.</li><li>3. Decide what type of control population will be appropriate for the study.</li><li>4. Decide whether cases and controls will be matched.</li></ol>
What to watch out for	Recall bias
Key statistical measure	Odds ratio (OR)



# Figure 10-2: Framework for a Case-Control Study





## 10.2 Finding Cases & Controls (1 of 2)

- All cases must have the same disease, disability, or other health-related condition as per the ***case definition***.
- Find cases through hospitals, specialty clinics, physicians' offices, public health agencies, disease registries, and disease support groups.



## 10.2 Finding Cases & Controls (2 of 2)

- Use a ***control definition*** to ensure that controls are similar to the cases except for their disease status.
- Find controls who are friends and relatives of cases, hospital or clinic patients without the disease of interest, or members of the general population.



## 10.3 Matching

- Three options:

A. No matching

***B. Frequency (group) matching:*** Select one or more controls per case who are similar by age, sex, or other characteristics, but do not match cases to particular controls.

***C. Matched-pairs (individual) matching:*** Recruit a genetic sibling or other control who is linked to a particular case during analysis.

- Avoid ***overmatching***.



## 10.4 Special Considerations

- Avoid ***misclassification bias*** with good case & control definitions.
- Be aware of ***recall bias***, which occurs when cases & controls systematically have different memories of the past.

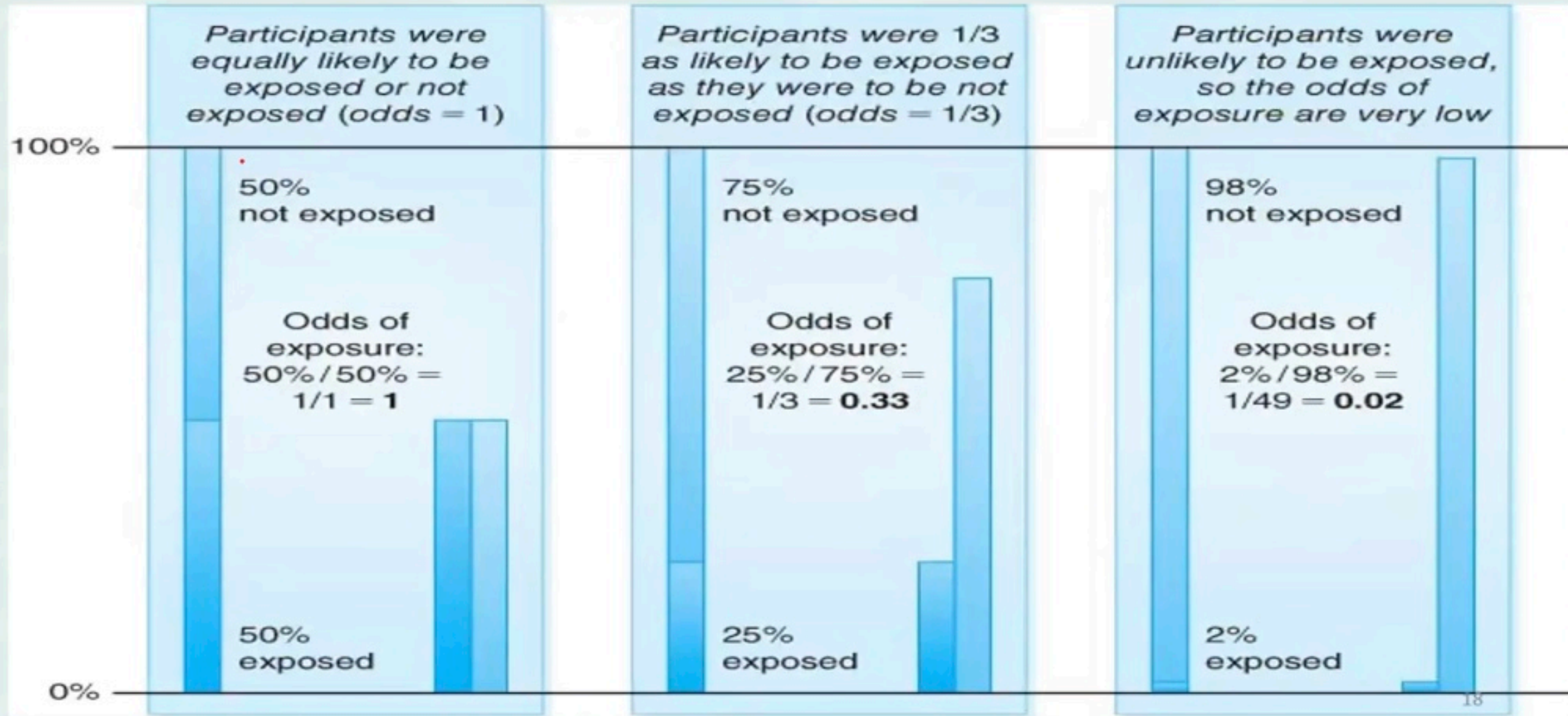


## 10.5 Analysis: Odds Ratios (ORs)

- ***Odds***: Compares the likelihood of having had a particular exposure to not having had it.
- ***Odds ratio***: Compares the odds of exposure among cases to the odds among control



# Figure 10-3: Odds



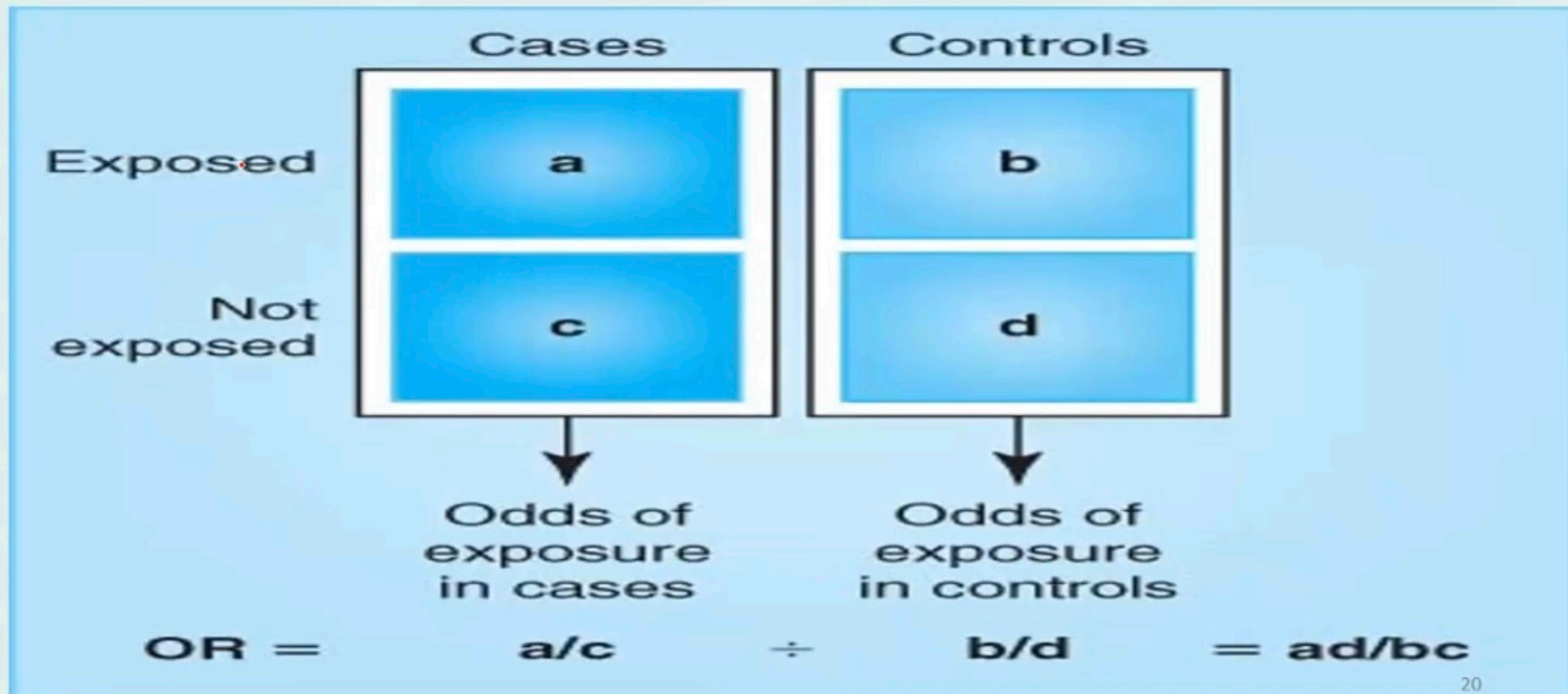


## 10.5 Analysis: Odds Ratios (ORs)

- Examine the figures explaining odds and odds ratios (ORs).
- A **2X2 table** displays the counts of people with various combinations of exposure status & disease status.
- $OR = ad/bc$ 
  - OR = 1: The odds of exposure were the same for cases & controls.
  - OR > 1: Cases had higher odds of exposure than controls, implying that the exposure was risky.
  - OR < 1: Cases had lower odds of exposure than controls, implying that the exposure was protective.

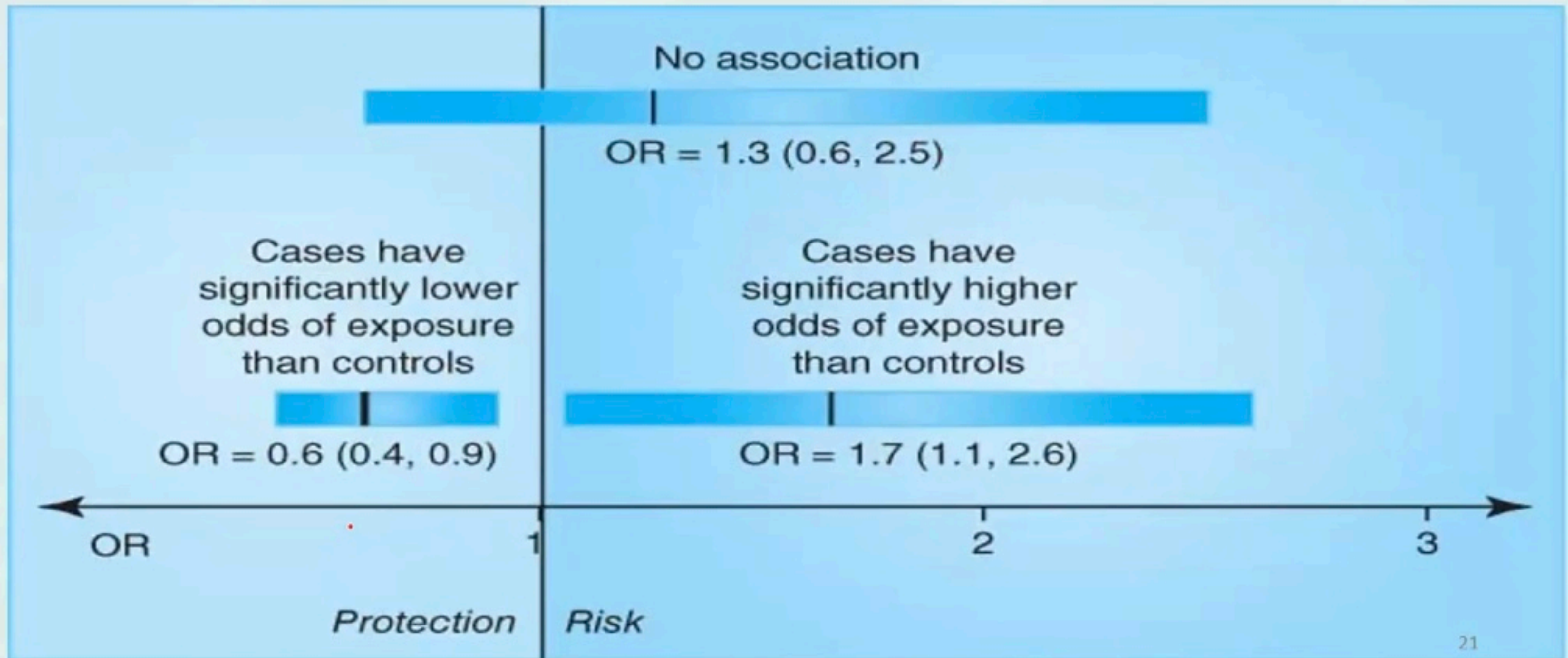


# Figure 10-4: Odds Ratio (Point Estimate)



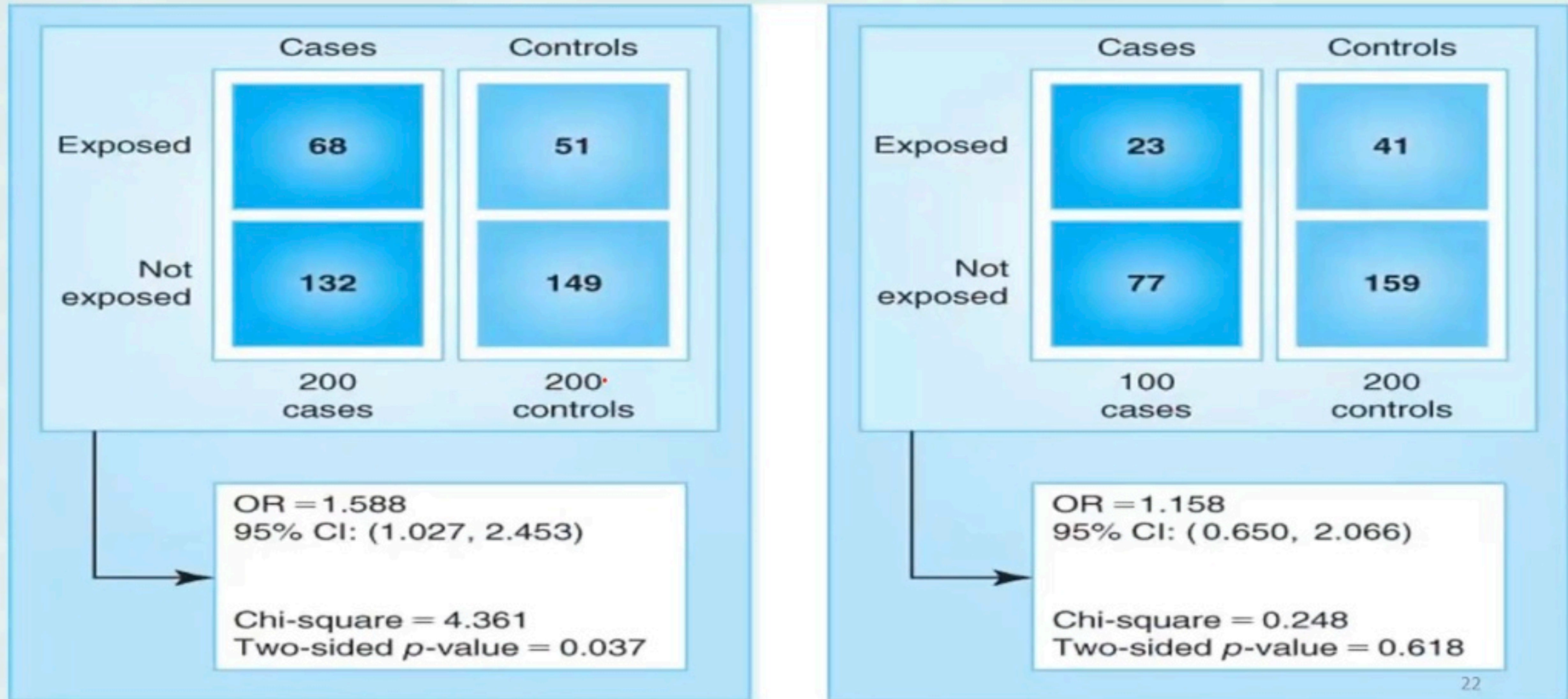


# Figure 10-5: Interpretation of the Odds Ratio Based on Its 95% Confidence Interval





# Figure 10-6: Examples of Odds Ratio Calculations



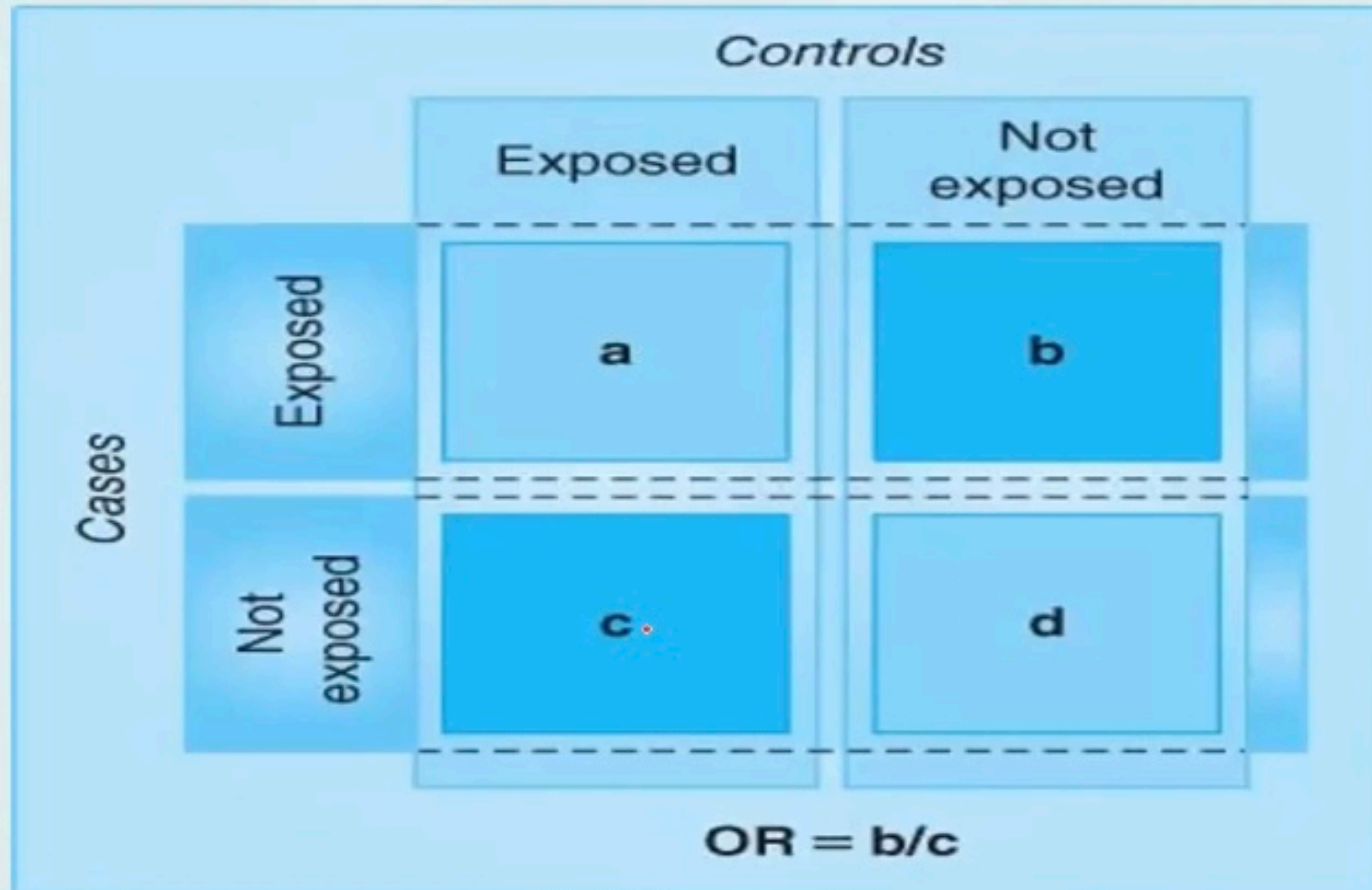


## 10.6 Matched Case-Control Studies

- A special kind of 2X2 table displays the distribution of pairs of cases & controls.
  - In ***concordant*** pairs, the case & control have the same exposure history.
  - In ***discordant*** pairs, the case & control have different exposure histories.



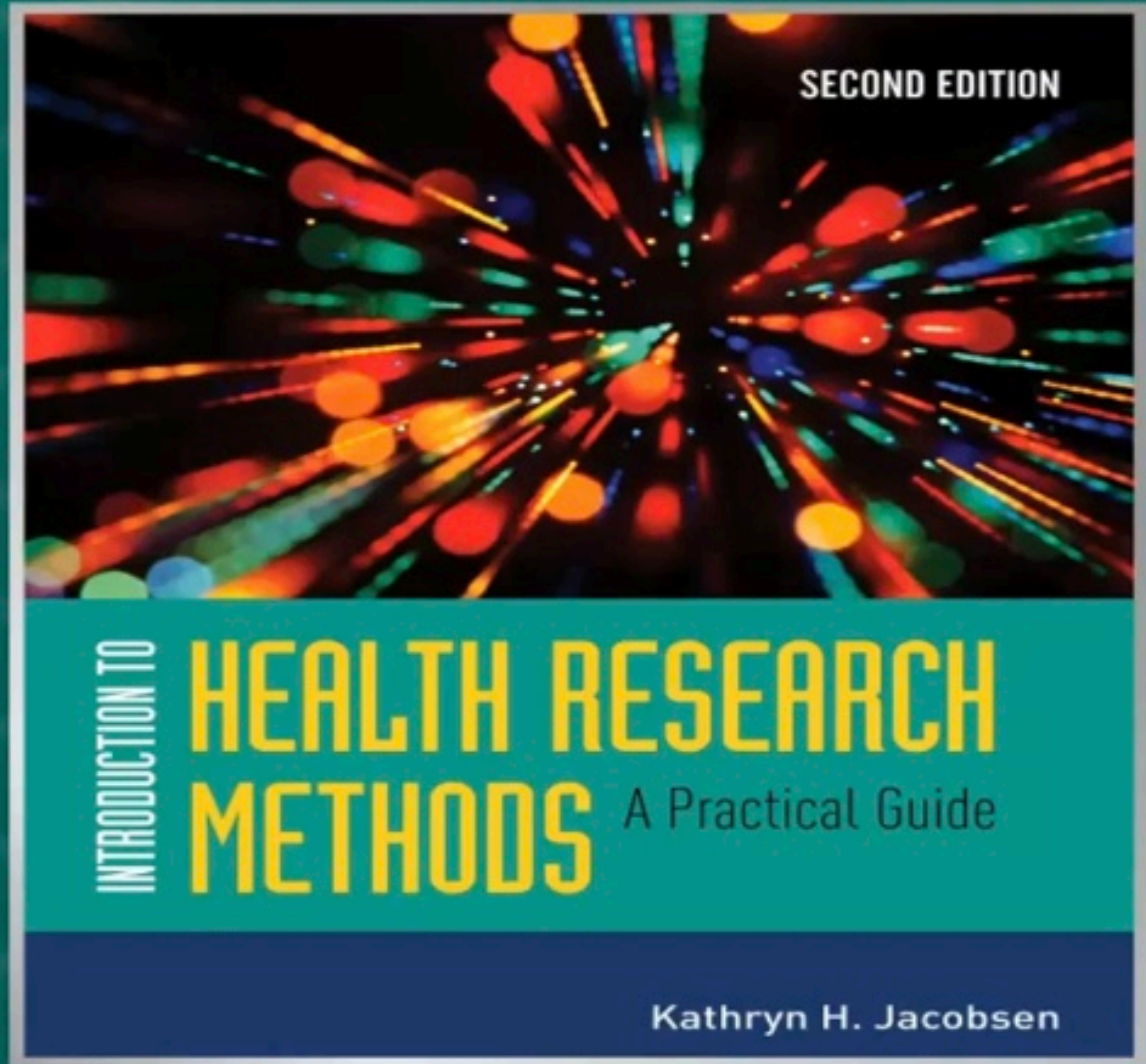
# Figure 10-7: Matched-Pairs Odds Ratio





# Cohort Studies

## Chapter 11



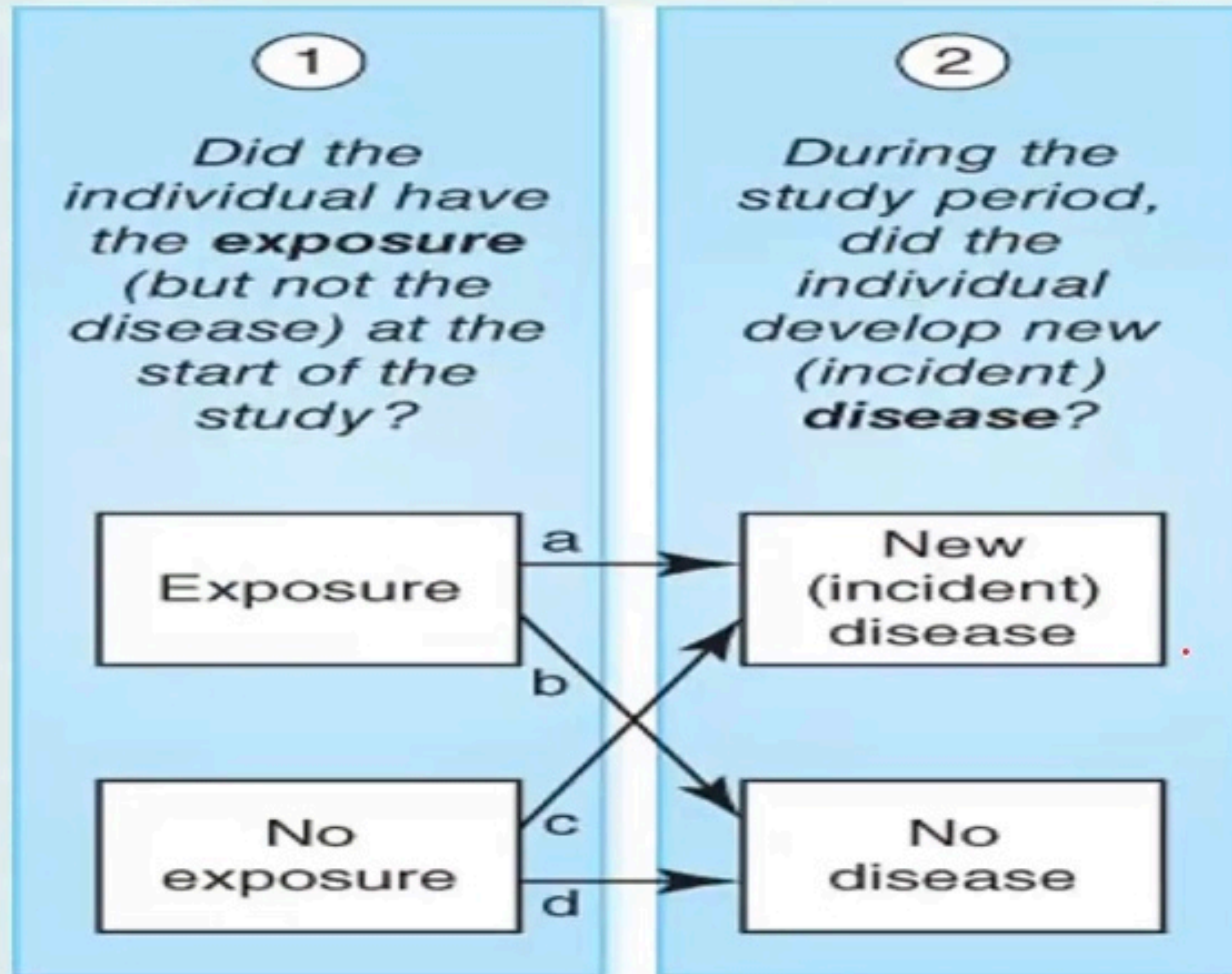


## 11.1 Overview

- A ***cohort*** is a group of similar people followed through time together.
- All ***cohort studies*** are observational (not experimental) studies with at least two measurement times: a baseline & a follow-up examination.
- Cohort studies quantify the rate of incident (new) disease.



# Figure 11-2: Framework for a Cohort Study



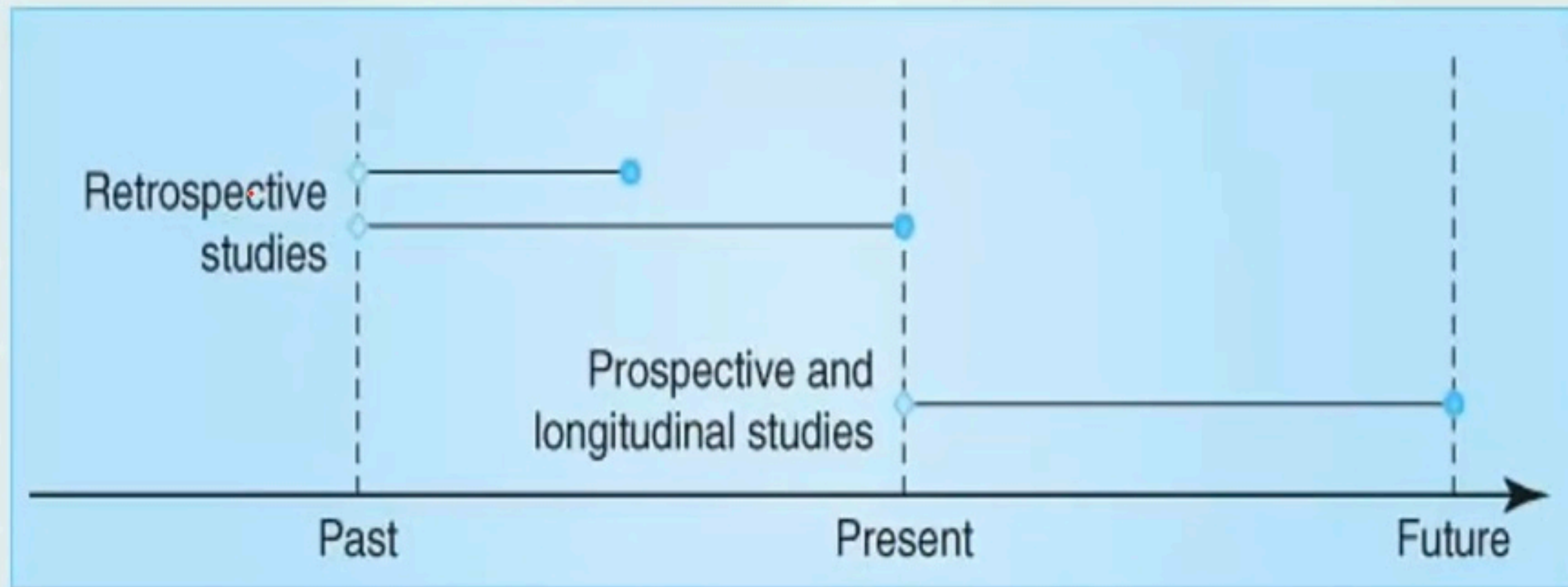


## 11.2 Types of Cohort Studies (1 of 2)

- Cohort studies can take many forms. For simplicity, this chapter groups cohort study designs into three categories:
  - A. *Retrospective (historic) cohort study*:** recruits based on exposure status at some point in the past and uses follow-up data from some point after that old exposure to ascertain disease status
  - B. *Prospective cohort study*:** recruits based on exposure status in the present and follows them forward in time
  - C. *Longitudinal study*:** recruits a representative sample of a population and follows people forward in time (does NOT recruit based on exposure status)



## Figure 11-3: Times of Baseline and Follow-Up Data Collection for Cohort Studies





**FIGURE 11-1**    **Key Characteristics of Cohort Studies**

<b>Approach</b>	<b>Prospective or Retrospective Cohort</b>	<b>Longitudinal Cohort</b>
Objective	Compare rates of new (incident) disease over time in people with and without a particular well-defined exposure.	Follow a representative sample of a well-defined population forward in time to look for new (incident) diseases associated with a diversity of exposures.
Primary study question	Is exposure associated with an increased incidence of disease?	Is exposure associated with an increased incidence of disease?



FIGURE 11-1

Key Characteristics of Cohort Studies (continued)

Approach	Prospective or Retrospective Cohort	Longitudinal Cohort
Population	Participants must be similar except for exposure status.	Participants must be available for follow-up months or years after enrollment.
Use this approach when	Because the goal is to look for incident disease, no one can have the disease of interest at the start of the study.	The study participants must be reasonably representative of the population from which they were drawn.
Do not use unless	An exposure is relatively uncommon but a source of exposed individuals is available.	The goal is to examine multiple exposures and multiple outcomes and time is not a concern.
First steps	A source of individuals with the exposure is available.	There is adequate time and money for the study.
Watch out for	<ol style="list-style-type: none"> <li>1. Identify a source of individuals with the exposure.</li> <li>2. Decide what type of unexposed individuals will be an appropriate comparison group.</li> </ol>	<ol style="list-style-type: none"> <li>1. Select a source population.</li> <li>2. Select the exposures and outcomes that will be assessed.</li> <li>3. Decide how often data will be collected.</li> <li>4. Develop a strategy for minimizing the burden of participation and maximizing benefits and incentives.</li> </ol>
	Loss to follow-up (prospective studies) or missing records (retrospective studies)	Loss to follow-up
	Information bias in which the exposed participants are more thoroughly examined for disease than unexposed participants	Potential data management challenges if a lot of information is collected at many points in time
Key statistical measure	Incidence rate ratio (RR, also called the relative risk)	Incidence rate ratio (RR, also called the relative risk)

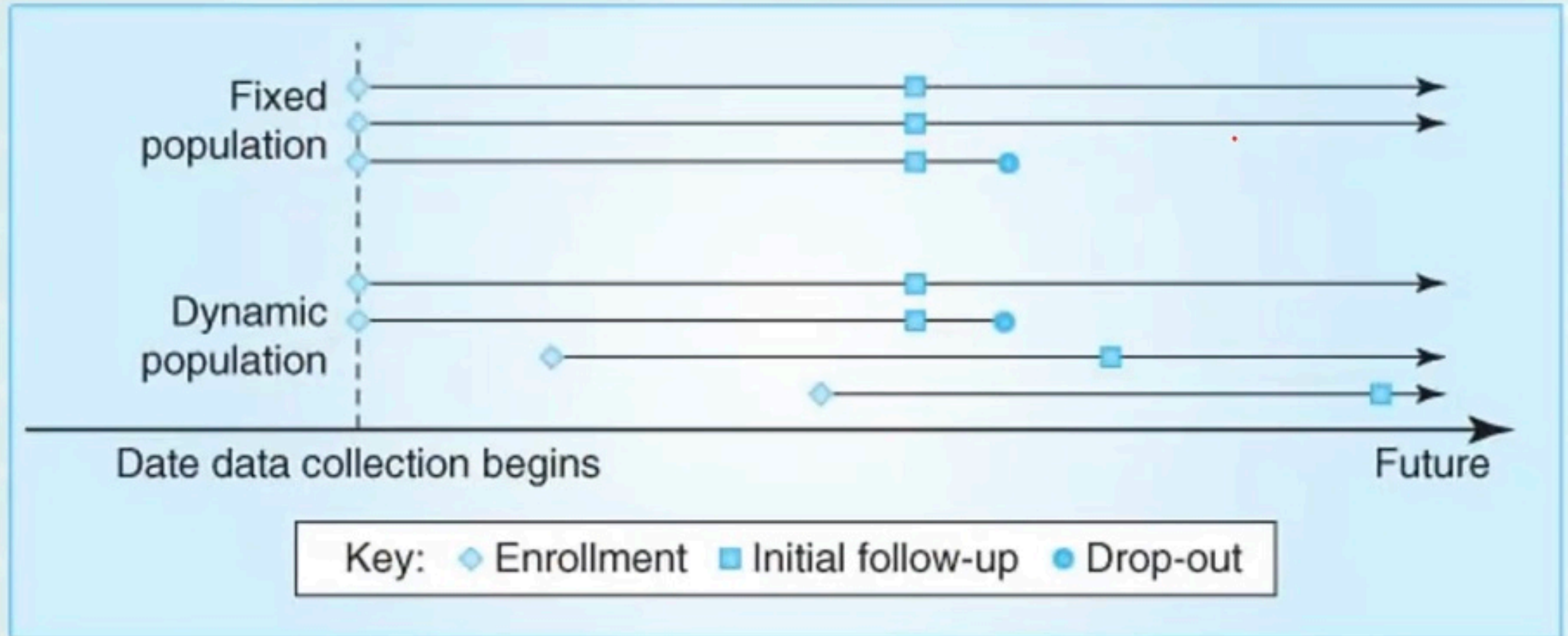


## 11.2 Types of Cohort Studies (2 of 2)

- Longitudinal studies may use a ***fixed population*** or a ***dynamic (open) population*** with rolling enrollment.



## Figure 11-4: Longitudinal Studies





## 11.3 Special Considerations

- **Retrospective** studies require a source of valid data about past exposure status.
- **Prospective & longitudinal** studies must take steps to minimize loss to follow-up when studies continue for many years.

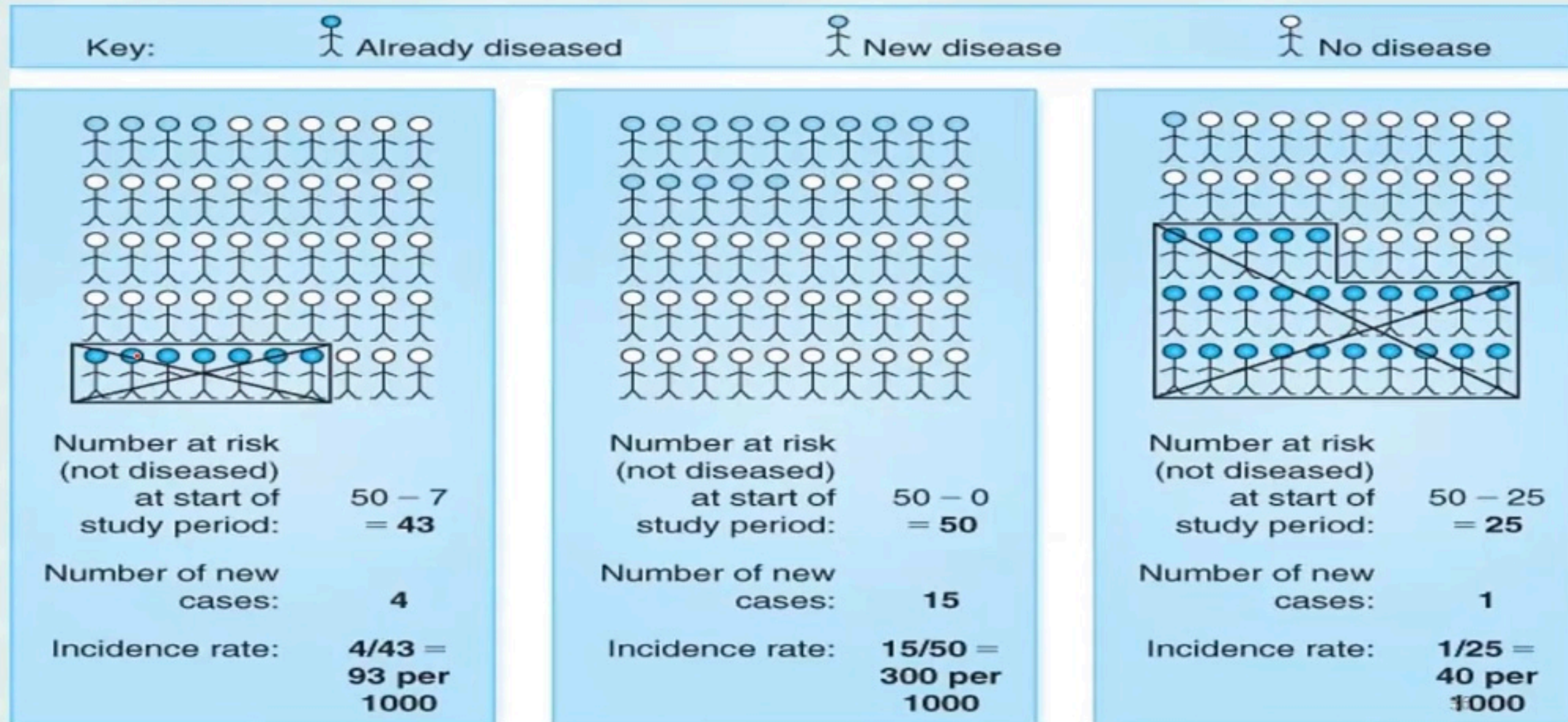


## 11.4 Analysis: Incidence Rate Ratios (RRs) (1 of 3)

- The ***incidence rate***: the number of new cases of disease in a population during a specified period of time divided by the total number of persons in the population who were at risk during that period.



# Figure 11-5: Calculating *incidence rate*



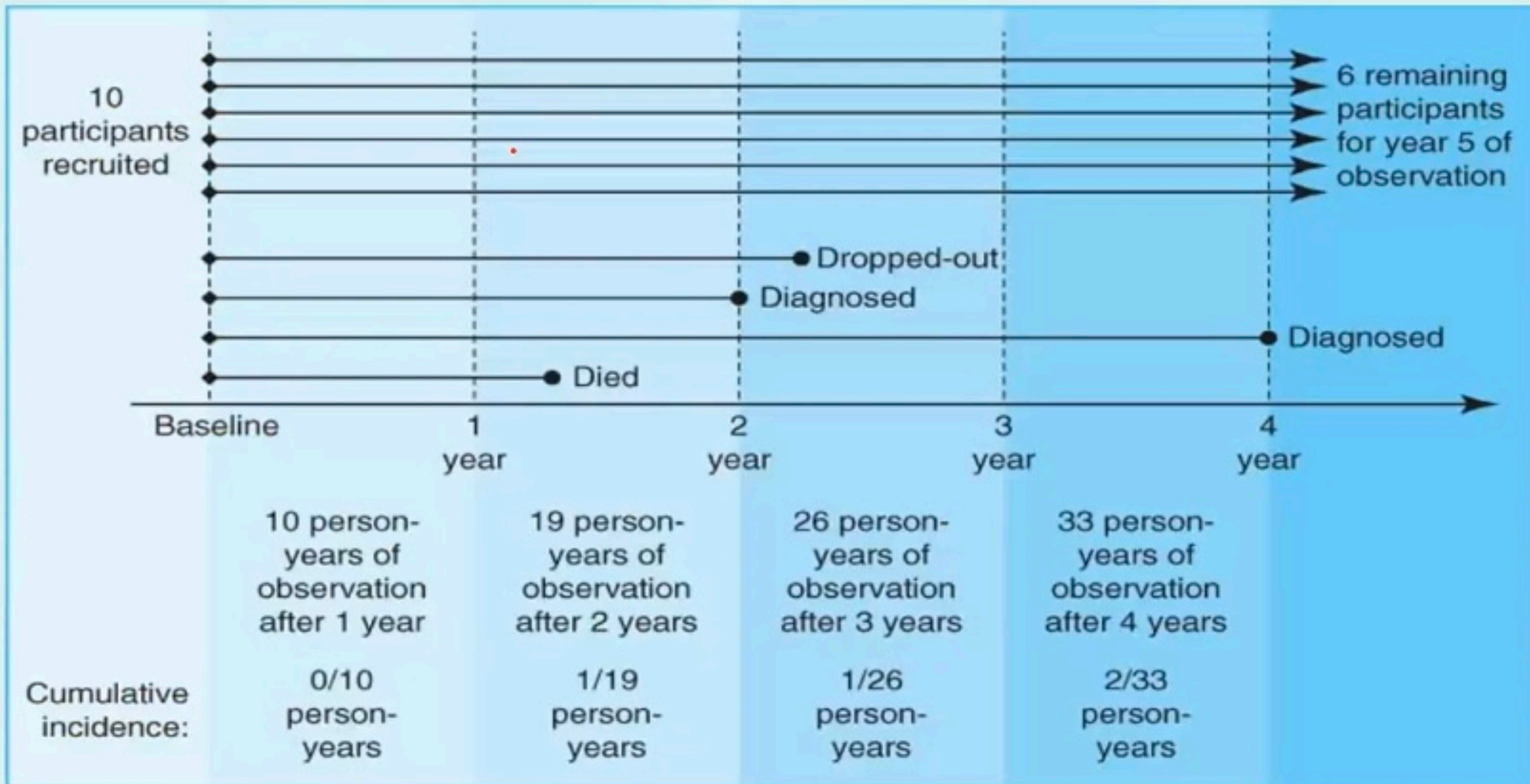


## 11.4 Analysis: Incidence Rate Ratios (RRs) (2 of 3)

- ***Person-time*** is used for studies with dynamic enrollment.



# Figure 11-6: *Person-time*



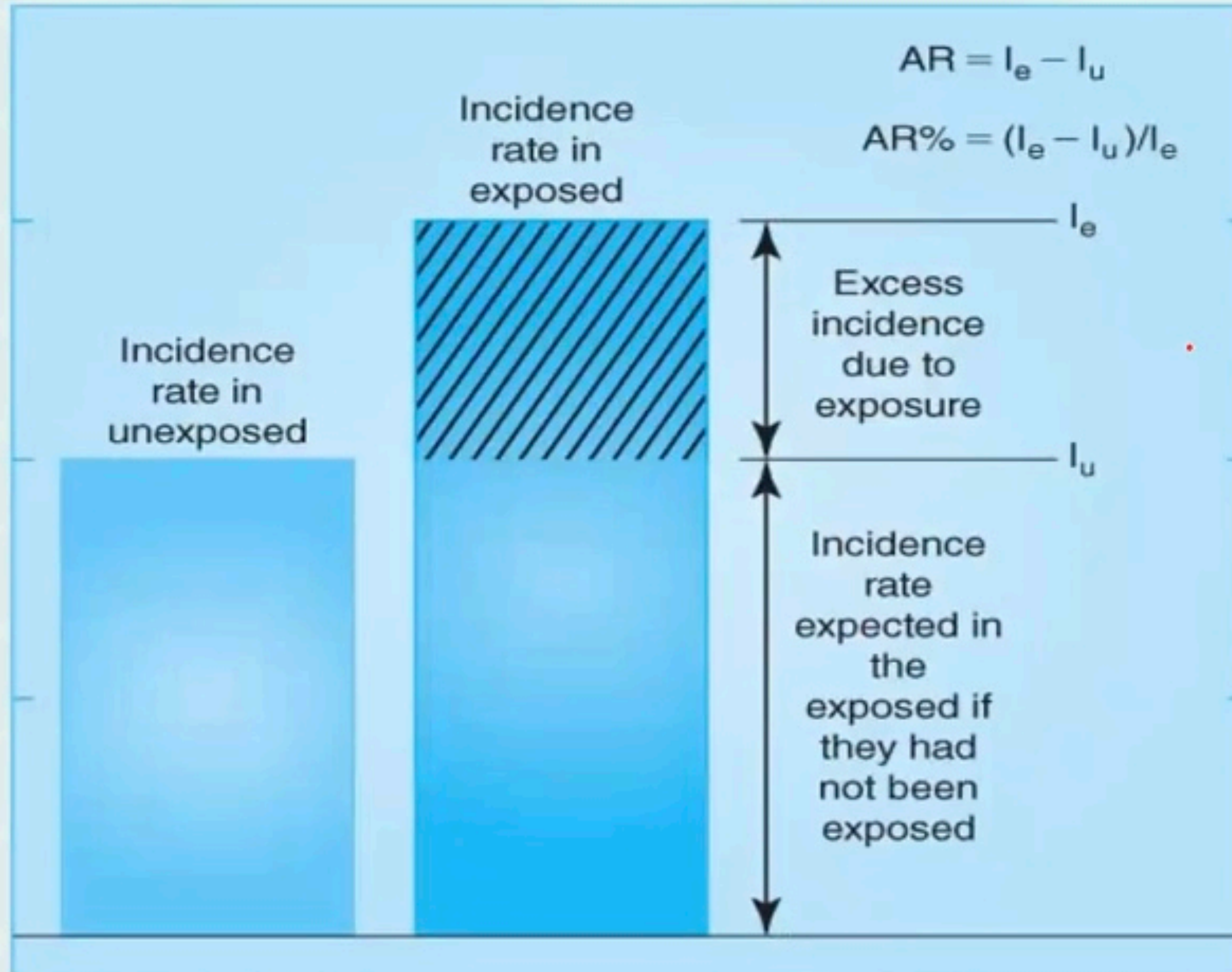


## 11.4 Analysis: Incidence Rate Ratios (RRs) (3 of 3)

- Examine the figures explaining **ARs**, **RRs**, and related metrics
- ***Incidence rate ratios (RRs)***
  - **RR = 1:** The incidence rate was the same in the exposed and in the unexposed.
  - **RR > 1:** The incidence rate was higher in the exposed than in the unexposed, suggesting that the exposure was risky.
  - **RR < 1:** The incidence rate was lower in the exposed than in the unexposed, suggesting that the exposure was protective.

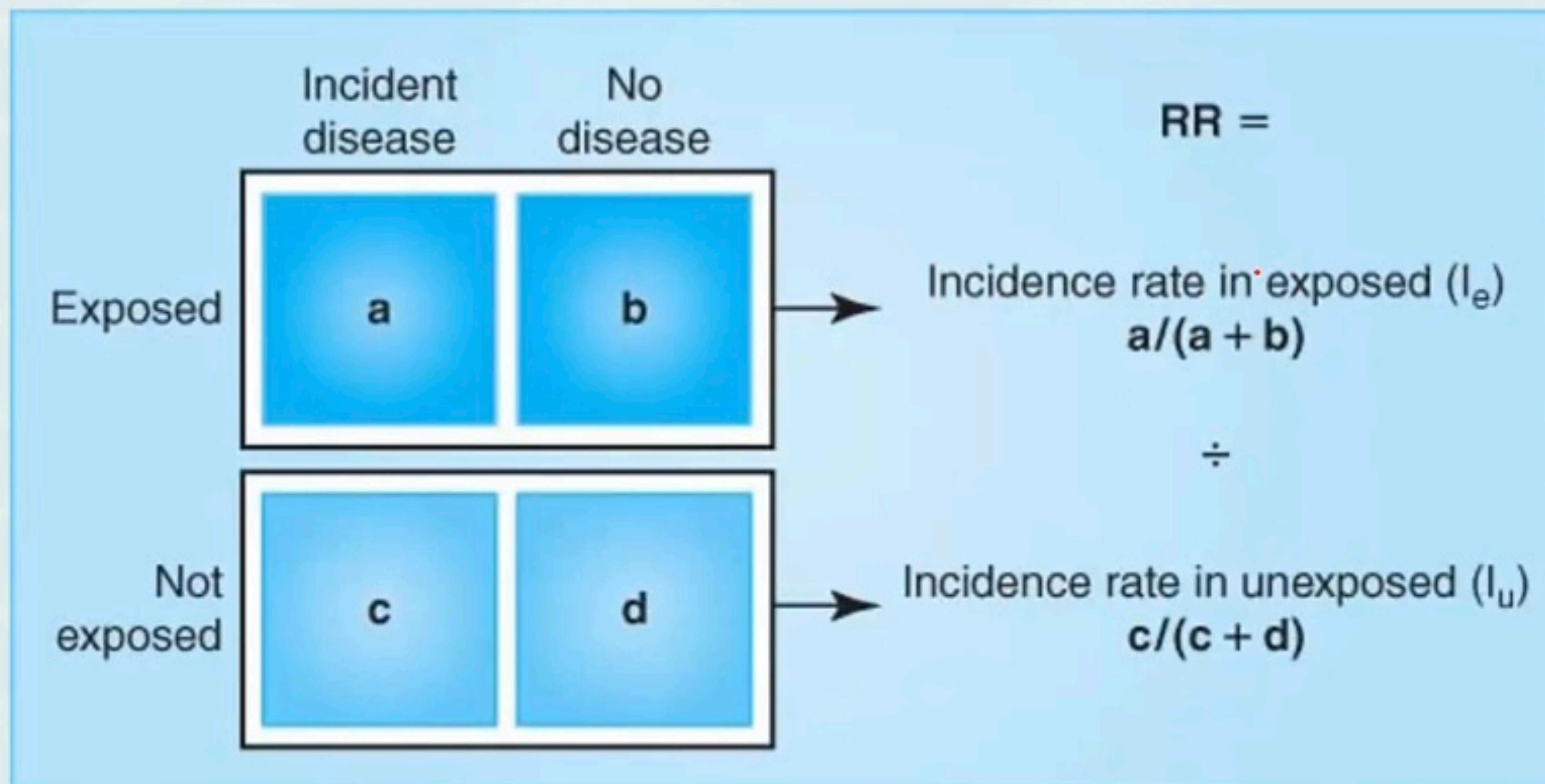


# Figure 11-7: Attributable (Excess) Risk



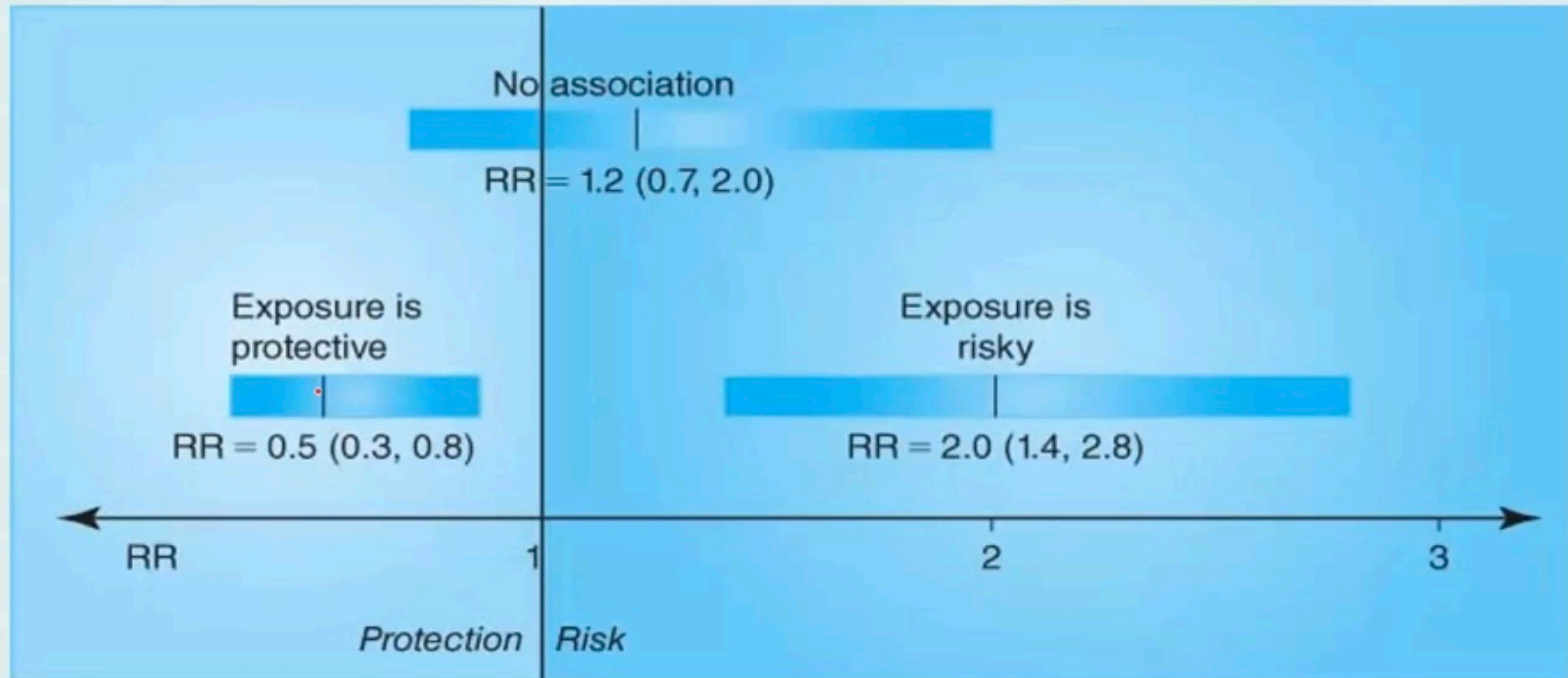


## Figure 11-8: Rate Ratio (Point Estimate)



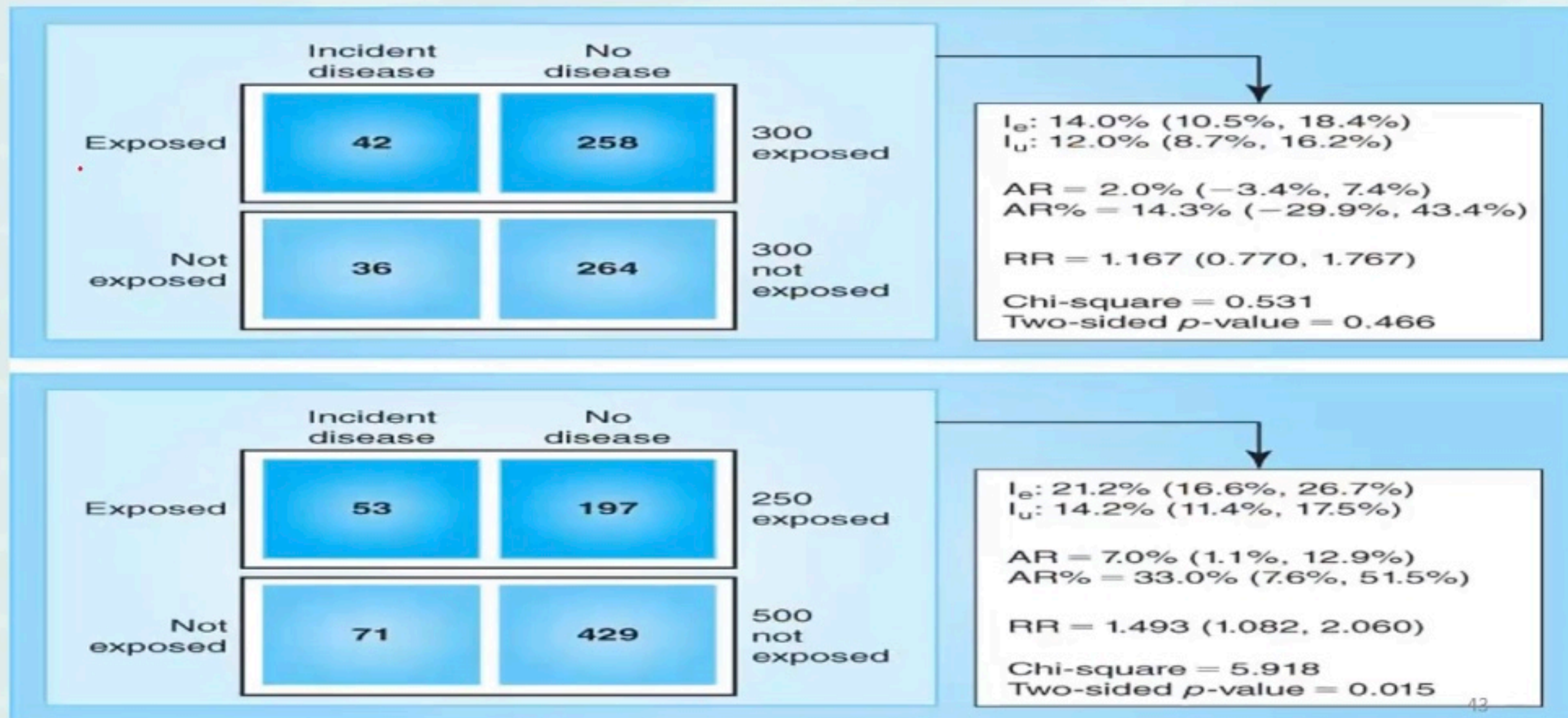


# Figure 11-9: Interpretation of the Rate Ratio Based on Its 95% Confidence Interval





# Figure 11-10: Examples of Rate Ratio Calculations





# Thank You