RESEARCH METHODOLOGY

[PT 309]

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LECTURE NOTES FOR 3rD GRADE BPT STUDENTS

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DEPARTMENT OF PHYSIOTHERAPY, FACULTY OF APPLIED HEALTH SCIENCES

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POPULATION AND SAMPLING

LECTURE OUTLINE

- Learning objectives
- Population
- Sample
  - Probability sampling techniques
  - Non-probability sampling techniques
- Review
- Reading resources/additional materials

RESEARCH METHODOLOGY

LEARNING OBJECTIVES

- Define population
- Define sample
- Understanding the different types of sampling techniques including advantages and disadvantages

RESEARCH METHODOLOGY

COMMON STATISTICAL TERMS

Data

- Measurements or observations of a variable
- Example: pain levels measured on a scale of 1-10 before & after treatment.
  patient demographics such as age, gender, and weight.

Variable

- A characteristic or factor that is observed or manipulated
- Can take on different values
- Example: exercise therapy, manual therapy, range of motion, age, gender.
- Variable can be dependent or independent
- **Dependent variable**:
  - Variable that is measured as an outcome. It depends on the independent variable e.g. pain levels, range of motion, blood glucose levels
- **Independent variable**:
  - Variable often manipulated by the researcher, e.g. treatment

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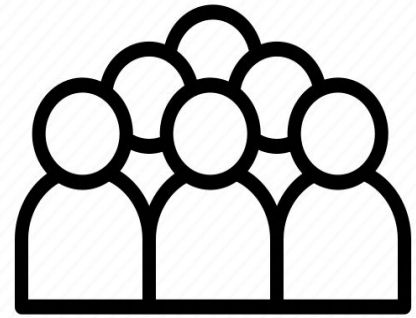
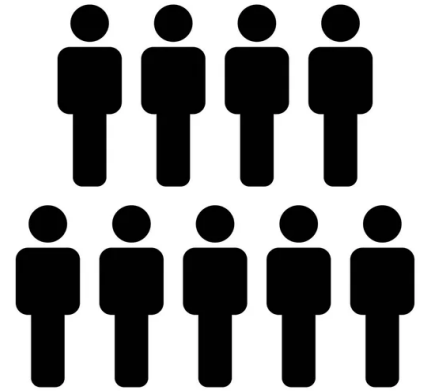
POPULATION

- A population is the larger group from which a sample is drawn in a study.
- Entire group or set of individuals, objects, or events that share a common characteristic & are the focus of a study
- Example:
    - All individuals with chronic knee pain in Erbil, Iraq
    - All undergraduate students in TIU
- In research, it is not practical to include all members of a population
- Thus, a sample (a subset of a population) is taken.





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SAMPLE

- A subset or smaller group selected from a larger population for the purpose of conducting research.
- The sample is studied to make inferences or generalizations about the entire population.
- Sampling is used when studying the whole population is impractical, expensive, or time-consuming
- Example:
    - **Population:** All patients with chronic back pain in a Erbil city.
    - **Sample:** A group of 100 patients selected from different physiotherapy clinics in Erbil city.

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Sampling methods

Defining the target population

- It is critical to the success of the research project to clearly define the target population.
- The population should be defined in connection with the objectives of the study.

Technical terminologies

Elements: Refers to an individual unit or member of the population being studied.

- Example
  - **Population**: All patients with knee OA in Physiotherapy clinic, Erbil Teaching Hospital
  - **Element**: A single patient with knee pain who is part of the study.

Population: A collection of elements about which we wish to make an inference.

Sampling units: Are nonoverlapping collections of elements from the population that cover the entire population

- Example:
- Unit 1: All patients attending physiotherapy sessions on Mondays
- Unit 2: All patients attending physiotherapy sessions on Tuesdays etc..

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Sampling methods

Sampling frame: Refers to the complete list or sets of all the elements in the population or sampling unit from which a sample can be drawn.

- Example
  - A list of patients' names, ID numbers, or appointment schedules who have been diagnosed with knee OA & are registered in the physiotherapy clinic, Erbil Teaching Hospital

Sample: A collection of sampling units drawn from a sampling frame.

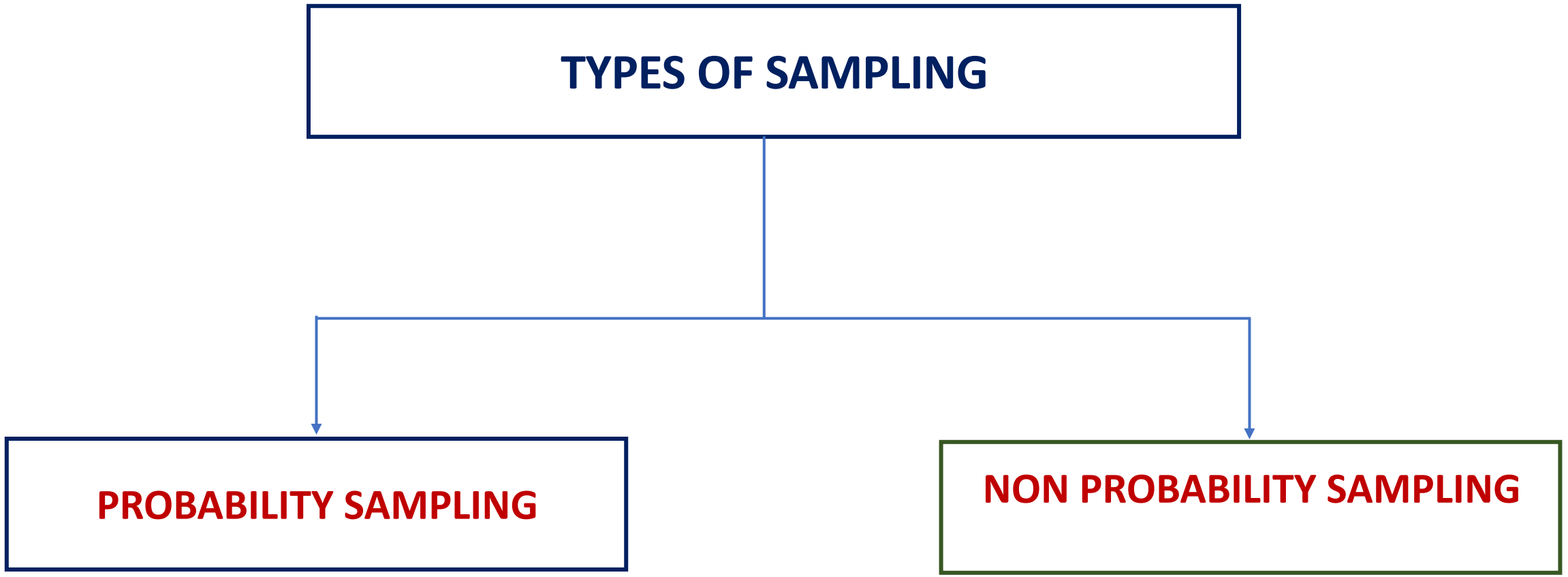
Sampling error: Refers to the difference between the sample statistic (e.g., sample mean, sample proportion) & the corresponding population parameter (e.g., population mean, population proportion).

This error occurs because a sample is only a subset of the population & may not perfectly represent the entire population.

Errors can arises from:

1. Nonresponse bias
2. Sampling method bias
3. Smaller sample size

Sampling methods

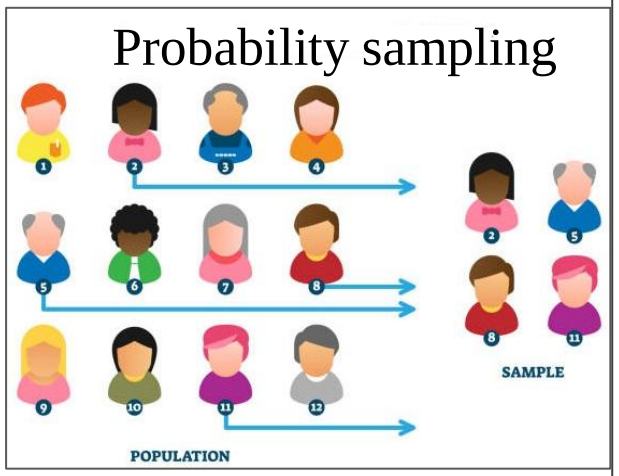


RESEARCH METHODOLOGY

Sampling methods

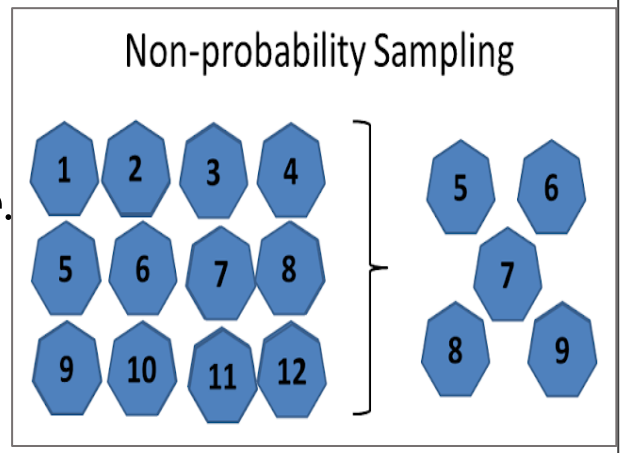
Probability sampling method

- Each member of the population has a known, non-zero probability of being selected
- Key characteristics are **random selection, equal opportunity, & unbiased**.
- These help to ensure that the sample is representative of the entire population.
- Include the following methods:
    1. Random sampling,
    2. Systematic sampling,
    3. Stratified sampling, and
    4. Cluster sampling



Non-probability sampling method

- Members are selected from the population in some non-random manner.
- The sample may not be representative of the entire population.
- Key characteristics are **non-random selection, potential bias, & convenience**.
- Include the following methods:
    1. Convenience sampling,
    2. Judgmental or purposive sampling,
    3. Quota sampling
    4. Snowball sampling



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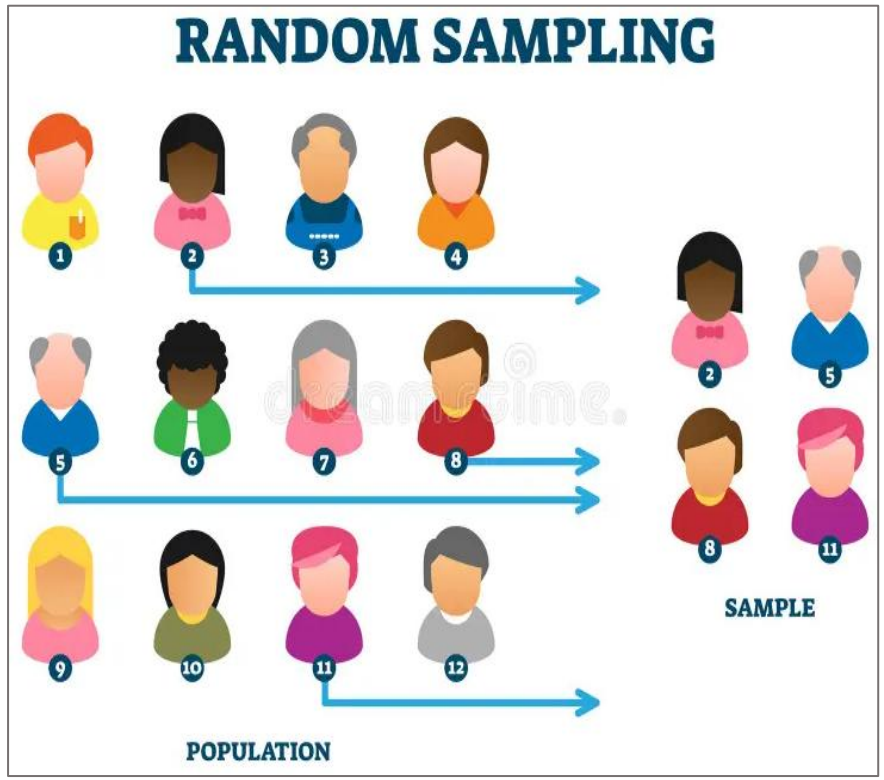
Sampling methods

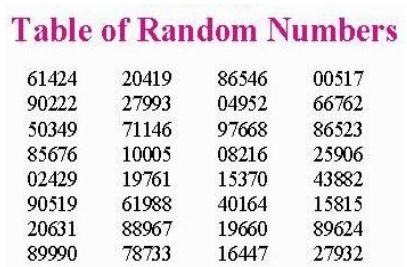
Random sampling

- Each member of the population has an equal and known chance of being selected.
- It is the purest form of probability sampling.
- Ensures that the sample is unbiased & is likely to be representative of the larger population, making the results more reliable & generalizable.
- The following ways can be used to achieve random sampling:
    1. Lottery using a piece of paper or flipping a coin
    2. Random number table
    3. A computer-generated random number generator (RNG)
    4. Drawing names from a hat
    5. Use of software tools e.g. SPSS

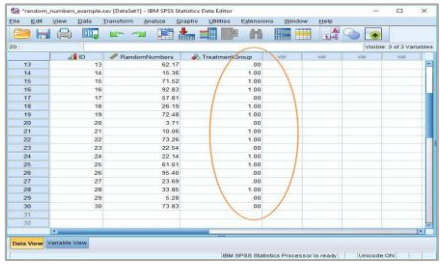


Draw from a hat

Flipping a coin



SPSS generated Random numbers



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Sampling methods

Stratified sampling

- Probability sampling where the population is divided into distinct subgroups or strata based on a specific characteristic (e.g., age, gender, income, disease status).
- Then, random samples are drawn from each of these strata to ensure that each subgroup is adequately represented in the overall sample.
- Commonly used method that is superior to random sampling because it reduces sampling error.
- Example: In a study examining the effects of physiotherapy on knee OA, the population might consist of male & female patients of different age groups. The researcher could use stratified sampling as follows:
    - Stratum 1: Male patients with knee OA
    - Stratum 2: Female patients with knee OA
    - Stratum 3: Patients aged 50-60 years with knee OA
    - Stratum 4: Patients aged 61+years with knee OA
- Then, the researcher would randomly sample a proportion of individuals from each stratum (e.g., 10 males, 10 females, 10 patients aged 50-60, etc.) to ensure that each group is adequately represented in the final sample.

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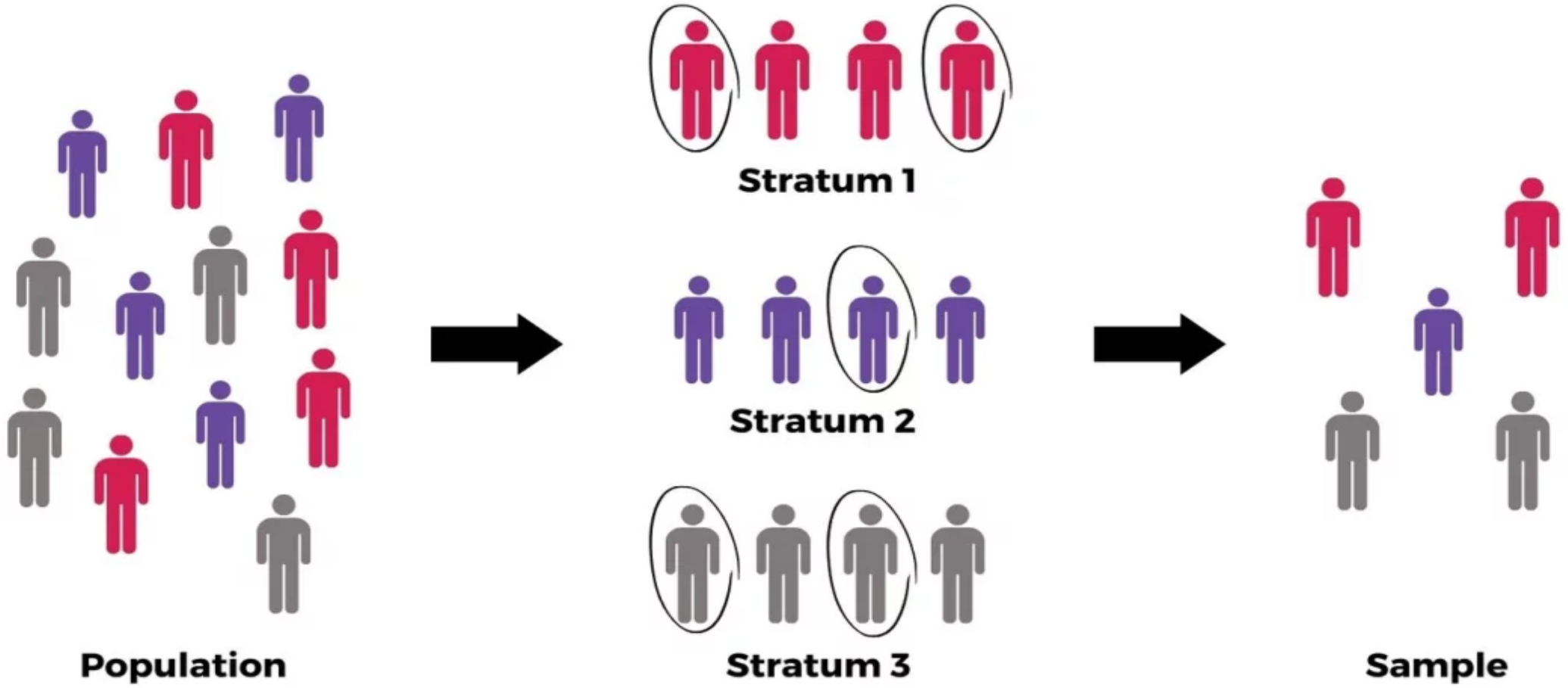
Sampling methods

Stratified sampling



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Sampling methods

Systematic sampling

- Probability sampling where the researcher selects every **n-th** individual from a list of the population after choosing a random starting point.
- It's simpler & cost-effective than simple random sampling & can be more practical when dealing with large populations or databases.
- Example: assuming we want to survey 10 patients about their physiotherapy experience, & there are 100 patients in total.
    - Population size = 100 patients
    - Sample size = 10 patients
    - Sampling interval (k) = 100 ÷ 10 = 10
    - Random starting point: Suppose we randomly choose the 4th patient on the list.
- Then, we will select patients as follows: 4th, 14th, 24th, 34th, 44th, and so on, every 10th patient until you have your sample of 10.

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Sampling methods

Systematic sampling

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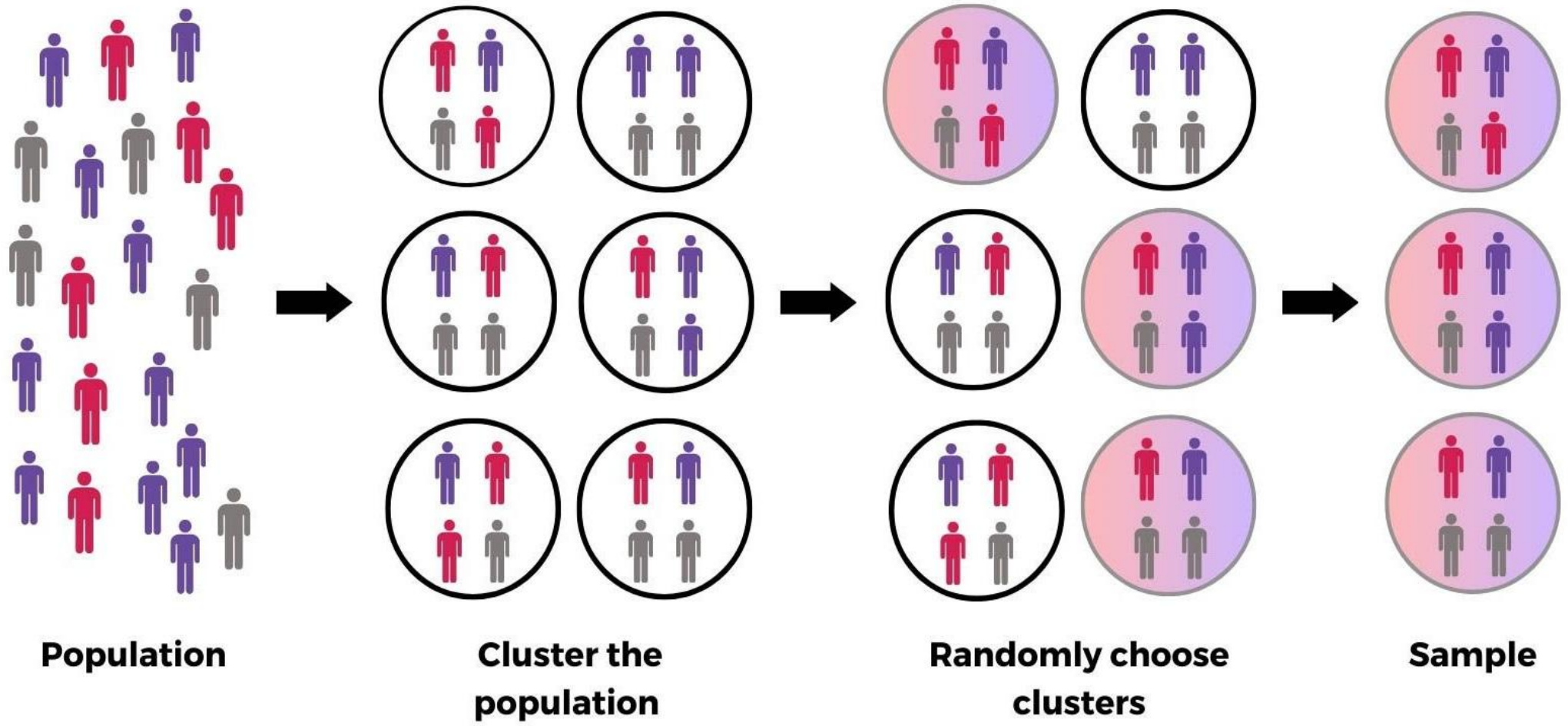
Sampling methods

Cluster sampling

- Probability sampling where the population is divided into clusters (groups or subsets), & entire clusters are randomly selected to be included in the study.
- Unlike other probability sampling methods, the sampling unit is the whole cluster, not just individual elements.
- Population is divided into clusters based on a relevant characteristic (e.g., geographic location, organization, etc.), for example city, region, hospitals.
- Example: If we want to study the effectiveness of physiotherapy treatments across multiple clinics. The population consists of patients from 20 clinics in a city.
    - Step 1: Divide the clinics into clusters (20 clinics represent 20 clusters)
    - Step 2: Randomly select 5 clinics to participate in the study
    - Step 3: Choose all patients from the 5 selected clinics or randomly select a few patients from each of those clinics.
- One major disadvantage of this method is that it increases sampling error.

Sampling methods

Cluster sampling



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REVIEW

OTHER READING SOURCES

TEXT

1. *Kumar, R. (2011). Research methodology: A step-by-step guide for beginners (3rd ed.). Sage Publications.*
2. *Kothari, C. R. (2019). Research methodology: Methods and techniques (4th ed.). New Age International.*
3. *Walliman, N. (2011). Research methods: The basics (1st ed.). Routledge.*

THANKS FOR LISTENING