

Nursing Research Series

Essentials of Science: Methods, Appraisal and Utilization




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*Essentials of Science:
Methods, Appraisal and Utilization*




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Part 11 of 20

Population, Samples, and Sampling
Descriptions




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Objectives


- To describe how the concepts of population, sample, and sampling are used in the research process.
- To identify what discriminates populations from a sample.
- To describe basic sampling techniques for qualitative and quantitative studies.



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Population

- An entire aggregation of cases that meet a designated set of criteria.
 - All persons with Diabetes
 - All persons with Diabetes who are hospitalized.
 - Persons with newly diagnosed Diabetes who have had no prior Diabetic education.
- Whatever the base unit, the population always comprises the entire aggregate of elements in which the researcher is interested.
 - All possible candidates for the sample should be in the population.



Population

- Target Population
 - Aggregate of cases about which the researcher would like to make generalizations.
- Accessible Population
 - Aggregate of cases that conform to the designated criteria and that are accessible to the researcher as a pool of subjects for study.



Approaches to Sampling

- Quantitative
 - Seek to select samples that will allow them to generalize their results to much broader groups.
- Qualitative
 - Seek to select samples that allow for a in-depth understanding of the phenomenon of interest.

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Sampling

- The process of selecting a portion of the population to represent the population in its entirety
- The overriding consideration in assessing a sample in a quantitative study its *representativeness*.
- A representative sample is one whose key characteristics closely approximates those of the population.


Basic Sampling Concepts in Quantitative Studies

Sampling Plan

- Specifies in advance how study participants are to be selected.
- How many study participants to include.


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How the participants are to be selected:

- Eligibility Criteria
 - The purpose of the eligibility criteria is to define a fairly homogeneous sample as a means of controlling extraneous variables.
- Inclusion Criteria
 - A list of the characteristics that all persons in the sample must have.
 - Diabetics who on taking oral glucose lowering agents
 - Data may or may not be collected in regards to sub-categories.
- Exclusion
 - A list of characteristics that no person in the sample may have
 - Diabetics who are taking insulin.




How the participants are to be selected:

- Sampling Designs
 - Techniques and methods adopted for selecting a sample and obtaining estimates
 - Selecting a Sample: Sampling Types
 - Non-Probability Samples
 - Probability Samples
 - Sample Size: Obtaining Estimates
 - Power Analysis
 - Other sampling estimate techniques




Probability Samples

- Involve a selection process in which each element in the population has an equal chance of being selected.
- The hallmark of probability selection is the random selection of elements from the population. 

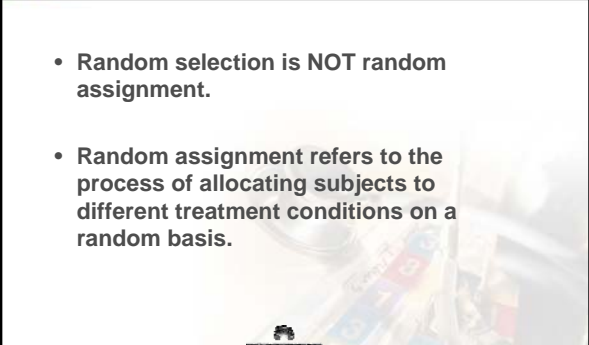
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Random Selection VS Random Assignment

- Random selection is NOT random assignment.
- Random assignment refers to the process of allocating subjects to different treatment conditions on a random basis.






Types of Probability Samples

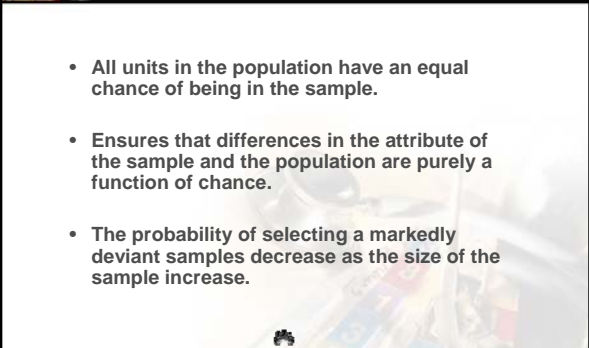
- Simple Random Sample
- Stratified Random Sample
- Cluster Sampling
- K-Sampling






Simple Random Sample

- All units in the population have an equal chance of being in the sample.
- Ensures that differences in the attribute of the sample and the population are purely a function of chance.
- The probability of selecting a markedly deviant samples decrease as the size of the sample increase.




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Simple Random Sample

- **Step One: Sampling Frame**
 - The technical name for the actual list of the sampling units or elements from which the sample will be chosen.
- **Step Two: Listing of the Elements**
 - The elements are numbered consecutively.
- **Step Three: Table of Random Numbers**
 - Starting blindly numbers from the table are matched to the number of elements.



Sampling Frame

| | |
|---|--|
| <ul style="list-style-type: none"> 1. N. Alexander 2. H. Bos 3. R. Cytron 4. F. Doolittle 5. C. Eldred 6. R. Fellerath 7. R. Granger 8. G. Hamilton 9. R. Ivry 10. S. James 11. V. Knox 12. S. Lynn 13. C. Michalopoulos 14. S. Nelson 15. J. O'Brien 16. M. Price 17. J. Quint 18. L. Robling 19. B. Schall 20. K. Trister 21. M. Valmont 22. J. Walter 23. R. Yun 24. M. Zaslow 25. M. Agudelo | <ul style="list-style-type: none"> 26. G. Berlin 27. G. Cave 28. R. De los Santos 29. D. Edelstein 30. D. Friedlander 31. J. Gueron 32. G. Hoerz 33. D. Jones-Brown 34. J. Kemple 35. L. London 36. L. Miyazaki 37. C. Nicholson 38. K. Ofosuheme 39. K. Paget 40. G. Queto 41. J. Riccio 42. M. Salmon 43. L. Traeger 44. E. Vallejo 45. J. Wallace 46. D. Abraham 47. D. Butler 48. O. Cardenas 49. F. Derocher 50. J. Edison |
|---|--|


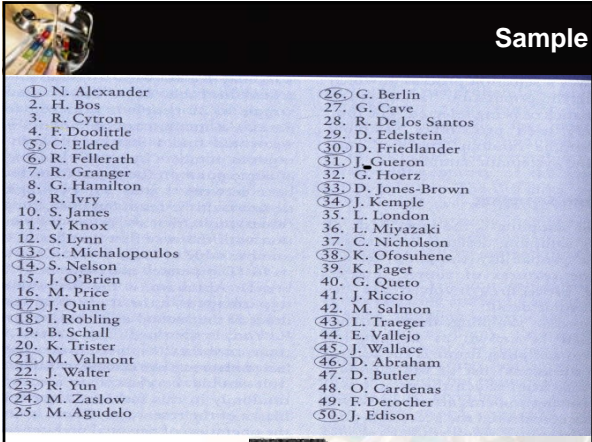


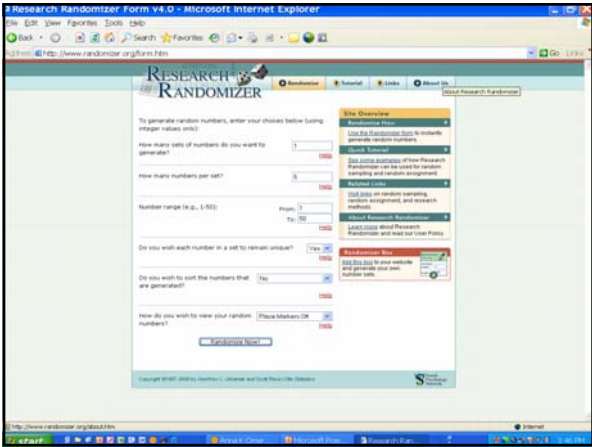
Table of Random Numbers

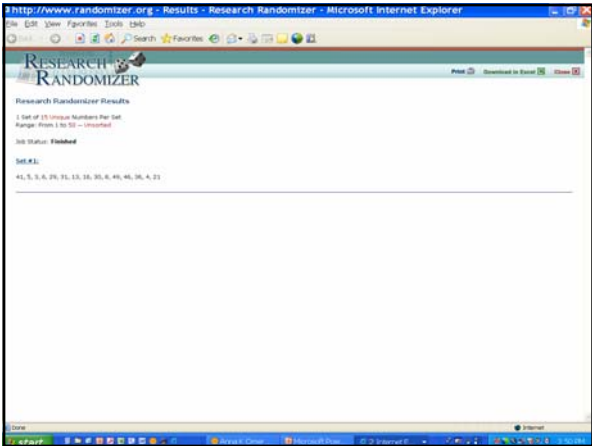
| | | | | |
|-------|-------|-------|-------|-------|
| 26 49 | 10 89 | 42 3 | 59 67 | 51 29 |
| 92 46 | 33 24 | 14 99 | 53 24 | 79 39 |
| 79 1 | 54 5 | 40 12 | 84 35 | 95 51 |
| 70 27 | 17 62 | 20 55 | 66 87 | 29 82 |
| 17 53 | 23 1 | 63 66 | 68 10 | 18 40 |
| 45 19 | 27 2 | 65 22 | 77 51 | 45 21 |
| 82 3 | 24 77 | 77 87 | 4 46 | 74 10 |
| 70 60 | 79 33 | 77 33 | 24 91 | 14 19 |
| 40 32 | 73 68 | 22 25 | 99 14 | 84 34 |
| 33 16 | 30 94 | 47 74 | 79 54 | 39 71 |

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Stratified Random Samples

- Divide the population into homogeneous subsets from which an appropriate number of elements can be selected at random.
- Stratification may be based on age, gender, occupation, disease status, and so forth.
- Selecting subjects in proportion to the size of the stratum in the population being studied.
- HIV Population:
 - 85% Male
 - 15% Female



Disproportionate Sampling

- Equal numbers of each subjects are selected from each stratum.
- Then the data from those subjects are weighted (a simple mathematical computation) or adjusted to reflect the overall population values.
- HIV Population:
 - 500 Males x 85%
 - 500 Females x 15%




Cluster Sampling


- A successive random sampling of units
- For example:
 - Stage 1: All states in the US
 - Stage 2: All counties in the states chosen.
 - Stage 3: All hospitals in the counties
 - Stage 4: All Surgical Patients admitted during a specific 24 hour time period.
- Also called “multistage sampling”


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K Sampling

- Also known as "Systematic Sampling"
- The first element is chosen from a table of random numbers.

- Then, each additional elements is chosen at a sampling interval or standard distance between the elements.
- Example: First randomly chosen number is 54, then every K or 200 subjects.




Non-Probability Samples

- Every element does not have a chance for inclusion.

- Types
 - Convenience or Accidental
 - Network or Snow-ball
 - Theoretical or Purposive




Convenience or Accidental

- The use of the most convenient elements as subjects for the sample.
- Most common sampling technique.



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Network or Snowball Samples


- Early sample members are asked to identify and refer other people who meet the same eligibility criteria.







Quota Samples

- The researcher first identified strata of the population.
- Then, the researcher determines the proportion of elements needed from the various segments of the population.
- Then, convenience sampling is used until that proportion of the sample is determined.






Theoretical or Purposive Samples




- Based on the belief that the researcher's knowledge about the population can be used to hand pick the cases to be included in the sample.
- Usually used to choose subjects who are either typical or experts in the issues/content under study.
- Frequently used in instrument development.

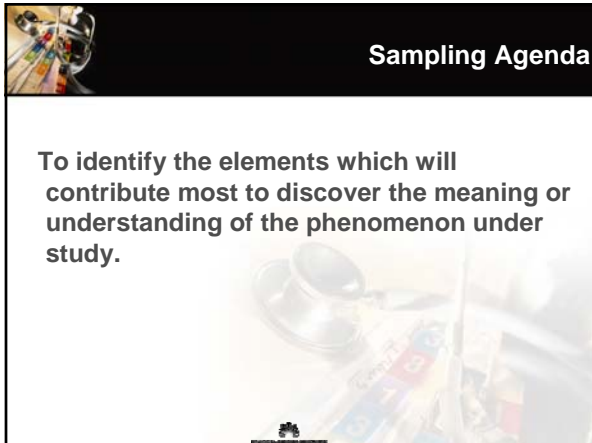


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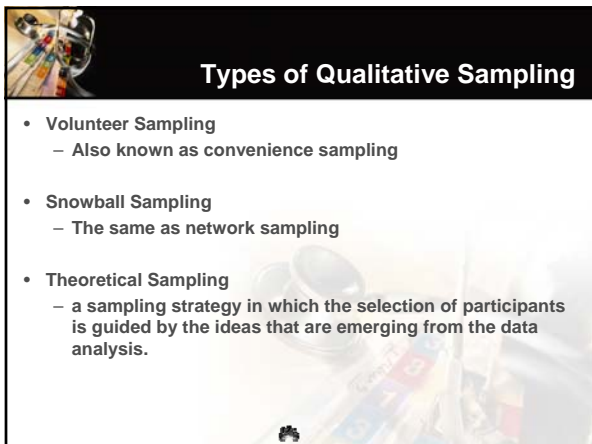


Basic Sampling Concepts in Qualitative Studies



Sampling Agenda

To identify the elements which will contribute most to discover the meaning or understanding of the phenomenon under study.



Types of Qualitative Sampling


- Volunteer Sampling
 - Also known as convenience sampling
- Snowball Sampling
 - The same as network sampling
- Theoretical Sampling
 - a sampling strategy in which the selection of participants is guided by the ideas that are emerging from the data analysis.

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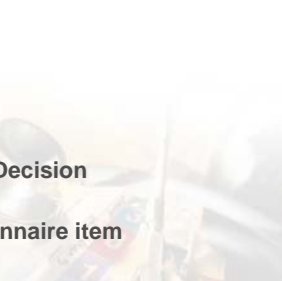


Sample size



Sample Size Considerations

- Homogeneity of the Population
- Attrition
- Number of Variable
- Subgroup Analysis
- Sensitivity of the Measures




Strategies for Determining Sample Size in Quantitative Studies

- Power Analysis
 - Effect size
 - Power
 - Alpha
- Multivariate Sampling Decision
 - Subject per variable
 - Subjects per questionnaire item


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Power Analysis

- A priori power analysis can be used to calculate the minimum sample size required to accept the outcome of a statistical test with a particular level of confidence (power).
- Effect
 - A measure of how wrong the null hypothesis is or how strong the effect of the independent variable is on the dependent variable.
- Power
 - The probability of rejecting the null hypothesis, i.e., that it will detect a significant difference.
- Alpha
 - The level of significance or the probability of a Type I error



Multivariate Sampling Decisions: Rule of Thumb

- 5-10 Elements/Variable
- 20-30 Elements/Variable
- 5-10 Elements/Item on a Questionnaire
- The larger the sample, the smaller the sampling error.

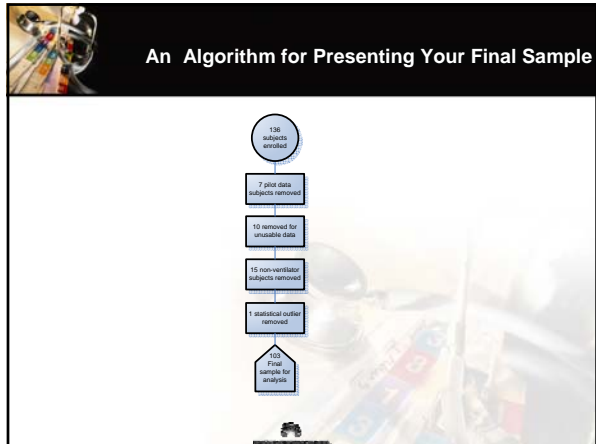


Strategies for Determining Sample Size in Qualitative Studies

- The sample size should be determined on the basis of knowledge needs and study design requirements.
- Examples:
 - Eidetic Phenomenology: It is possible to do a study with an N of 1
 - Grounded Theory: Data Saturation
 - Sampling to the point at which no new information is obtained and redundancy is achieved.

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- Recruitment Strategies**
- **Methods**
 - Face to face versus brochures, letters, etc
 - **Persistence**
 - Persistence versus coercion
 - **Payments**
 - Financial
 - Value of research to society
 - Offers of research summary
 - **Integrity in Research**
 - Human Subjects Protection

• Large sample sizes decrease confidence levels.

The illustration shows an open book with a red cover and a yellow spine. The pages are white with colorful patterns. The book is set against a background of a colorful, abstract pattern.

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References to Consider

- Burns, N. & Grove, S.K (2007). *Understanding Nursing Research, building an Evidence-Based Practice 4th Edition*. St. Louis, Missouri: Saunders.
- Harris, M. & Taylor, G. (2008). *Medical Statistics Made Easy, 2nd Edition*. Oxfordshire: Scion Publishing



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