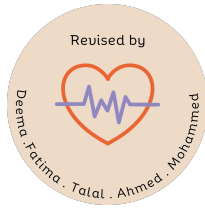# Cross-sectional study design

Lecture No. 8

Objectives:

1. Describe types of cross-sectional studies
2. Identify steps for conducting cross-sectional studies
3. Identify issues in the design of cross-sectional studies
4. Describe the strengths and weaknesses of cross-sectional studies

~ This lecture was presented by **Dr. Kholood Altassan**
~ It is included in the **Midterm Exam**
~ We highly recommended reading the **Ayah** in the first page

Slides

Color code

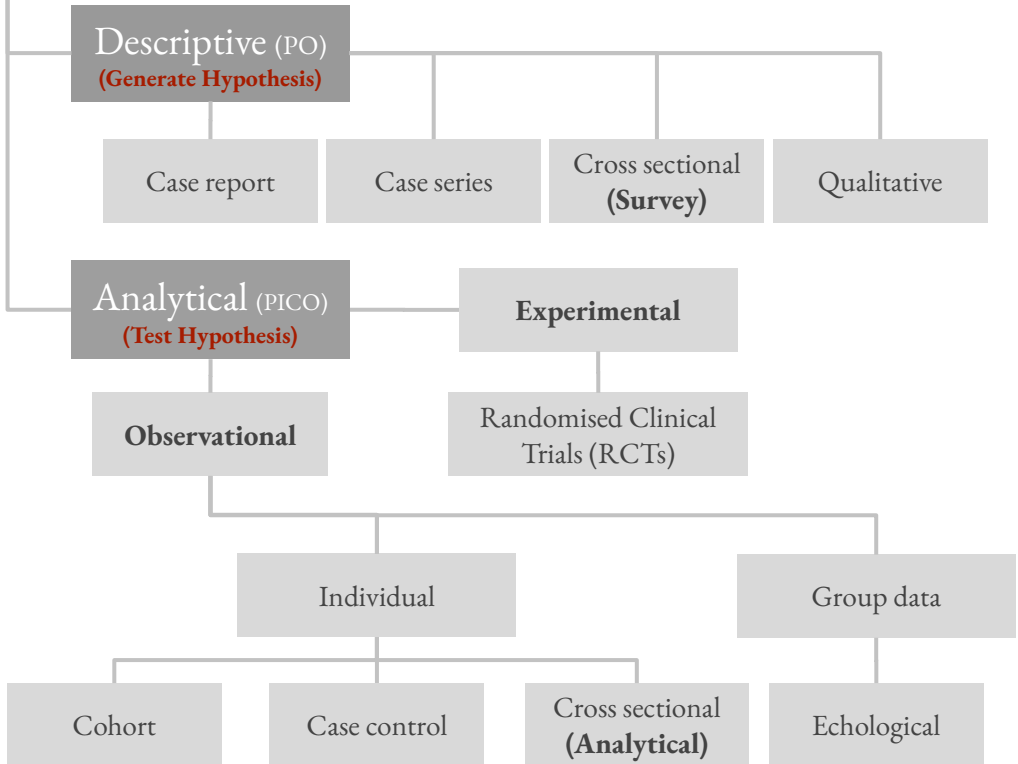Original text
Dr. Notes
Important
Golden note 🎁
Extra

Editing file

Overview of All studies

Descriptive (PO)
(Generate Hypothesis)

| Case report | Case series | Cross sectional **(Survey)** | Qualitative |

Analytical (PICO)
(Test Hypothesis)

Experimental

Observational

Randomised Clinical Trials (RCTs)

Individual

Group data

| Cohort | Case control | Cross sectional **(Analytical)** | Echological |

What is a cross sectional study

A cross-sectional study is a study that 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.**

هي عبارة عن دراسة مقطعية عن شيء معين في المجتمع بأخذ عينة تمثّل المجتمع

Types of cross sectional study

In cross sectional study you don't know which came first, the risk factor or the cause, e.g. smoking and anxiety

Cross sectional study

Descriptive
Study prevalence of health related events **at a point in time/snapshot** (e.g. diseases, risk factors, interventions, health service utilization, **knowledge, attitudes 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.

Cross sectional study is the only one that **measures prevalence**

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 (KAP)

- To **monitor trends over time** with serial cross-sectional studies (e.g. in the US the National Health and Nutrition Surveys (NHANES))

How to conduct a cross sectional study

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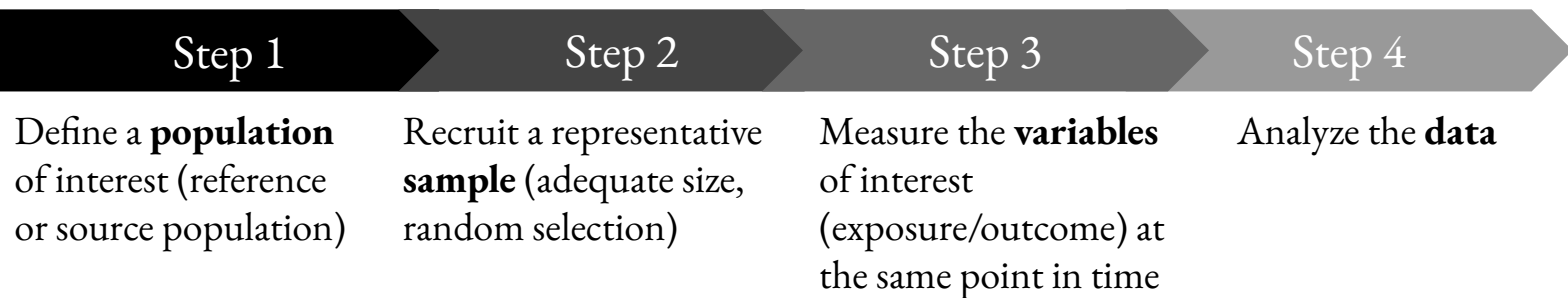
Identify Subjects from population

Collect data on **exposure & outcome** (e.g. disease)

Disease	No Disease
Exposed & have a disease / **Not Exposed** & have a disease	**Exposed** & Do not have a disease / **Not Exposed** & Do not have a disease

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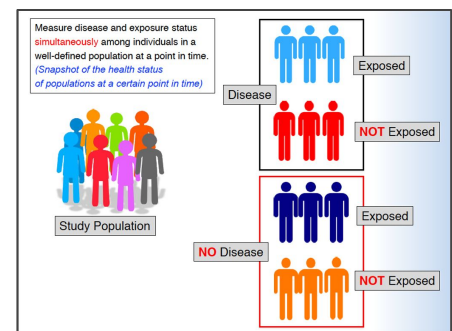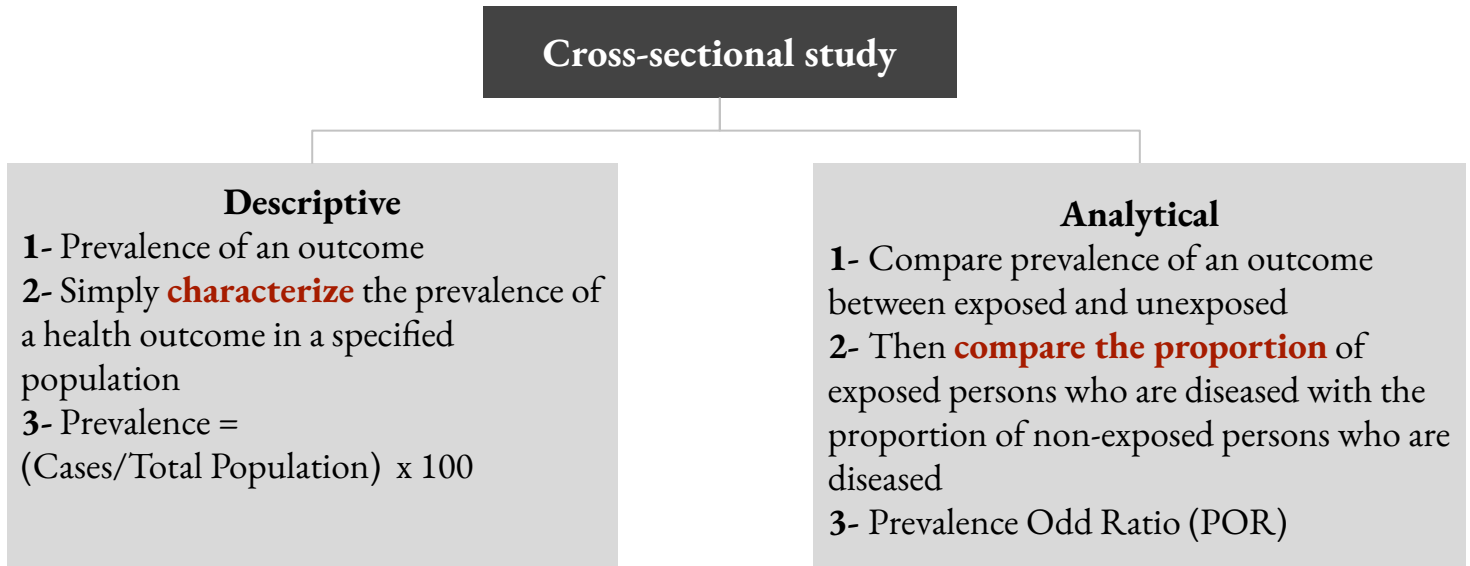
- The participants in a cross-sectional study are selected based on **the eligibility (inclusion and exclusion)** criteria set for the study.
- Measure disease and exposure status simultaneously among individuals in a well-defined population at a point in time (snapshot of the health status of populations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

In the eligibility you exclude the things that you know it will affect the relationship that your research interested in,
Do Not exclude the participant who actually not in your population!

Measurement & Analysis in Cross-Sectional studies

Cross-sectional study

Descriptive
1- Prevalence of an outcome
2- Simply **characterize** the prevalence of a health outcome in a specified population
3- Prevalence =
(Cases/Total Population) x 100

Analytical
1- Compare prevalence of an outcome between exposed and unexposed
2- Then **compare the proportion** of exposed persons who are diseased with the proportion of non-exposed persons who are diseased
3- Prevalence Odd Ratio (POR)

Calculating measures of disease frequency and association

	Outcome status	
Exposure status	+/+ **a**	+/- **b**
	-/+ **c**	-/- **d**

Example form slides: **Vaping and Advertisement**
You identify a random sample of young adults aged 18-25 in city of Riyadh.
Exposure: Ads about vaping on social media
Outcome: Vaping

Descriptive Cross-Sectional:

What is the prevalence of vaping?

Number of people who vape/Total population x 100
= 100/1000 x 100
= **10%**

	Vaping	Not Vaping	Total
Ads	50	200	250
No Ads	50	700	750
Total	100	900	1000

	Vaping	Not Vaping	Total
Ads	50 **a**	200 **b**	250
No Ads	50 **c**	700 **d**	750
Total	100	900	1000

Analytical Cross-Sectional:

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?

POR: Prevalence of odds ratio

POR = $\dfrac{\text{odds an exposed person developing the outcome (a/b)}}{\text{odds an unexposed person develop the outcome (c/d)}}$

= **ad / bc**

= (50 x 700) / (200 x 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

1- Study sample:

- Should be **representative** of the population
- Should be **large enough** to estimate prevalence of the conditions of interest with adequate precision (sample size calculation)

2- Biases:

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

Examples of bias:

- Selection Bias: when the study participants are **systematically different** in their **characteristics** compared with eligible participants who were not selected for the study.
- **Recall bias**: Recall bias occurs when there are **systematic differences** in the way subjects **remember** or report exposures or outcomes.

Common type: Non-response bias, e.g. only educated people answer surveys.

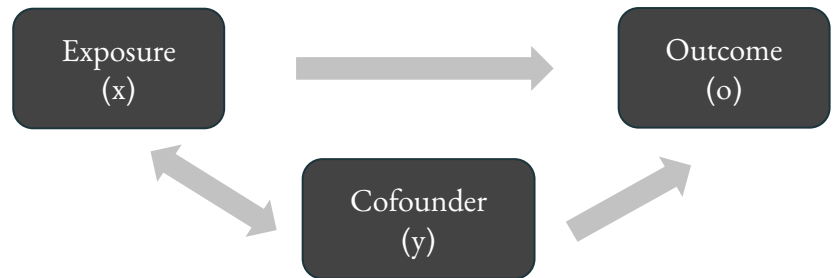Recall bias e.g. Cancer patients are more likely to remember "toxic" exposures.

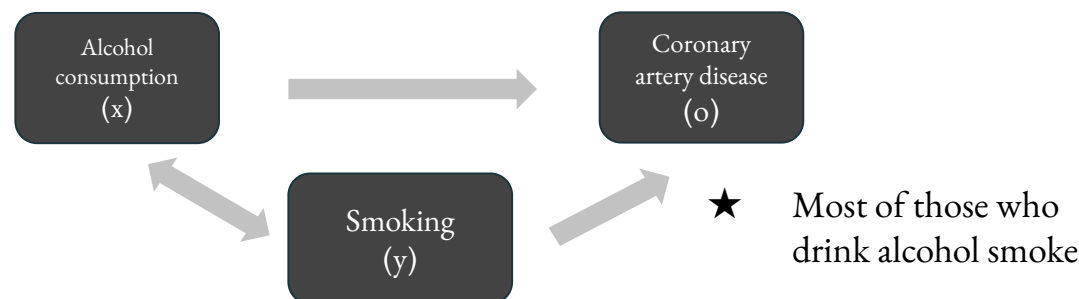## Issues in the design of cross-sectional studies, cont.

3- Confounding:

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:

Exposure (x) → Outcome (o)

Exposure (x) ↔ Cofounder (y) → Outcome (o)

Alcohol consumption (x) → Coronary artery disease (o)

Alcohol consumption (x) ↔ Smoking (y) → Coronary artery disease (o)

★ Most of those who drink alcohol smoke

Strengths & Weaknesses of cross-sectional study

- **Strengths:**
  - Relatively **quick and easy** to conduct.
  - **Multiple** outcomes and exposures can be studied.
  - Data on all variables is only **collected once.**
  - Able to measure prevalence for all factors under investigation.
  - Good for describing and for generating **hypotheses.**

- **Weaknesses:**
  - Difficult to determine **temporality** between exposure and outcome.
  - **Correlations** identified may be **difficult to interpret.**
  - Susceptible to **bias,** due to low response and misclassification of exposure and outcome due to recall bias.

القادة :

نواف التركي

ريان الغنامي

عبدالله الشهري

وهي المتحمي

الأعضاء:

عبدالله التركي

عبدالله المياح

محمد الزير

عبدالله النجرس

عثمان الدريهم

تركي العتيبي

عبدالعزيز القحطاني

عبدالله القرني

ناصر الغيث

عامر الغامدي

سعد السهلي

سعد الاحمري

رائد الماضي

معاذ آل صلام

سعود الشعلان

محمد الحصيني

رغد النظيف

ريما الجربية

شهد البخاري

نوف الضلعان

أثير الاحمري

وعد ابو نخاع

ثراء الهويش

في الدوسري

منار الزهراني

MCQ:

Q1: Descriptive cross-sectional study the prevalence of health related events at?
  A. All time
  B. Multiple points
  C. Single point
  D. Not related to the time

Q2: Why do we use cross sectional study?
  A. To estimate prevalence
  B. To learn about characteristics
  C. To monitor trends over time
  D. All of the above

MCQ:

Q3: To calculate POR the formula is?
  A. ab / dc
  B. ad / bc
  C. bc / ad
  D. ac / db

Q4: To identify the knowledge, attitudes and practice among certain population which study we should use?
  A. Descriptive cross sectional study
  B. Analytical cross sectional study
  C. Cohort
  D. Case series