Sampling In Research

In research terms a sample is a group of people, objects, or items that are taken from a larger population for measurement. The sample should be representative of the population to ensure that we can generalise the findings from the research sample to the population as a whole.

What is the purpose of sampling?

To draw conclusions about populations from samples, we must use inferential statistics, to enable us to determine a population's characteristics by directly observing only a portion (or sample) of the population. We obtain a sample of the population for many reasons as it is usually not practical and almost never economical.

There would also be difficulties measuring whole populations because: -

- **The large size of many populations**
- **Inaccessibility of some of the population** - Some populations are so difficult to get access to that only a sample can be used. E.g. prisoners, people with severe mental illness, disaster survivors etc. The inaccessibility may be associated with cost or time or just access.
- **Destructiveness of the observation-** Sometimes the very act of observing the desired characteristic of the product destroys it for the intended use. Good examples of this occur in quality control. E.g. to determine the quality of a fuse and whether it is defective, it must be destroyed. Therefore if you tested all the fuses, all would be destroyed.
- **Accuracy and sampling** - A sample may be more accurate than the total study population. A badly identified population can provide less reliable information than a carefully obtained sample.

Sampling Error

A sample is expected to mirror the population from which it comes, however, there is no guarantee that any sample will be precisely representative of the population. Chance may dictate that a disproportionate number of untypical observations will be made.

Sampling error can make a sample unrepresentative of its population. Sampling error comprises the differences between the sample and the population that are due solely to the particular participants that have been selected.

The main cause of sampling error is

- Chance: That is the error that occurs just because of bad luck. This may result in untypical choices. Unusual units in a population do exist and there is always a possibility that an abnormally large number of them will be chosen. The main protection against this kind of error is to use a large enough sample.

Sampling bias - Sampling bias is a tendency to favour the selection of participants that have particular characteristics. Sampling bias is usually the result of a poor sampling plan. The most notable is the bias of non-response when for some reason some participants have no chance of appearing in the sample e.g. no internet access for completion of an online questionnaire.

There can be two causes of this type of bias.

- The wrong study population were selected
- The study population was all inclusive but the poor design of the study introduced the bias e.g. only one group within the study population agreed to participate in the study

Non-sampling error (measurement error) - A non-sampling error is an error that results solely from the manner in which the observations are made. It can occur whether the total study population or a sample is being used. It may either be produced by participants in the study or be an innocent by product of the sampling plans and procedures. The simplest example of a non-sampling error is inaccurate measurements due to malfunctioning instruments or poor procedures. These biased observations can be innocent but very devastating to the findings of the study.

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In studies observing personal characteristics, unintended errors may result from: -

- The manner in which the response is elicited
- The social desirability of the persons surveyed
- The purpose of the study
- The personal biases of the interviewer or survey writer

Checks need to be put in place to ensure this type of error is minimal

The interviewers effect - No two interviewers are alike and the same person may provide different answers to different interviewers. The manner in which a question is formulated can also result in inaccurate responses. Individuals tend to provide false answers to particular questions.

The respondent effect – Participants may deliberately give incorrect answers (for many reasons). This type of error is the most difficult to prevent because it results from out right deceit.
It is important to acknowledge that certain psychological factors induce incorrect responses and great care must be taken to design a study that minimizes their effect.

Knowing the study purpose - Knowing why a study is being conducted may create incorrect responses. If you are looking at a particular behaviour and the study participant knows what you are studding this may change that behaviour in the study participant. There are two ways of avoiding this

1. Change your study methodology
2. Ask a sequence of questions rather than just one question.

Induced bias Finally, it should be noted that the personal prejudices of either the designer of the study or the data collector may tend to induce bias. In designing a questionnaire, questions can be slanted in such a way that a particular response will be obtained even though it is inaccurate. To protect against induced bias, Share your questionnaire widely, particularly with your professional peer group and if available seek the advice of an individual trained in statistics and someone else who can look at the questionnaire objectively. Don't forget to Pilot the questionnaire this not only checks for ambiguities but also could give an indication of bias if the questions are slanted in a particular direction

SELECTING THE SAMPLE

The sampling error may be due to either bias or chance. The chance component (sometimes called random error) exists no matter how carefully the selection procedures are implemented, and the only way to minimize chance-sampling errors is to select a sufficiently large sample (sample size is discussed towards the end of this tutorial). Sampling bias on the other hand may be minimized by the wise choice of a sampling procedure.

TYPES OF SAMPLES

- **The convenience sample** – the research population is chosen out of convenience from a population for observation e.g. recruiting patients with a particular illness from support groups.
- **Purposeful sample –** A sample collected from information rich cases for in-depth study. The size and specific cases depend on the study purpose

  Types of Purposeful sampling;

  - Extreme and deviant case sampling
  - Intensity Sampling
  - Homogenous sampling
  - Typical case sampling
  - Stratified purposeful sampling
  - Snowball or chain sampling
  - Theory based sampling
  - Opportunistic sampling
  - Convenience sampling

- **The judgement sample –** The research population is obtained according to the discretion of someone who is familiar with the research populations relevant characteristics
- **The random sample –** A sample chosen at random from the research population using a recognised method

  Types of random samples;

  - Simple random sample
  - A systematic random sample
  - A stratified sample
  - A cluster sample

SAMPLE SIZE

Before deciding how large a sample should be, you have to define your study population (who you are including and excluding in your study). The question of how large a sample should be is a difficult one. Sample size can be determined by various constraints (funding available, the time constraints etc.) Sample size depends on

- The type of data analysis to be performed
- The desired precision of the estimates one wishes to achieve
- The kind and number of comparisons that will be made
- The number of variables that have to be examined simultaneously
- How heterogeneous the sampled population is.

Deciding on a sample size for qualitative inquiry can be even more difficult than quantitative because there are no definite rules to be followed. It will depend on what you want to know, the purpose of the inquiry, what is at stake, what will be useful, what will have credibility and what can be done with available time and resources.
You can choose to study one specific phenomenon in depth with a smaller sample size or a bigger sample size when seeking breadth.

Sample Size Determination

There are several approaches to determining your sample size and the most popular of these is the one that studies the power of a test of hypothesis. (Power calculation) Therefore to undertake this approach the researcher must be clear what the researcher is looking at and what it hope to find at the end of the study. That is research must have a hypothesis.
For projects, other than small-scale projects, it is advisable to employ the skills of a statistician to help you with your power calculation. This will ensure that your sample size is large enough to ensure that your results are statistically significant but not so big that you could have achieved the same results with a much smaller size.

For small scale studies
Once you have the information required to do your power calculation there are computer software packages (available free on the web) that you can use to determine your sample size.

For further information please contact the R&D Office.

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