



Sample & Population in Statistics (Part 1)

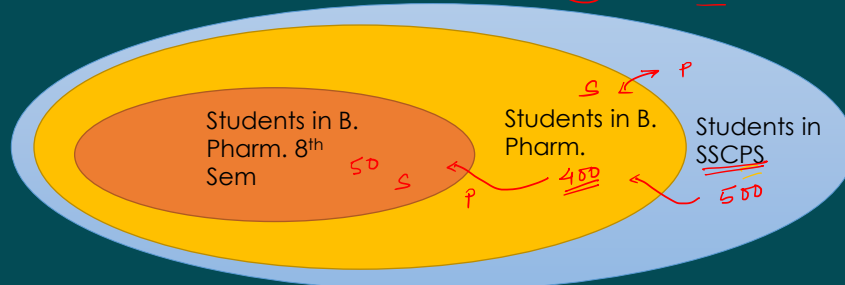
Basics Concept Sampling Techniques

Biostatistics & Research Methodology
B Pharm 8th Sem | M. Pharm. | PhD

Sample and Population



- 📌 **Population:** Entire group of individuals, which have similar or common characteristics
- 📌 **Sample:** Statistically significant Fraction of population, Which have some deviation or error.s
- 📌 In statistics, population is the group of individuals, from which a statistical sample is taken for a study
- 📌 For statistical calculations, we can use n for population and $n-1$ for a sample



Sample and Population



Population

Finite Population

- Countable
- E.G. No. of Students

Infinite Population

- Uncountable
- E.G. No. of Germs

Existent Population

- Available in solid form
- E.G. No. of books

Hypothetical Population

- Not Available in solid form
- E.G.- Outcomes

Sample and Population



Sample Size

Small Sample Size

- Less than 30
- Major small sample test
- Student t-test
- χ^2 test
- F-test

Large Sample Size

- Equal or More than 30
- Large sample test
- Z-test

S_1
(10)

S_2
10

population

8-8

(50)

Sample and Population



Sampling

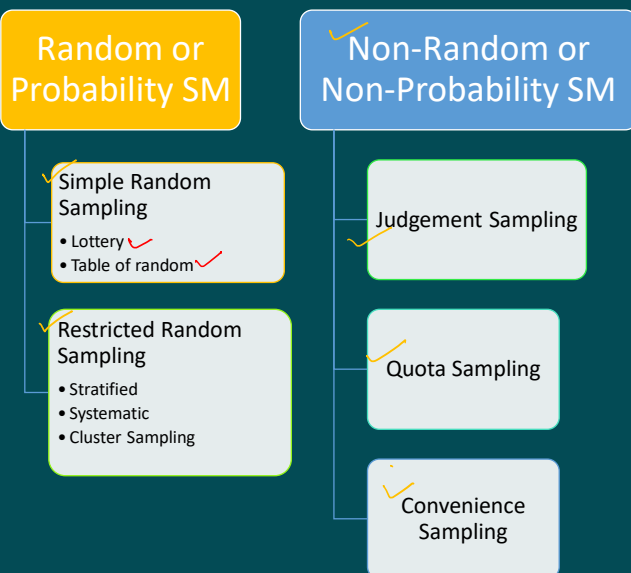
- 🗄 In statistics, taken individuals from a population for study
- 🗄 It is a process of learning about the population on the basis of sample drawn from it
- 🗄 Process of Sampling: involve 3 elements. ✓
 - 🗄 Selecting the sample ✓
 - 🗄 Collecting the information ✓
 - 🗄 Make a inference about the population ✓
- 🗄 Essential of sampling:
 - 🗄 Representiveness ✓
 - 🗄 Adequacy
 - 🗄 Independence ✓
 - 🗄 Homogeneity



Sample and Population



Sampling Techniques





Sample & Population Sampling Techniques (Part 1)

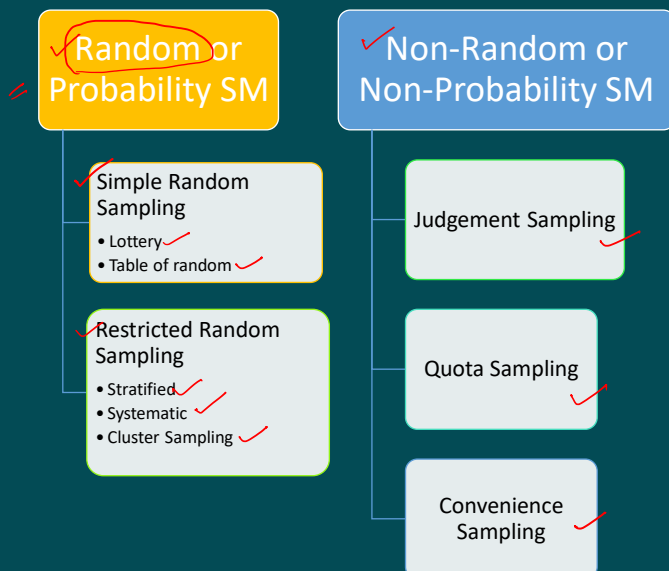
Random Sampling Techniques

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Sampling Techniques



Sampling Techniques / Methods



Probability or Random Sampling



- Each sample has equal opportunity/probability of selection ✓
- Unbiasedness during selection ✓
- It is also called probability sampling ✓
- In this method, we assume that all samples represent the population

Advantages

- It does not depend upon the existence of detailed information about the universe for effectiveness. ✓
- It provides estimates which are essentially unbiased and have significant precision
- In this sampling relative efficiency of various sample designs can be evaluated

Limitation

- Costly and Time Consuming ✓
- Very high level of skill and experience required to apply correctly ✓

Simple Random Sampling



Simple Random Sampling

Lottery Method ✓



Table of random Method ✓

- Each sample has equal opportunity/probability of selection
- Unbiasedness during selection
- Since the selection of item completely depends on the possibility, therefore this method is called "Method of chance Selection".
- Also, the sample size is large, and the item is selected randomly. Thus it is known as "Representative Sampling".

Characteristics

- Selection is independently ✓
- Sampling without replacement or with replacement

$$P = \frac{1}{60}$$

$$\frac{15}{60} = \frac{1}{4}$$

$$\frac{1}{59}$$

$$\frac{1}{58}$$

Simple Random Sampling

Lottery Method



60 population

Sample size = 10

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Simple Random Sampling

Table of random Method

- Random numbers are generally obtained by some mechanism
- Several standard table are used to obtain this number
- Tippet's (1927)-41600,
- Fisher & Yates (1938)-15000,
- Kendall & Babington Smith (1939)- 100000,
- Rang Corporation (1955)- 1000000

TABLE I. FIRST 40 NUMBERS FROM THE TIPPETT'S TABLE.

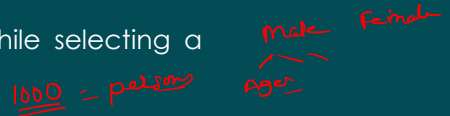
2952	6641	3997	9792	7979	5911	3170	5624
4167	9524	1545	1396	7203	5356	1300	2693
2370	7483	3408	2762	3563	1089	6913	7691
0506	5246	1112	6107	6008	8126	4433	8776
2754	9143	1405	9025	7002	6111	8816	6446

291600
Roll no
1-29
27
59
11
31

60
2 digit - 01
60

Restricted Random Sampling

- when samples are selected randomly but under certain restrictions, it is termed as restricted random sampling.
- It is may used in the case of the heterogeneous population,
- These restrictions are often used to ensure that the sample is representative of the population being studied and to reduce bias in the sample selection process.
- It involves the personal attention of the investigator while selecting a sample.
- It is not purely random
- E.g., → Study on heath in a village, then it should ensure that the sample includes individuals from different age groups, genders and socioeconomic backgrounds to make it representative of the population.



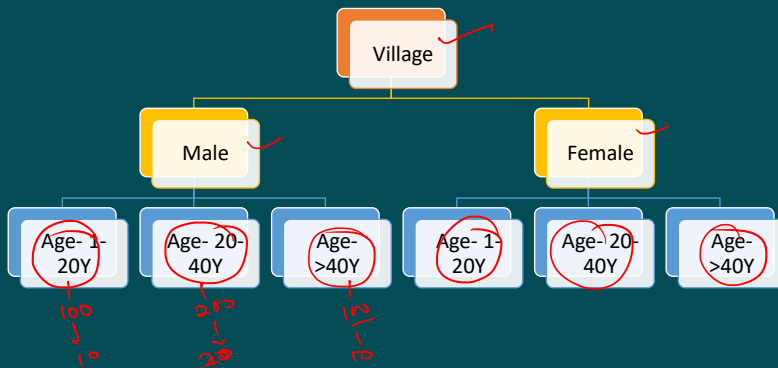
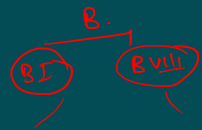
Restricted Random Sampling

Stratified

Systematic

Cluster Sampling

- It involves dividing a population into distinct subgroups or strata, (Homogeneous group) based on certain characteristics or attributes, and then selecting a random sample from each stratum.
- Eg, Study on Health in a village



Restricted Random Sampling

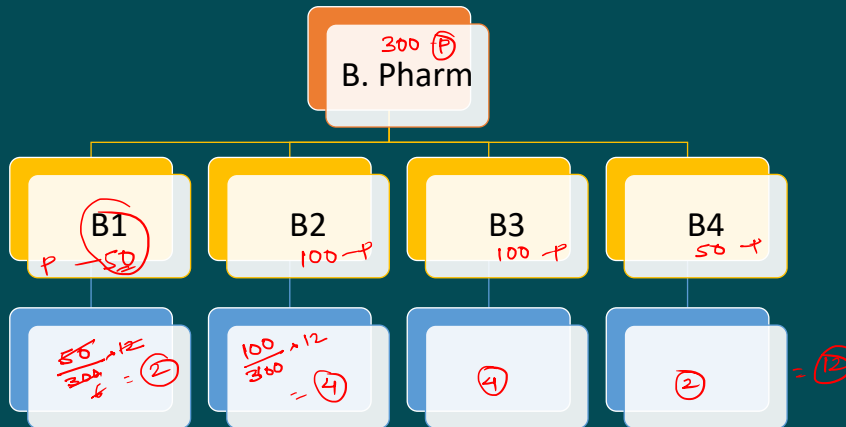


Stratified

Systematic

Cluster Sampling

Eg, Select 12 students in B Pharm for a team



Restricted Random Sampling



Stratified

Systematic

Cluster Sampling

Merits:

- Samples represent their population
- Easy to organize and provide equality in each subgroup
- Greater accuracy

Demerits:

- It is not possible if information about the population or 'strata' is not available.
- If stratification is not done properly, the purpose will not be served.

Restricted Random Sampling



Systematic

Cluster Sampling

- It is also known as quasi-random sampling.
- Under this method, the whole population is arranged in systematic order like 'alphabetically', 'geographically', 'numerically', or in some other systematic order.
- Eg. Calculate the avg weight of class (N= 30 students)

$$k = \frac{N}{n}$$

- ✓ k - sample interval
- ✓ N - population size = 30
- n - Sample size = 10

$$k = \frac{30}{10} = 3$$

1-4
2
3
4
10

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30

- Then every 'nth' item (k) is selected as a sample item. Where 'n' stands for any number.
- For better results, a list of items should be completely random and the first items should be selected using a simple random sampling method.

Restricted Random Sampling



Systematic

Cluster Sampling

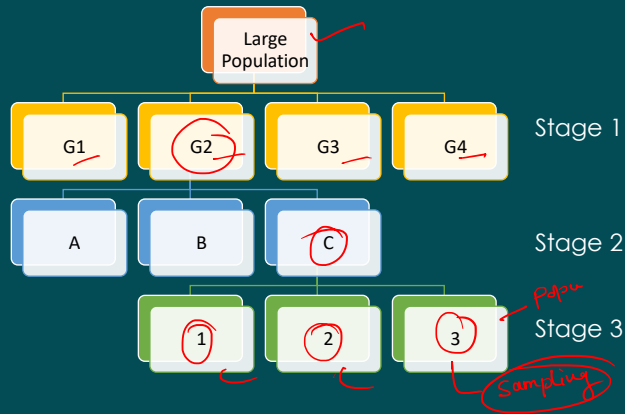
- Merits
 - very simple and satisfactory.
 - Re-checking can be done quickly.
 - It requires the same amount of time and effort.
- Demerits
 - It is possible only if the complete list of items is available.
 - It is feasible only if the units are systematically arranged.
 - There are chances of biasness.

Restricted Random Sampling



Cluster Sampling

- Large population divided into groups known as **clusters** and drawing a sample of clusters to represent the population.
- It is carried out in multiple stages say, two, three, or four stages.



Restricted Random Sampling



Cluster Sampling

- The process of division and subdivision of clusters and selection of multistage samples is carried out until the sample size is reduced to a reasonable extent
- Merits
 - It is very helpful in large scale surveys
 - It represents the population with reasonable accuracy.
 - It saves time and money
- Demerits
 - The division of population into clusters and sub-clusters is quite a difficult task.
 - The investigator needs to have detailed knowledge about the universe expertise in division and selection of clusters.

Sample & Population Sampling Techniques (Part 2)

Non-Random Sampling Techniques

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Non-Random Sampling

- ❑ Sample selection is based on subjective judgment rather than the random selection. ✓
- ❑ In this method, every samples have not equal chance to participate in the study, so called "Non-probability sampling methods" ✓
- ❑ Selection process is partially subjective on the basis of convenience or judgement ✓
- ❑ Eg, selection for quiz competition from a college (Students have > 70 %) ✓
- ❑ The major types:
 - ❑ Judgment ✓
 - ❑ Quota ✓
 - ❑ Convenience ✓

Non-Random Sampling



Judgement ✓✓

Quota

Convenience

- ❏ In the judgmental sampling method, researchers select the samples based purely on the researcher's knowledge and credibility
- ❏ He tries to select best representative of the whole population
- ❏ It is also known as purposive and deliberate sampling
- ❏ E.g., selection a team for a cricket match, Quiz competition, debate competition
- ❏ Merits: privilege the knowledge of selector ✓
- ❏ Demerit- unbiasedness ✓

$g^{th} = \underline{60}$
 $s^{th} = \underline{best}$

Non-Random Sampling



Quota

Convenience

- ❏ The samples of population are subdivided into various group and then a quota is fixed (no. of sample to be selected from each group)
- ❏ The selection of sample depends upon the personal judgement of the investigator ✓
- ❏ E.g., Survey is conducted in a village for hypertension patient ($n = \underline{500}$)

SN	Quota	Sample No
1	✓ Working male People	150
2	✓ Working female People	150
3	✓ House wife	50
4	✓ Children	50
5	✓ Old age	100

→ 500

Non-Random Sampling



✓ Convenience

- ❏ The selection of sample based on easiest for the researcher to access
- ❏ This can be due to geographical proximity, availability at a given time, or willingness to participate in the research.
- ❏ Easy and quick



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