

# Cross sectional study design



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Editing file

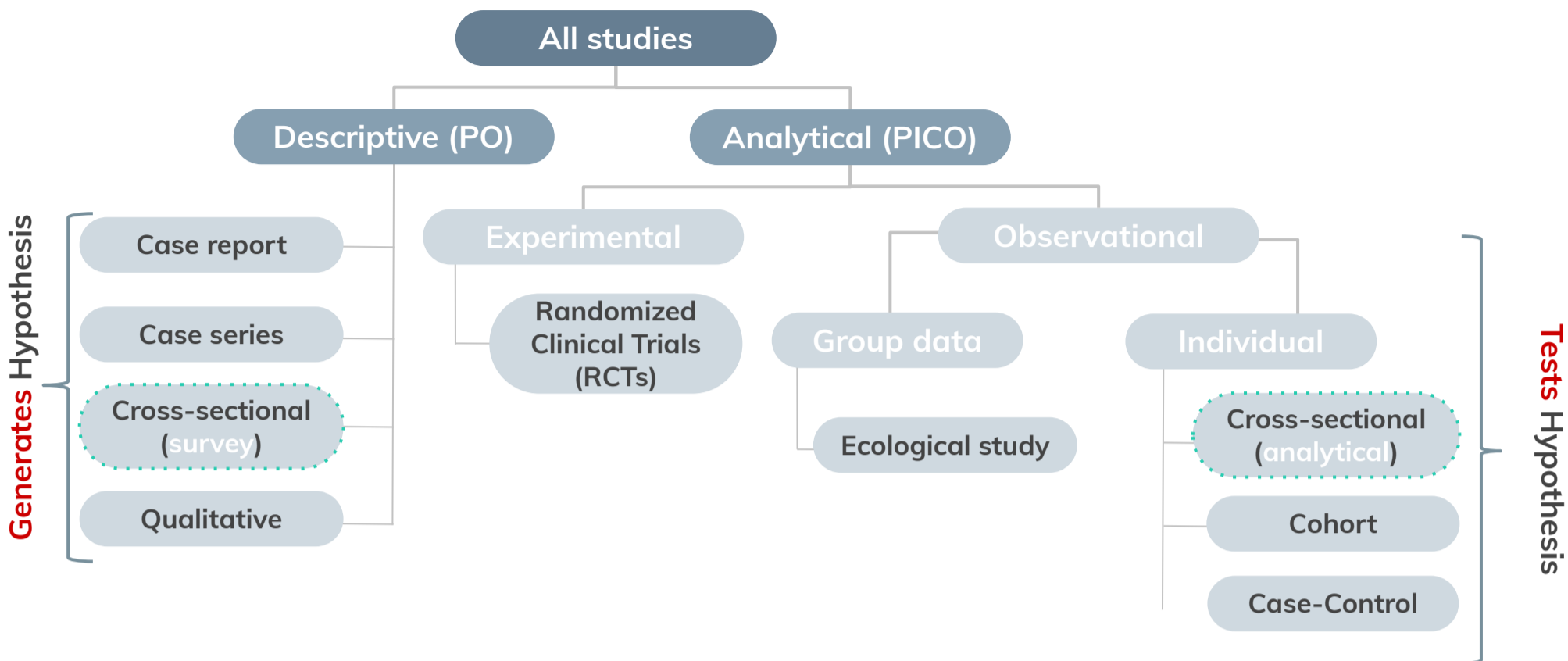
Black: in male AND female slides

Red : important

Gray: extra information

# Cross-sectional studies & its types

## Overview of all studies:



## What Is A cross-sectional study?

- **Definition:** A cross-sectional study is a study that either quantifies an outcome of interest **AND/OR** examines the relationship between disease (or other health related state) and other variables of interest as they exist in a defined population at a single point in time or over a short period of time.

## What are the types of cross-sectional studies?

### Descriptive

- ✓ Study **prevalence** of health related events **at a point in time/snapshot**
- ✓ **Examples:**
  - Diseases
  - risk factors
  - coverage of interventions
  - health service utilization
  - knowledge, attitude and practice

### Analytical

- ✓ Assess **association** between exposure and outcome.
- ✓ Exposure and disease status are assessed **simultaneously** among individuals **at the same point in time**
- ✓ **Compare prevalence** of disease in persons with and without the exposure of interest

◦ **In practice, cross-sectional studies will include an element of both types of design.**

## When to Conduct a Cross-Sectional Study ? ★

- To estimate **prevalence** of a **health condition** or prevalence of a behavior or **risk factor**
- To learn about **characteristics** such as knowledge, attitude and practices of individuals in a population
- To **monitor trends over time**<sup>1</sup> with **serial cross-sectional studies (Interrupted time series)** (e.g. in the US the National Health and Nutrition Surveys (NHANES)). **(it is a study that is aimed to assess the nutritional status among nurses in the US. it is still ongoing and it is the famous example of serial cross sectional or Interrupted time series study)**

1. How can it be a cross-sectional study when it is not a snapshot? Trends over time means that you are taking snapshots of the past years for what you want to measure. E.g: assessing the prevalence of diabetes among saudis in the past 10 years.

# How to conduct a cross-sectional study?

## Steps in conducting a cross-sectional study:

- 1) Define a population of interest (reference or source population) →
- 2) Recruit a representative sample (adequate size, random selection) →
- 3) Measure the variables of interest (exposure/outcome) at the same point in time →
- 4) Analyze the data

Identify Subjects from population

Collect data on exposure and outcome (e.g. disease)

Disease

NO Disease

Exposed and have a disease

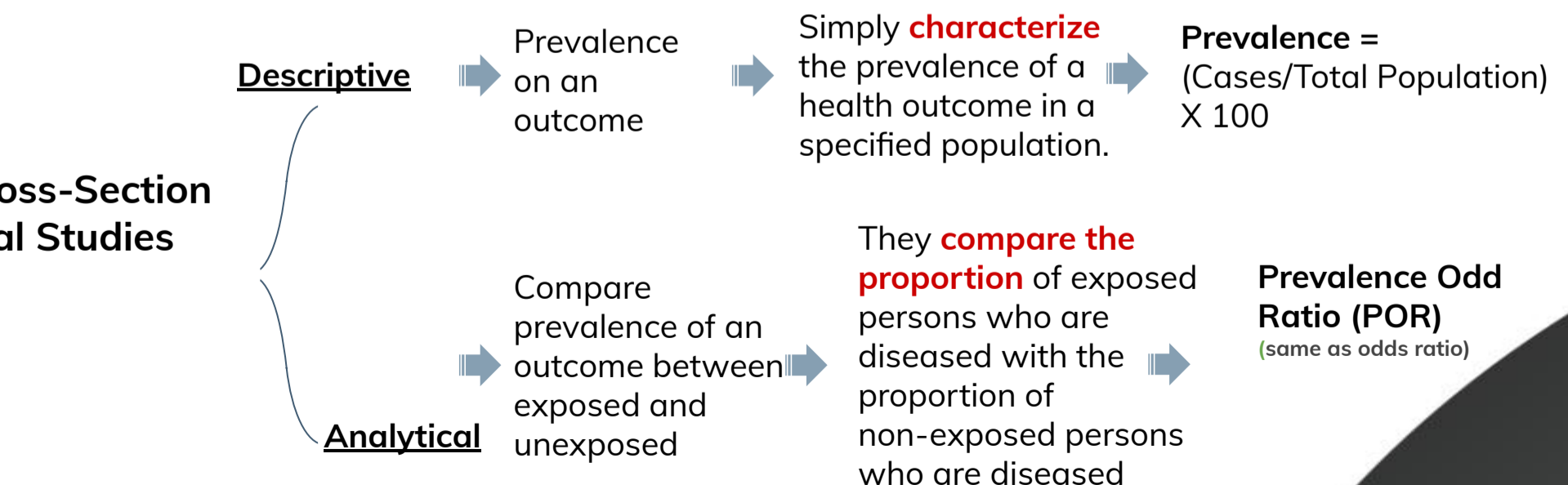
Not Exposed and have a disease

Exposed, and Do not have a disease

Not Exposed, and Do not have a disease

- The participants in a cross-sectional study are selected based on the **inclusion and exclusion criteria** set for the study. (the purpose of this is to eliminate confounders)
- Measure disease and exposure status simultaneously among individuals in a well-defined population at a point in time. (snapshot of the health status of populations at a certain point in time)

## Measurement & Analysis in Cross-Sectional studies:



# How to conduct a cross-sectional study?

## Example from Dr Slides:

### Vaping and Advertisement

- You identify a random sample of young adults aged 18–25 at city of Riyadh.
- Exposure: Ads about vaping
- Outcome: Vaping

	Vaping	Not vaping	Total
Ads	50 <b>a</b>	200 <b>b</b>	250
No Ads	50 <b>c</b>	700 <b>d</b>	750
Total	100	900	1000

#### Descriptive cross-sectional study

- ✓ **What is the prevalence of vaping?**  
✓ Prevalence =  
(Number of people who vape / Total population) X 100  
=  $100/1000 \times 100$   
= 10%

#### Analytical cross-sectional study

- ✓ **Does the prevalence of vaping vary by the status of exposure to advertisement?** I.e. What are the odds of vaping given exposure to advertisement versus not exposed to advertisement?  
✓ **Odds Ratio =**  
Odds an exposed person develop the outcome (**a/b**) ÷ odds an unexposed person develop the outcome (**c/d**)  
=  $ad / bc$   
=  $(50 \times 700) / (200 \times 50)$   
= 3.5

#### What does 3.5 mean?

- The odds of vaping is 3.5 times higher after seeing a vaping advertisement as opposed to not seeing one.

# Issues in the design of cross-sectional studies

IMP

## Study Sample:

- should be representative of the population.
- should be large enough to estimate prevalence of the conditions of interest with adequate precision
- For example, a study of the prevalence of diabetes among women aged 40-60 years in Town A should comprise a random sample of all women aged 40-60 years in that town.

## Biases in Cross-Sectional Studies

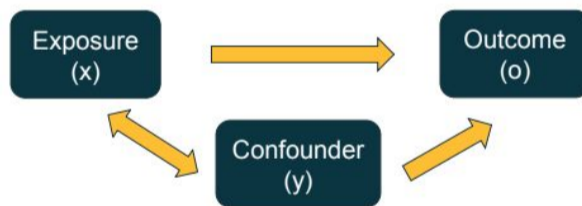
Bias may be defined as any systematic difference between groups in an epidemiological study that results in an incorrect estimate of the true effect of an exposure on the outcome of interest.

Types of bias:

- 1. Selection Bias:** when the study participants are systematically different in their characteristics compared with eligible participants who were not selected for the study.  
**Common type of selection bias:** Nonresponse bias (some people from the sample you selected may not respond to you. That's why usually we add 10% extra to the sample size)
- 2. Recall bias:** Recall bias occurs when there are systematic differences in the way subjects remember or report exposures or outcomes. Recall bias can also occur in case-control studies and retrospective cohort studies. In a case-control study: subjects with disease may remember past exposures differently (more or less accurately) than those who do not have the disease. (Where there is interview. Especially in knowledge, altitude & practice.) it is not simply just about "forgetting". Example is if you ask a teenager in front of his family whether he/she smokes or not, in both cases they will say no. This is considered a recall bias

## Confoundings

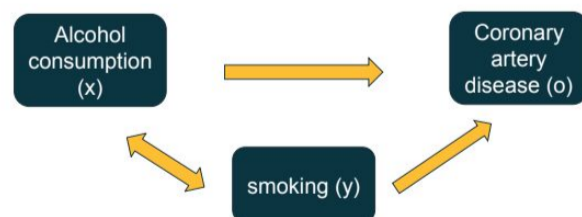
Occurs when an observed association is in fact distorted because the exposure (x) is correlated with another risk factor(y) which is also associated with the outcome (o).



### Characteristics of a confounder:

1. Associated with exposure
2. Causing the outcome
3. Does not lie in the causal pathway

example:



Most of those who drink Alcohol smoke

Example of Confounding (Extra)

Seeing an ad (Exposed)



More males (higher risk of vaping)

Not seeing an ad (Unexposed)



More Females (lower risk of vaping)

Association between seeing a vaping ad and vaping overestimated

## Sample Size in Cross-Sectional Studies

- The sample size should be sufficiently large enough to estimate the prevalence of the conditions of interest with adequate precision.
- Sample size calculations can be carried out using sample size tables or statistical packages such as Epi Info.

## Strengths & Weaknesses

Strengths	Weaknesses
<ul style="list-style-type: none"><li>● Relatively quick and easy to conduct.</li><li>● Data on all variables is only collected once.</li><li>● Able to measure prevalence for all factors under investigation.</li><li>● Multiple outcomes and exposures can be studied.</li><li>● Good for descriptive analyses and for generating hypotheses.</li></ul>	<ul style="list-style-type: none"><li>● Difficult to determine determine temporality between exposure and outcome (whether the outcome followed exposure in time or exposure resulted from the outcome)</li><li>● Associations identified may be difficult to interpret.</li><li>● Susceptible to bias due to low response and misclassification due to recall bias.</li></ul>

# Lecture Summary

## Cross-sectional studies & its types

<b>Definition</b>	a study that either quantifies an outcome of interest AND/OR examines the relationship between disease (or other health related state) and other variables of interest as they exist in a defined population at a single point in time or over a short period of time.	
<b>Types</b>  <small>In practice, cross-sectional studies will include an element of both types of design</small>	<b>Descriptive</b>	<b>Analytical</b>
	<ul style="list-style-type: none"> <li>Study <b>prevalence</b> of health related events at a point in time/snapshot</li> </ul>	<ul style="list-style-type: none"> <li>Assess <b>association</b> between exposure and outcome.</li> <li><b>Compare prevalence</b> of disease in persons with and without the exposure of interest</li> </ul>

## When & How to conduct a cross-sectional study

<b>When</b>	<ul style="list-style-type: none"> <li>❖ To estimate prevalence of a health condition or prevalence of a behavior or risk factor</li> <li>❖ To learn about characteristics such as knowledge, attitude and practices of individuals in a population</li> <li>❖ To monitor trends over time with serial cross-sectional studies (National example of cross-sectional studies of great importance is the National Health and Nutrition Surveys (NHANES).</li> </ul>	
<b>Steps</b>	<ol style="list-style-type: none"> <li>1. Define a population of interest (reference or source population)</li> <li>2. Recruit a representative sample (adequate size, random selection)</li> <li>3. Measure the variables of interest (exposure/outcome) at the same point in time</li> <li>4. Analyze the data</li> </ol>	
<b>Measurement &amp; Analysis</b>	<b>Descriptive</b>	<b>Analytical</b>
	<ul style="list-style-type: none"> <li><b>characterize the prevalence of a health outcome in a specified population</b></li> </ul>	<ul style="list-style-type: none"> <li><b>compare the proportion</b> of exposed persons who are diseased with the proportion of non-exposed persons who are diseased</li> </ul>

## Strengths & Weaknesses

<b>Strengths</b>	<ul style="list-style-type: none"> <li>• Relatively quick and easy to conduct</li> <li>• Data on all variables is only collected once.</li> <li>• Able to measure prevalence for all factors under investigation.</li> <li>• Multiple outcomes and exposures can be studied.</li> <li>• Good for descriptive analyses and for generating hypotheses.</li> </ul>
<b>Weaknesses</b>	<ul style="list-style-type: none"> <li>• Difficult to determine whether the outcome followed exposure in time or exposure resulted from the outcome.</li> <li>• Associations identified may be difficult to interpret.</li> <li>• Susceptible to bias due to low response and misclassification due to recall bias.</li> </ul>



# Questions

**(1) In analytical Cross-Sectional studies we ..... hypotheses :**

- A) Generate
- B) Test
- C) Evaluate
- D) Asses

**(2) A population-based study determined whether there is a relationship between childhood asthma and environmental exposure to secondhand smoke. A sample of the population was interviewed to gather information about asthma symptoms and some environmental exposures in 2003. What is the type of the study?**

- A) Case-control
- B) Case-series
- C) Cross-sectional
- D) Retrospective-cohort

**(3) Which one of the following is a weakness of a cross-sectional study?**

- A) Susceptible to bias
- B) Multiple outcomes and exposures can be studied.
- C) Quick and easy to conduct
- D) Data on all variables is only collected once.

**(4) Measurement & Analysis in Cross-Sectional study is done by measuring?**

- A) Incidence rate
- B) Relative risk
- C) Odds Ratio
- D) Risk ratio



## Leaders



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# Thank you for checking our work!

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Keep it simple, Keep it focused