DEPARTMENT OF OPHTHALMOLOGY

FACULTY OF MEDICINE PADJADJARAN UNIVERSITY

NATIONAL EYE CENTER CICENDO EYE HOSPITAL BANDUNG

Paper	: Sampling Methods
Presenter	: Degiana Syabdini Edwiza
Supervisor	: Nina Ratnaningsih, MD

Has been reviewed and approved

by Supervisor of Community Ophthalmology Unit

Nina Ratnaningsih, MD

I. Introduction

Sample selection is a vital step when designing any study and can determine whether research questions will be answered. Good sample selection and appropriate sample size strengthen a study, protecting valuable time, money and resources. Sampling is a method that allows researchers to infer information about a population based on results from a subset of the population, without having to investigate every individual. Reducing the number of individuals in a study reduces the cost and workload, and may make it easier to obtain high quality information, but this has to be balanced against having a large enough sample size with enough power to detect a true association. This paper aim to explain about population, sample, and the sampling methods.[1,2]

II. Sampling Process Steps

The process through which a sample is extracted from a population is called as sampling. In investigation it is impossible to assess every single element of a population so a group of people (smaller in number than the population) is selected for the assessment. If it does then the sample/s should represent the population for inferences to be made. The more the sample is representative of the population, the higher is the accuracy of the inferences and better are the results generalizable. The sampling process contain of several stages; defining the population of concern, select a sampling frame (a set of items or events possible to measure), choose sampling methods for selecting items or events from the frame, determine the sample size, data collection and reviewing the sampling process. Sampling process may encounter the problem of systematic errors and sampling biases.[1–4]

2.1. Define Target Population

The first stage in the sampling process is to clearly define target population. Target population refers to all the members who meet the particular criterion specified for a research investigation. A single entity of any given population which is not decomposable further is called as an element. An element may be an individual, a

household, a factory, a market place, a school, etc. For example; all institutionalized elderly with Alzheimer's, all people with AIDS, all low birth weight infants, all school-age children with asthma, all pregnant teens. Accesible population is the portion of the population to which the researcher has reasonable access; may be a subset of the target population. Accesible population also mentioned as study population may be limited to region, state, city, county, or institution.[3–5]

What a population is going to be depends on the nature of investigation. A population may be homogenous or heterogeneous. A population is said to be homogenous when its every element is similar to each other in all aspects. A population is said to be heterogeneous when its elements are not similar to each other in all aspects.[1,3,5]

2.2. Select Sampling Frame

A sample can be defined as a portion of elements selected from a population. The members of the sample are called as participants or subjects. The sample should be chosen carefully so that will draw conclusion valid for the whole population. Sampling is the process of selecting a group of people, events, behaviors, or other elements with which to conduct a study.[3–5]

Sampling frame is a list of all the elements in the population from which the sample is drawn. Frame is needed so that everyone in the population is identified so they will have an equal opportunity for selection as a subject (element). The sampling frame must be representative of the population.[2–5]

2.3. Sampling Methods

In general, sampling methods can be divided into two types; probability or random sampling and non- probability or non- random sampling. Before choosing specific type of sampling technique, it is needed to decide broad sampling technique. Figure 1 shows the various types of sampling techniques.[2,3,6]

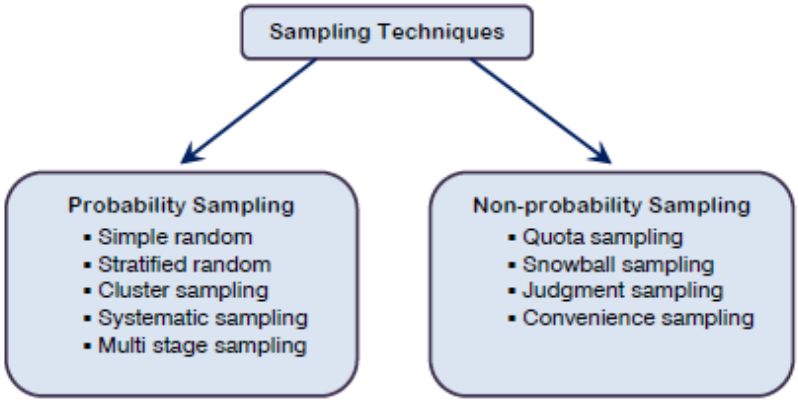

Figure 2.1. Sampling Techniques
Source: Taherdoost[2]

2.3.1. Probability Sampling

Probability sampling is also called as random sampling or representative sampling. Probability sampling means that every elements in the population has an equal chance of being selected in the sample, eliminating the possibility of sample selection bias. These techniques need population to be very precisely defined. These techniques cannot be used for the population that is too general a category found almost everywhere in the world.[2,3]

The advantage of this techniques; reduces the chance of systematic errors, minimize the chance of sampling biases, a better representative sample is produced and inferences drawn from sample are generalisable to the population. Disadvantage of the techniques includes requires a lot of effort, consuming a lot of time, and expensive.[3,6]

2.3.1.1. Simple Random Sampling

Applicable when population is small, homogeneous & readily available. All subsets of the frame are given an equal probability. Each element of the frame thus has an equal probability of selection. It provides for greatest number of possible samples. This is done by assigning a number to each unit in the sampling frame. A table of random number or lottery system is used to determine which units are to be selected. Other

methods may be the use of any random table generated through computer or any other resource.[2,3,6]

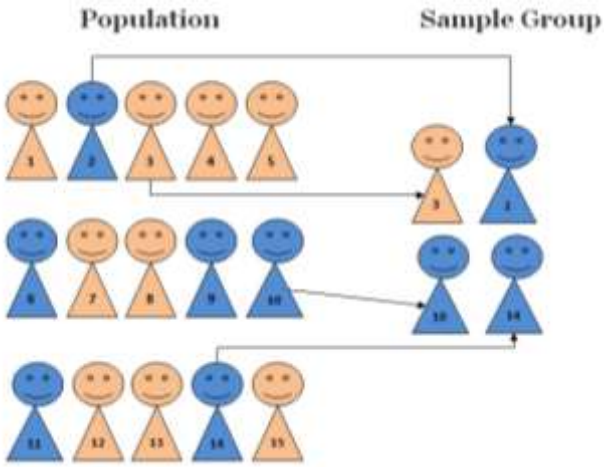

Figure 2.2. Simple Random Sampling
Source: Dudovsky[7]

2.3.1.2. Systematic Sampling

This type of sampling is also used for homogenous population. It is a bit different from simple random sampling. Unlike simple random sampling, there is not an equal probability of every element been included. In this type of sampling the elements are selected at a regular interval. Systematic sampling is where every nth case after a random start is selected. For example, if surveying a sample of consumers, every 5th consumer may be selected from your sample. The advantage of this sampling technique is its simplicity. Thus the regularity and uniformity in selection makes the sampling systematic.[2,3,6]

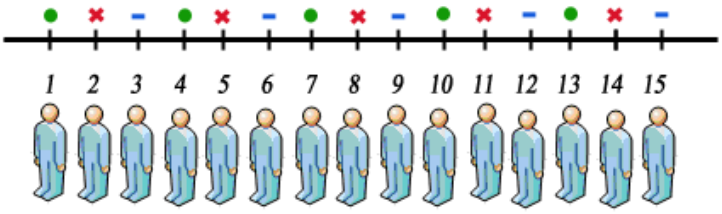

Figure 2.3. Sytematic Sampling
Source: Doduvsky[8]

2.3.1.3. Stratified Random Sampling

This type of sampling method is used when population is heterogeneous. Stratified sampling is where the population is divided into strata (or subgroups) and a random sample is taken from each subgroup. A subgroup is a natural set of items. Subgroups might be based on company size, gender or occupation (to name but a few). Stratified sampling is often used where there is a great deal of variation within a population. Its purpose is to ensure that every stratum is adequately represented.[2,4]

Accordingly, application of stratified sampling method involves dividing population into different subgroups (strata) and selecting subjects from each strata in a proportionate manner. The table below illustrates simplistic example where sample group of 10 respondents are selected by dividing population into male and female strata in order to achieve equal representation of both genders in the sample group.[2,3,9]

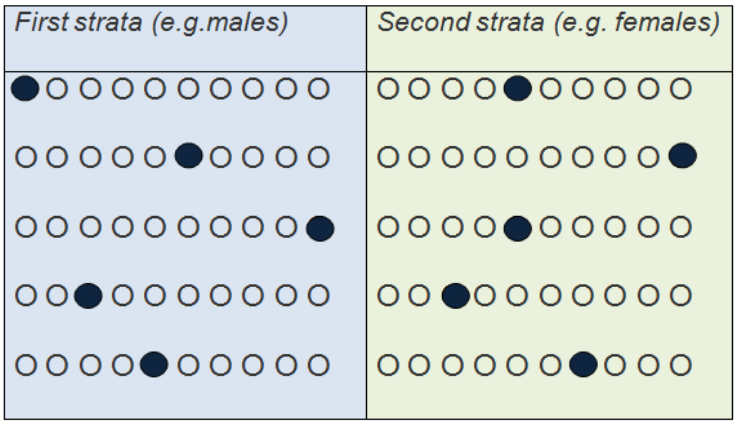

Figure 2.4. Stratified Random Sampling
Source: Dudovsky[9]

2.3.1.4. Cluster Sampling

Cluster sampling is where the whole population is divided into clusters or groups. Subsequently, a random sample is taken from these clusters, all of which are used in the final sample. Cluster sampling is advantageous for those researchers whose subjects are fragmented over large geographical areas as it saves time and money. The stages to cluster sampling can be summarized as follows; choose cluster grouping for sampling

frame, such as type of company or geographical region, number each of the clusters, select sample using random sampling. First of all the population is divided into clusters. The clusters are selected randomly using simple random or systematic random sampling techniques. The selected clusters are visited. All the elements (may be individuals, households, schools, markets etc. depending on the nature of investigation) within the selected clusters are investigated.[2,3]

2.3.1.5. Multistage Sampling

Multi-stage sampling is a process of moving from a broad to a narrow sample, using a step by step process. It is a sampling technique where two or more probability techniques are combined. It is used when the elements of population are spread over a wide geographical region and it is not possible to obtain a representative sample with only one aforementioned technique. It can be described as sampling within the sample. The final unit or element of population which is used in investigation is obtained after sampling at several stages.[2,3,10]

2.3.2. Non-probability Sampling

In non-random or non-probability sampling, the sampling technique is not random; therefore, all members of the population do not have an equal chance of being selected for recruitment into the study. Non probability sampling is often associated with case study research design and qualitative research. Case studies tend to focus on small samples and are intended to examine a real life phenomenon, not to make statistical inferences in relation to the wider population. A sample of participants or cases does not need to be representative, or random, but a clear rationale is needed for the inclusion of some cases or individuals rather than others. The majority of non-probability sampling techniques include an element of subjective judgement. Non-probability sampling is the most helpful for exploratory stages of studies such as a pilot survey.[2,3,11]

2.3.2.1. Quota Sampling

This type of sampling method is used when population is heterogeneous i.e. every element of population does not matches all the characteristics of the predefined criteria. Instead the elements differ from one another on a characteristic. So the sub groups are formed that are homogenous i.e. all the elements within a group contains same kind of characteristics. The topic and nature of the investigation tells on what criterion quota is to be set. The main difference between quota and stratified sampling can be explained in a way that in quota sampling researchers use non-random sampling methods to gather data from one stratum until the required quota fixed by the researcher is fulfilled.[2,3,11]

2.3.2.2. Snowball Sampling

Snowball sampling is also called as chain sampling. One element of the population is approached at a time and then is asked to refer the investigator to the other elements of the population. This sampling method that uses a few cases to help encourage other cases to take part in the study, thereby increasing sample size. This approach is most applicable in small populations that are difficult to access due to their closed nature, e.g. secret societies and inaccessible professions.[2,3]

2.3.2.3. Judgement Sampling

This methods also called purposive sampling. Judgmental sampling is a strategy in which particular settings persons or events are selected deliberately in order to provide important information that cannot be obtained from other choices. The researcher chooses the sample based on who they think would be appropriate for the study. This is used primarily when there is a limited number of people that have expertise in the area being researched. In purposive sampling the sample is approached having a prior purpose in mind. The criteria of the elements who are to include in the study is predefined.[2,3]

2.3.2.4. Convenience Sampling

Convenience sampling is also called as accidental sampling or opportunity sampling. The researcher includes those participants who are easy or convenient to approach. The technique is useful where target population is defined in terms of very broad category. Typically, convenience sampling tends to be a favored sampling technique among students as it is inexpensive and an easy option compared to other sampling techniques. Convenience sampling often helps to overcome many of the limitations associated with research. For example, using friends or family as part of sample is easier than targeting unknown individuals.[2,3]

2.4. Determine Sample Size

General rule of sample size is to recruit sample as large as possible to increase the representativeness of the sample. Increased size decreases sampling error. Sample size calculation in quantitative research depends on a number of factors; research design, sampling method, the degree of precision required, the variability of the factors being investigated, the incidence of a particular variable in the population.

In order to generalize from a random sample and avoid sampling errors or biases, a random sample needs to be of adequate size. What is adequate depends on several issues which often confuse people doing surveys for the first time. This is because what is important here is not the proportion of the research population that gets sampled, but the absolute size of the sample selected relative to the complexity of the population, the aims of the researcher and the kinds of statistical manipulation that will be used in data analysis. As a general statement, the larger the sample the higher the likelihood that the findings will accurately reflect the population because larger samples have lower sampling error.

2.5. Data Collection

Once target population, sampling frame, sampling technique and sample size have been established, the next step is to collect data. Data collection is a process of

collecting information from all the relevant sources to find answers to the research problem, test the hypothesis and evaluate the outcomes. Data collection methods can be divided into two categories: secondary methods of data collection and primary methods of data collection.[2]

III. Conclusion

The use of an appropriate sampling technique is very important to make a research project beneficial, meaningful and successful. As mentioned, there are two types of sampling methods generally; probability sampling and non-probability sampling. Each of these methods includes different types of techniques of sampling. Probability Sampling includes Simple random, Stratified random, Cluster sampling, Systematic sampling and Multi stage sampling. Non-probability Sampling includes Quota sampling, Snowball sampling, Judgment sampling, and Convenience sampling.