Editing file

Feedback

Sampling techniques

Objectives:

To understand:

1. Why should we use sampling methods ?
2. To know definitions of few terms in sampling
3. What are the different Sampling and non-sampling methods
4. And you should able to use sampling methods appropriately in research process

Click here for the practical

14th lecture

Color Index:

- Boys' Slides
- Girls' Slides
- Doctors Notes
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Sampling Techniques

What is Sampling?

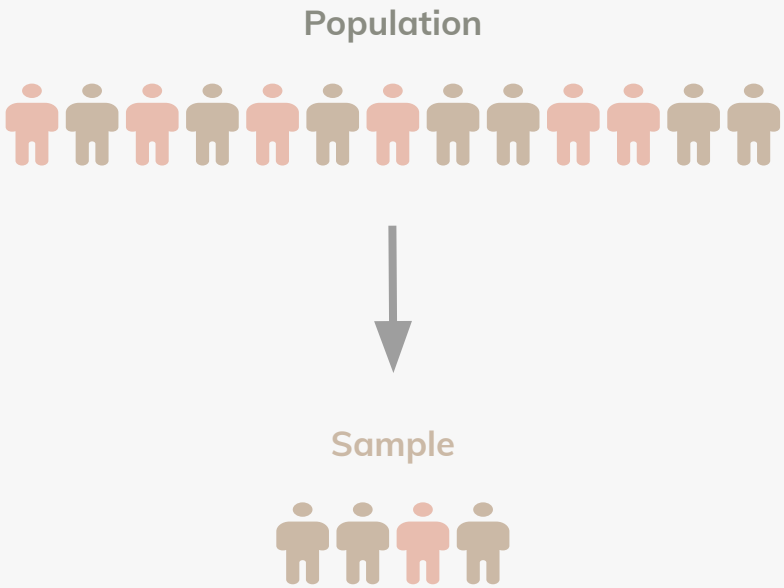
Sampling is the process or technique of selecting a study sample of appropriate characteristics and of adequate size.

Why to use Sampling in Research?

- Unable to study all members of a population
- Reduce selection bias
- Save time and money
- Measurements may be better in sample than in entire population
- Feasibility

Definitions:

Population	Sample
group of things (people) having one or more common characteristics	representative subgroup of the larger population - Used to estimate something about a population (generalize) - Must be similar to population on characteristic being investigated
a set which includes all measurements of interest to the researcher (The collection of **all** responses, measurements, or counts that are of interest)	A subset of the population



Sampling Techniques

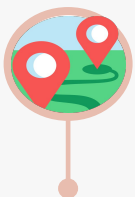
Definitions- cont:

Sampling Frame	• This is the complete list of sampling units in the target population to be subjected to the sampling procedure. • Completeness and accuracy of this list is essential for the success of the study. • **Ex. Group B attendance sheet it has to be complete**
Sampling Units	• These are the individual units / entities that make up the frame just as elements are entities that make up the population. • **Ex. Each member from the sampling frame is sampling unit**
Sampling Error	• This arises out of random sampling and is the discrepancies (inconsistency) between sample values and the population value.
Sampling Variation	• Due to infinite variations among individuals and their surrounding conditions. • Produce differences among samples from the population and is due to chance. • Example: In a clinical trial of 200 patients we find that the efficacy of a particular drug is 75% If we repeat the study using the same drug in another group of similar 200 patients we will not get the same efficacy of 75%. It could be 78% or 71%. **"Different results from different trails though all of them conducted under the same conditions"**

Representativeness (validity):

A sample should accurately reflect distribution of relevant variable in population

Person (e.g. age, sex)



Place (e.g. urban vs. rural)

Time

- Representativeness essential to generalise
- Ensure representativeness before starting,
- Confirm once completed

Sampling Techniques

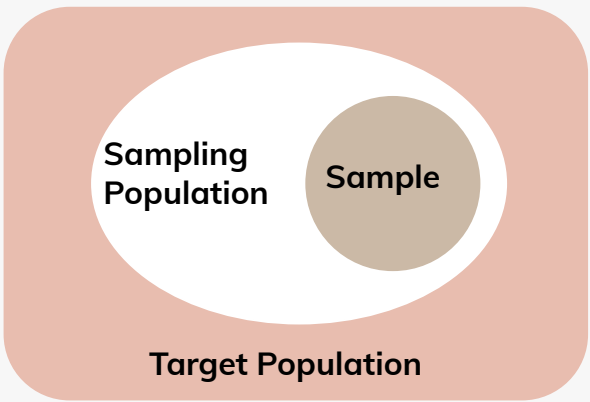
Representativeness (validity):

Validity of a Study.

There is two components of validity:

	1 - Internal validity	2 - External validity
	- A study is said to have internal validity when there have been proper selection of study group and a lack of error in measurement. - For example, it is Concerned with the appropriate measurement of exposure,outcome, and association between exposure and disease. **- You must have proper selection of the study group and their measurement to say that you have good internal validity.**	- External validity implies the ability to generalize beyond a set of observations to some universal statement. - For instance, do the findings apply to other people, settings, situations, and time periods?
Difference	The essential difference between internal and external validity is that internal validity refers to the structure of a study and its variables while external validity relates to how universal the results are	

Sampling and representativeness



Target Population ⟶ Sampling Population ⟶ Sample

How to sample ?

1. Sampling frame must be available, otherwise develop a sampling frame.
2. Choose an appropriate sampling method to draw a sample from the sampling frame.

Sampling Techniques

The Sampling Design Process:

Define the Population

↓

Determine the Sampling Frame

↓

Select Sampling Technique(s)

↓

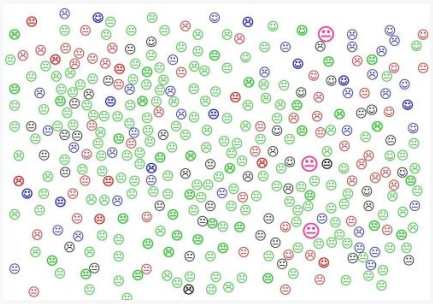
Determine the Sample Size

↓

Execute the Sampling Process

Who are They?

- Black / Blue / Green / Red
- Thin / Bold
- Smiling / Normal / Sad



Consider this picture is your target population, there are a lot of variety someone happy someone sad..etc

Types of Sampling Methods

Probability Sampling

Where you have some random mechanism , so you have some methods to select your sample

- Simple Random Sampling (SRS)
- Stratified Random Sampling
- Systematic Random Sampling
- Cluster Sampling
- Multistage Sampling

Non- probability Sampling

- Deliberate (Quota) Sampling
- Convenience Sampling
- Purposive Sampling
- Snowball Sampling
- Consecutive Sampling

1. Simple Random Sampling

Equal probability

Techniques: • Lottery method • Table of random numbers

Advantage: Most representative group, Avoids selection bias

Disadvantage: Difficult to identify every member of a population

Table of random numbers:	6 8 4 2 5 7 9 5 4 1 2 5 6 3 2 1 4 0 5 8 2 0 3 2 1 5 4 7 8 5 9 6 2 0 2 4 3 6 2 3 3 3 2 5 4 7 8 9 1 2 0 3 2 5 9 8 5 2 6 3 0 1 7 4 2 4 5 0 3 6 8 6

How to select a simple random sample?

1. Define the population
2. Determine the desired sample size
3. List all members of the population or the potential subjects
   - **For example:**
     - 4th grade boys who have demonstrated problem behaviors
     - Lets select 10 boys from the list

Potential Subject Pool

1. Ahamed
2. Munir
3. Khalid
4. Ameer
5. Junaid
6. Khadeer
7. Shaffi
8. Rafi
9. Ghayas
10. Fayaz

11. Riyaz
12. Yaseen
13. Jaffar
14. Sattar
15. Ghouse
16. Imran
17. Khaleel
18. Shabu
19. Shanu
20. Javid

21. Fahad
22. Iqbal
23. Jabbar
24. Aziz
25. Anwar
26. Shohail
27. Shohaib
28.Rehaman
29. Naeem
30. Rahim

So our selected subjects are with numbers 10, 22, 24, 15, 6, 1, 25, 11, 13, & 16.

1. Ahamed
2. Munir
3. Khalid
4. Ameer
5. Junaid
6. Khadeer
7. Shaffi
8. Rafi
9. Ghayas
10. Fayaz

11. Riyaz
12. Yaseen
13. Jaffar
14. Sattar
15. Ghouse
16. Imran
17. Khaleel
18. Shabu
19. Shanu
20. Javid

21. Fahad
22. Iqbal
23. Jabbar
24. Aziz
25. Anwar
26. Shohail
27. Shohaib
28.Rehaman
29. Naeem
30. Rahim

1. Simple Random Sampling CONT'

simple random sampling

- Estimate hemoglobin levels in patients with sickle cell anemia
  1. Determine sample size
  2. Obtain a list of all patients with sickle cell anemia in a hospital or clinic
  3. Patient is the sampling unit
  4. Use a table of random numbers to select units from the sampling frame
  5. Measure hemoglobin in all patients
  6. Estimate the levels (normal & abnormal) of hemoglobin

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
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170
171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190
191	192	193	194	195	196	197	198	199	200

2. Systematic Random Sampling

Technique: Use "system" to select sample (e.g., every 5th item in alphabetized list, every 10th name in phone book)

Advantage: Quick, efficient, saves time and energy

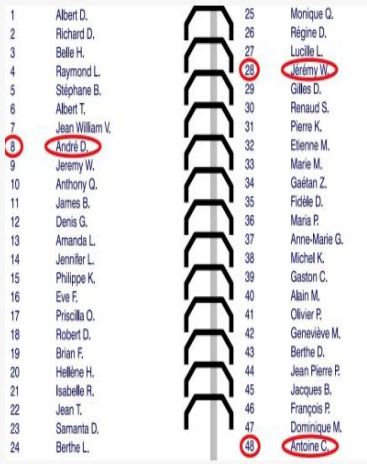
Disadvantage:
- Not entirely bias free; each item does not have equal chance to be selected
- System for selecting subjects may introduce systematic error
- Cannot generalize beyond population actually sampled

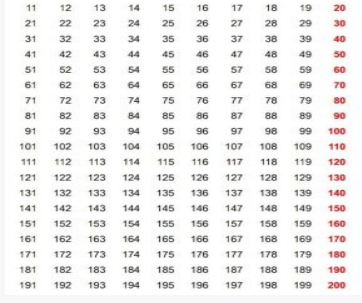
First number must be random if its not random then its called systematic non-random sampling

Example:

-If a systematic sample of 500 students were to be carried out in a university with an enrolled population of 10,000, the sampling interval would be:
I = N/n = 10,000/500 =20

- All students would be assigned sequential numbers. The starting point would be chosen by selecting a random number between 1 and 20. If this number was 8, then the 8th student on the list of students would be selected along with every following 20th student. The sample of students would be those corresponding to student numbers 8, 28, 48, 68, ... 9928, 9948, 9968 and 9988.





Select a random starting point and then select every kth subject in the population

3. Stratified Random Sampling

Technique:
- Divide population into various strata
- Randomly sample within each strata
- Sample from each strata should be proportional

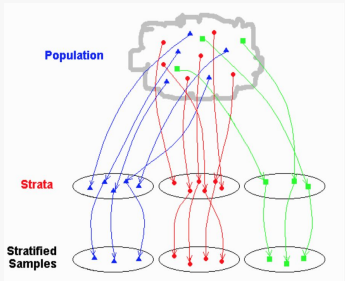
Advantage: Better in achieving representativeness on control variable

Disadvantage:
- Difficult to pick appropriate strata
- Difficult to Identify every member in population

Divide the population into at least two different groups with common characteristic(s), then draw subjects randomly from each group (group is called strata or stratum)

women

Men

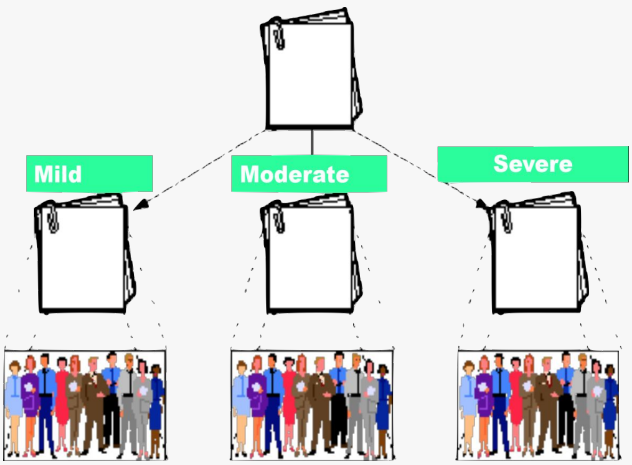


Stratified Random selection for drug trial in hypertension:

List of clients

Strata

Random subsamples of n/N



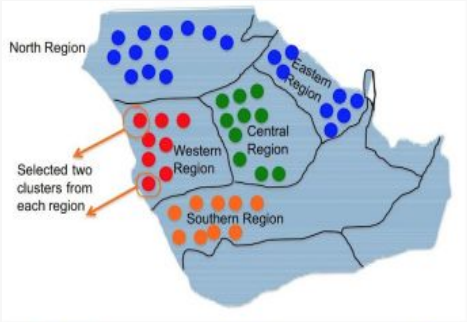
Sampling in Epidemiology:

- Stratified random sample
  Assess dietary intake in adolescents:
  1. Define three age groups: 11-13, 14-16, 17-19
  2. Stratify age groups by sex
  3. Obtain list of children in this age range from schools
  4. Randomly select children from each of the 6 strata until sample size is obtained
  5. Measure dietary intake

4. Cluster (Area) random sampling

<u>Randomly</u> select groups (cluster) – all members of groups are subjects

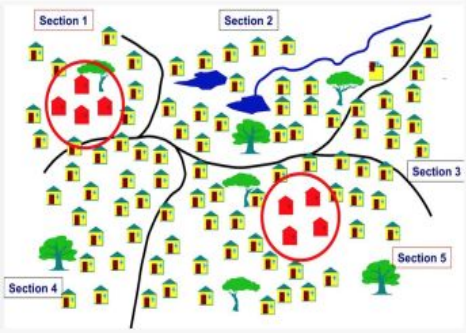
Appropriate when:
- you can't obtain a list of the members of the population
- have little knowledge of population characteristics
- Population is scattered over large geographic area



Advantage: More practical, less costly

Conclusions should be stated in terms of cluster (sample unit – school)

Sample size is number of clusters

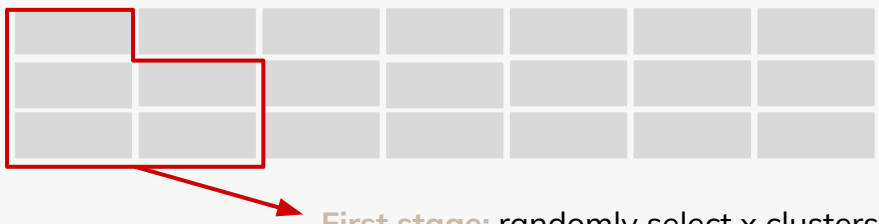


Ex. If your sample includes people in malls take the list of the region malls and you take random sample of the malls, in a particular day and time, take the data from all the customers

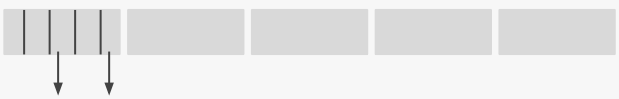
5. Multistage random sampling

Extension of cluster sampling

Stage 1	Stage 2	Stage 3
randomly sample clusters (schools)	randomly sample class rooms from the schools selected	random sample of students from class rooms



First stage: randomly select x clusters (schools)

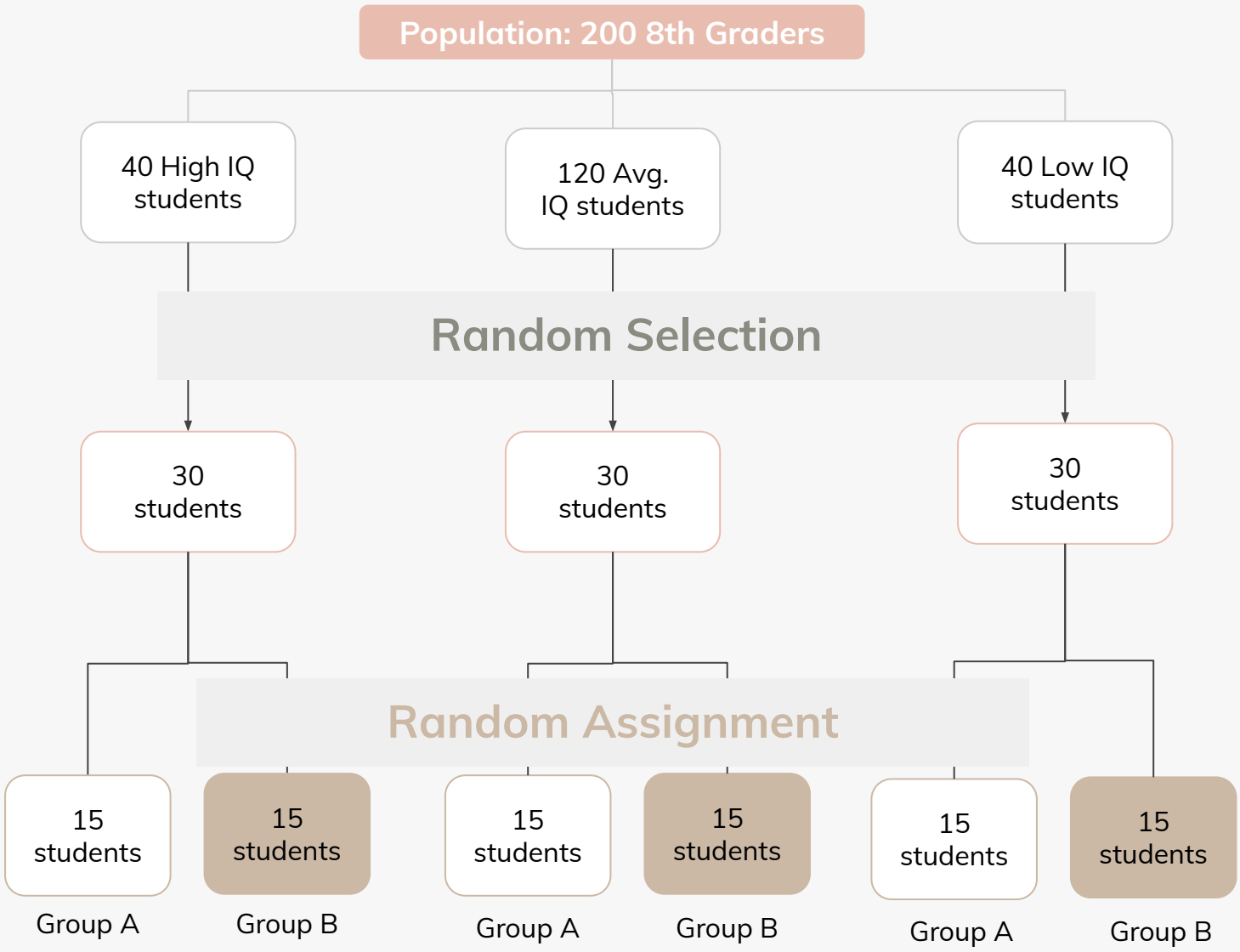


Second stage: within each school, randomly select y clusters (class rooms)

Third stage: randomly select x number of people from the class room

Random Selection vs. Random Assignment

Random Selection	Random Assignment
- every member of the population has an equal chance of being selected for the sample. - Subject Selection (Random Selection) : Choosing which potential subjects will actually participate in the study	- every member of the sample (however chosen) has an equal chance of being placed in the experimental group or the control group. - Random assignment allows for individual differences among test participants to be averaged out. **Both the study group and control group must have similar characteristics otherwise you'll get bias.** - Subject Assignment (Random Assignment) : Deciding which group or condition each subject will be part of



Non- probability Sampling (Page4)

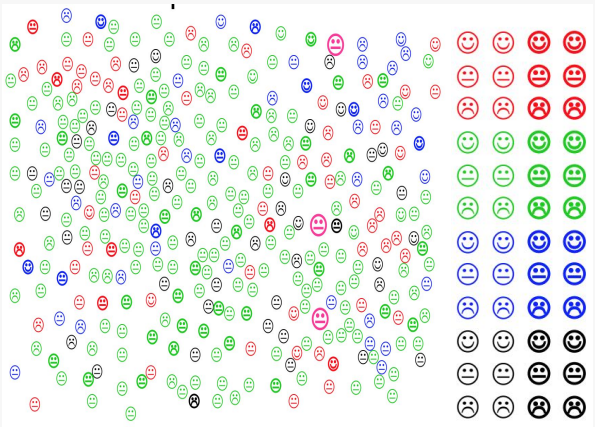
All non-probability sampling will be used in qualitative research NOT quantitative research.

1. Deliberate (Quota) Sampling

Similar to stratified random sampling

Technique
- Quotas set using some characteristic of the population thought to be relevant
- ¨Subjects selected non-randomly to meet quotas (usu. convenience sampling)

Disadvantage
- selection bias
- Cannot set quotas for all characteristics important to study

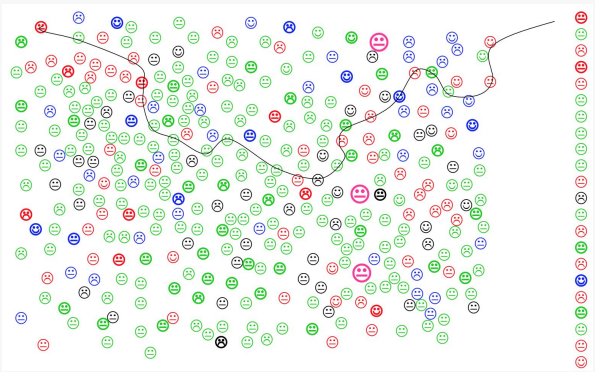


2. Convenience(Haphazard) Sampling

"Take them where you find them" -nonrandom

Intact classes, volunteers, survey respondents (low return), a typical group, a typical person

Disadvantage
- selection bias

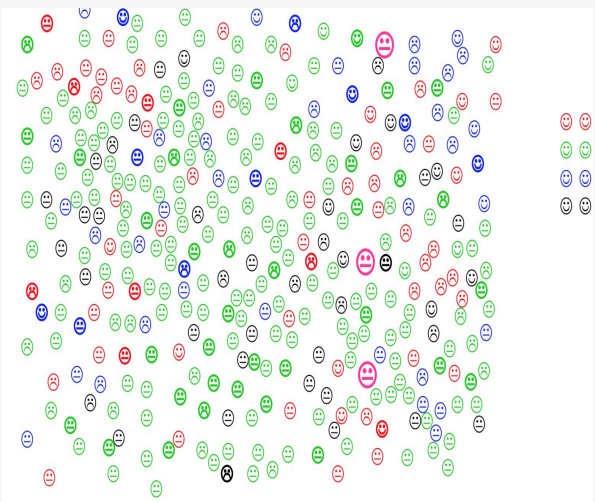


3. Purposive Sampling

- Purposive sampling (criterion-based sampling)
  - Establish criteria necessary for being included in study and find sample to meet criteria.

- Solution: Screening
  - Obtain a sample of larger population and then those subjects that are not members of the desired population are screened or filtered out.

    EX: want to study smokers but can't identify all smokers

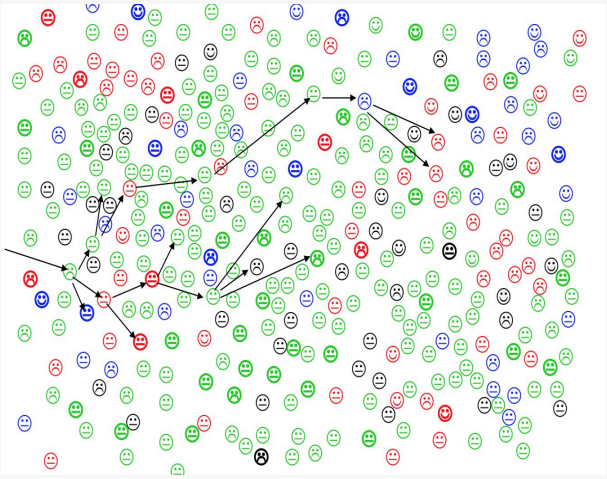


4. Snowball Sampling

In **snowball sampling**, an initial group of respondents is selected.

After being interviewed, these respondents are asked to identify others who belong to the target population of interest.

Subsequent respondents are selected based on the referrals.



5. Consecutive sampling

Outcome of 1000 consecutive patients presenting to the emergency room with chest pain

Natural history of all 125 patients with HIV-associated TB during 5 year period

Explicit efforts must be made to identify and recruit ALL persons with the condition of interest

Choosing probability vs. non-probability sampling method

Prof.shaffi : very important table

Probability sampling	Evaluation Criteria	Non-probability sampling
Conclusive	Nature of research	Exploratory
Larger sampling errors	Relative magnitude sampling vs non-sampling error	Larger non-sampling error
High [Heterogeneous]	Population variability	Low [Homogeneous]
Favorable	Statistical Considerations	Unfavorable
High	Sophistication Needed	Low
Relatively Longer	Time	Relatively shorter
High	Budget Needed	Low

In Conclusion

For any research, based on its study design and objectives an appropriate random sampling technique should be used.

Lecture Summary

Sampling

What is Sampling? Sampling is the process or technique of selecting a study sample of appropriate characteristics and of adequate size.
Why to use Sampling in Research?
Unable to study all members of a population, Reduce selection bias, Save time and money, Measurements may be better in sample than in entire population, Feasibility
Representativeness (validity):
A sample should accurately reflect distribution of relevant variable in population
Representativeness essential to generalise. Ensure representativeness before starting, Confirm once completed

Sampling methods

Probability sampling

	techniques	advantages	disadvantages
Simple random sampling	• Lottery method • Table of random numbers	Most representative group	Difficult to identify every member of a population
Systematic random sampling	Select a random starting point and then select every k^{th} subject in the population	Quick, efficient, saves time and energy	
Stratified random sampling	• Divide population into various strata • Randomly sample within each strata • Sample from each strata should be proportional	Better in achieving representativeness on control variable	• Difficult to pick appropriate strata • Difficult to Identify every member in population
Cluster random sampling	Randomly select groups	• More practical. • Less costly.	
Multistage random sampling	1. Stage 1: randomly sample clusters (schools) 2. Stage 2: randomly sample (classrooms) 3. Stage 3: randomly sample (students)		

Non-Probability sampling

Deliberate sampling	Quotas set using some characteristic of the population thought to be relevant		• selection bias • Cannot set quotas for all characteristics important to study
Convenience sampling	• Take them where you find them • intact classes, volunteers, survey respondents (low return), a typical group, a typical person		• selection bias
Purposive sampling	criterion-based sampling: Establish criteria necessary for being included in study and find sample to meet criteria. Solution: Screening. Obtain a sample of larger population and then those subjects that are not members of the desired population are screened or filtered out.		
Snowball Sampling	Based on referrals		• selection bias
Consecutive sampling	Explicit efforts must be made to identify and recruit ALL persons with the condition of interest		

Questions

(1) A survey will be given to 100 students randomly selected from the freshmen class at Lincoln High School. What is the population**?**

A) all freshmen at Lincoln High School

B) all students at Lincoln High School

C) the 100 selected students

D) All high school students in the US

(2) A truck manufacturer selects 3 trucks at random from each of 6 models for safety testing. What type of sample is this**?**

A) Systematic random sample

B) Cluster random sample

C) Stratified random sample

D) Simple random sample

(3) A quality control worker at a factory selects the first 10 items she sees as her sample for the day.What type of sample is this**?**

A) Convenience sample

B) Simple random sample

C) Systematic random sample

D) Stratified random sample

(4) Inspectors for a hospital chain with multiple locations randomly select some of their locations for a cleanliness check of their operating rooms. The inspectors check every operating room in the hospitals that were chosen**?**

A) Systematic random sample

B) Cluster random sample

C) Convenience sample

D) Simple random sample

(5) Security workers at an airport randomly choose one of the first 505050 people to pass through a checkpoint for extra security screening. After that person, they choose every 50^{th} person who passes through for extra screening as well.**?**

A) Systematic random sample

B) Cluster random sample

C) Convenience sample

D) Simple random sample

(6) Each student at a school has a student identification number. Counselors have a computer generate 50 random identification numbers, and the students associated with those numbers are asked to take a survey.**?**

A) Systematic random sample

B) Cluster random sample

C) Convenience sample

D) Simple random sample

Answers:
1: A | 2: C | 3: A | 4: B | 5: A | 6: D

Research Team

RESEARCH TEAM
438
Keep it simple, Keep it focused

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