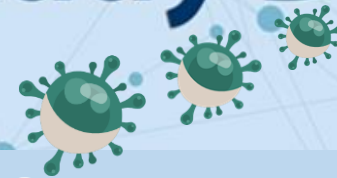


CHAPTER 5

Epidemiology Study Designs



Episode 5.2:

3) Cross-sectional analytic study

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Principle of **cross-sectional analytic study**

- Conducted at a single point in time or over a short period of time (snapshot of the population)
- Exposure status and disease status are measured at one point in time or over a period.
- Providing the prevalence of a disease
- Comparison of prevalence among exposed and non-exposed (analytic cross-sectional study)
- It does not involve manipulating variables

Basic concepts of analytical studies

Formulating Hypothesis & Comparing the prevalence of exposed and non-exposed groups

The magnitude of effect /
Point estimation

Precision / Interval estimation /
Statistical significance

Parameter

Target Population

Process of cross-sectional analytic study

1. Study by observing the phenomenon of illness or health problem at a particular point of time.



2. Study the whole group suspected to be a factor causing disease or health problems.



3. Randomly select a certain number of sample sizes.



4. Measure the factors that are expected to affect the occurrence of the disease, and measure the prevalence of existing disease



5. Comparing disease occurrence between the exposed and non-exposed group, Is it different or not?

Note: Analytical cross-sectional studies can only obtain correlations from studies at the point of interest.

Objectives of the **cross-sectional analytic study**

Objectives

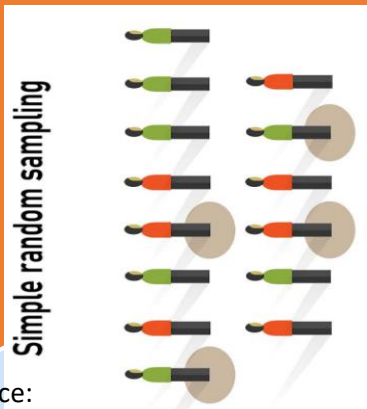
- To examine the presence or absence of an outcome and the presence or absence of exposure at a specific point of time.
- To provide information about the prevalence of disease or health problems of a current population.
- To measure the association between exposure and a disease, condition, or outcome within a defined population.



Method of study - random sampling of samples

Simple Random Sampling

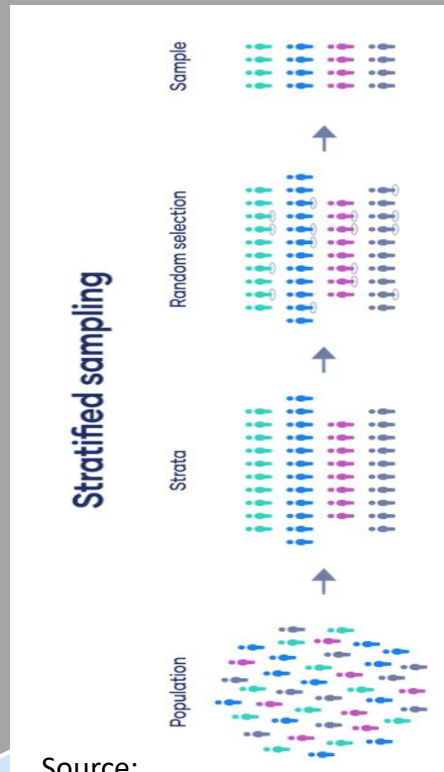
- drawing (lottery)
- random number table (random table)
- spinning wheel
- artificial intelligence



Simple random sampling

Source: <https://www.simplypsychology.org/stratified-random-sampling.html>

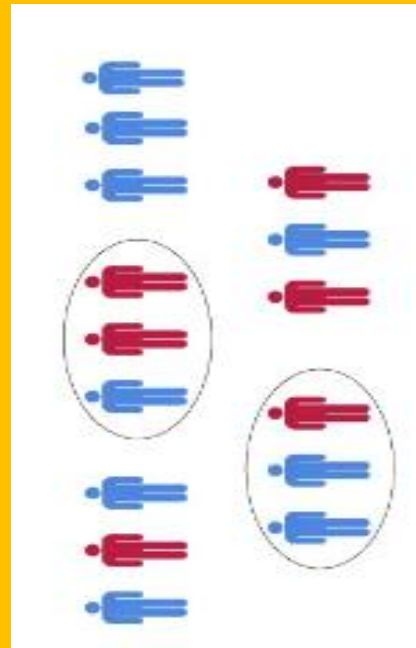
Stratified Random Sampling



Stratified sampling

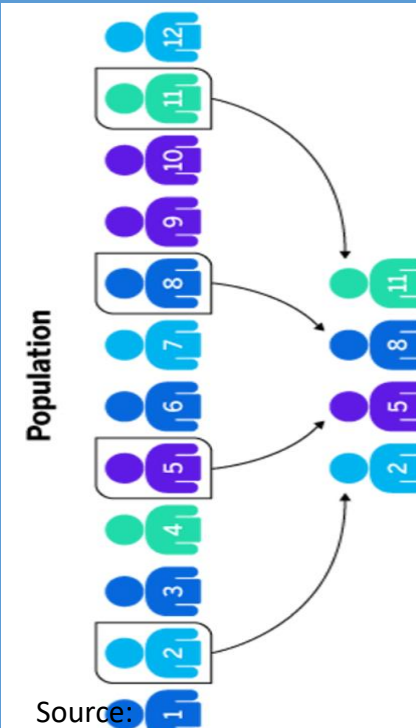
Source: <https://www.scribbr.com/methodology/stratified-sampling/>

Cluster Sampling



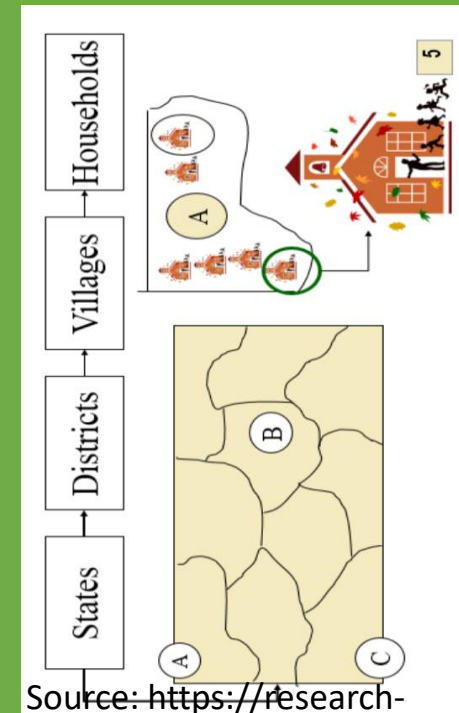
Source: <https://www.voxco.com/blog/stratified-sampling-vs-cluster-sampling/>

Systematic Random Sampling



Source: <https://www.qualtrics.com/experienmanagement/research/systematic-random-sampling/>

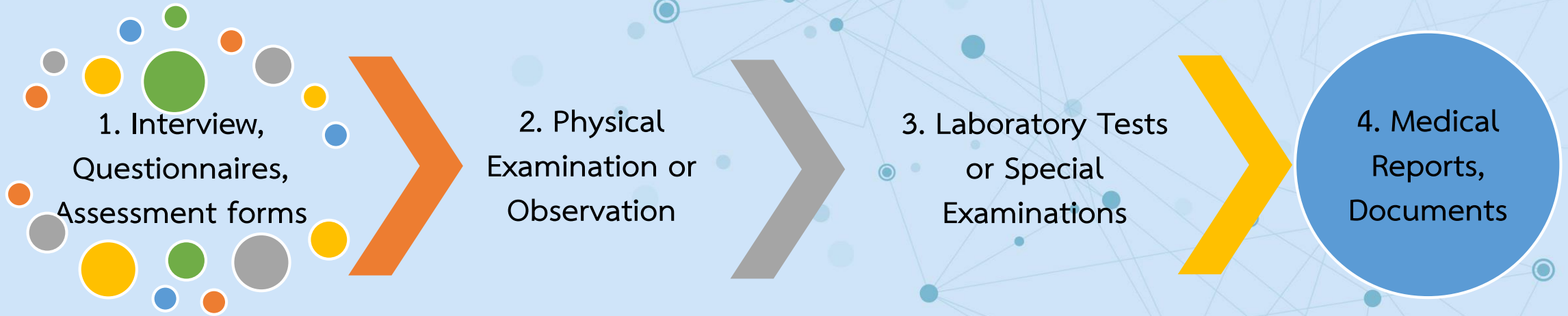
Multi-stage Sampling



Source: <https://research-methodology.net/sampling-in-primary-data-collection/multi-stage-sampling/>



Data Collection





1. Prevalence rate

It is the proportion of persons in a population who have a particular disease or attribute at a specified point in time or over a specified period of time.

$$= \frac{\text{All new and pre-existing cases during a given time period}}{\text{Population during the same time period}} \times K$$

The value of k (constant) can be 100, 1000, 10,000

Odds ratio Interpretation

- A **odds ratio of 1.0** indicates identical risk among the two groups.
- A **odds ratio greater than 1.0** indicates an increased risk for the group in the numerator, usually the exposed group.
- A **odds ratio less than 1.0** indicates a decreased risk for the exposed group, indicating that perhaps exposure actually protects against disease occurrence.



Data Analysis: OR using a 2x2 table

2x2 table

Exposure	Outcomes		Total
	Diseased	Non-diseased	
Exposed (+)	a	c	a + c
Non-exposed (-)	b	d	b + d
Total	a + b	c + d	n

OR = (odds of disease in exposed) / (odds of disease in the non-exposed)

Formula

Odds of exposure in cases = a/c
Odds of exposure in controls = b/d
Odds Ratio = $(a/c) / (b/d)$

$$\begin{aligned} \text{OR} &= (a/c) / (b/d) \\ &= (a*d) / (b*c) \end{aligned}$$

Examples of data analysis and conclusions

Calculate the prevalence of cardiovascular disease in the smokers' group and the cardiovascular disease prevalence rate in the non-smokers' group.

Exposure	Outcomes		Total
	Diseased	Non-diseased	
Exposed (+)	14	17	89
Non-exposed (-)	3	87	90
Total	17	162	179

Results

Odds of exposure in cases (P_{ex}) = $14 / 89$, = 0.157 or 15.7%

Odds of exposure in controls (P_{non}) = $3 / 90$, = 0.033 or 3.3%

Prevalence Ratio, Odds Ratio = $15.7 / 3.3$, = 4.8

Prevalence Difference = $15.7 - 3.3$, = 12.4%

An odds ratio of 4.8 means that the prevalence of cardiovascular disease in smokers is 4.8 times as high as in non-smoker people.

A prevalence difference of 12.4% means that the difference in smoker rate among people with cardiovascular disease and those without disease is 12.4 per 100.

The biases of the cross-sectional analytic study

1. Selection bias

1.1 Self-selection

1.2 Late look bias (occurs when one test detects disease earlier)

1.3 Healthy worker effect

2. Information bias: response / non-response bias < 70%

Biases

Solution

1. Selection bias

- A random sampling of samples

2. Information bias

- Definition

- Orientation & Emphasizing the importance of cooperating



Advantages & Disadvantages

Advantages

- Rapid, inexpensive, and can provide analytic clues
- Less prone to error about exposure recall bias

Disadvantages

- Unable to sort out what came from first exposure or outcome
- Prone to sample distortion bias.
- Not suitable for rare diseases, diseases that recur that last a short time, and acute disease outbreaks

Summary

An analytical cross-sectional study is an epidemiological study that observes the occurrence of a disease or health problem without any intervention. Health problems in both exposed and non-exposed groups during the specified period. The correlation was then analyzed and the outcomes were compared between the two groups.

The results of this study were able to infer the relationship between factors and outcomes. However, it is not possible to determine what is the cause and what is the consequence of the disease/or health problem.



Thank you

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