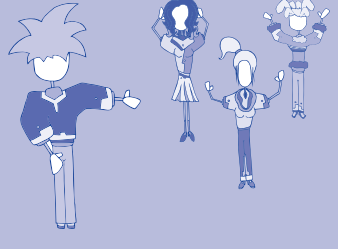
CHAPTER 6

Selecting Research Participants

OBJECTIVES

After studying this chapter, students should be able to

- Define the term *sampling frame*
- Describe the difference between random sampling and random assignment
- Define the term *probability sampling*
- Describe the difference between random, systematic, stratified, cluster, and multistage sampling
- Define the term *nonprobability sampling*
- Describe the difference between convenience, quota, and referral sampling
- Determine the best sampling method for a given research problem
- Describe the relationship between sample size and effect size
- Describe the relationship between statistical power and sample size



Have you ever received a phone call from someone who works for some research institute and wants a few minutes of your time? Have you received a questionnaire in the mail or online? Anyone come to your door wanting to know what kinds of products you prefer? We certainly have. How come they picked you, you might have wondered? In this chapter, we discuss methods researchers use to select the people they want to study.

Whether you are surveying people on the street or gathering participants for an experiment, you are selecting a sample from a population of potential participants. Probably the only research that is conducted on whole populations is carried out by government agencies when they conduct a census. We all know that only the government can afford to measure the entire population. The rest of us conduct our research on some sample from a population. We then use inferential statistics to make statements about the population based on the findings from our sample. One of the assumptions of inferential statistics is that the samples were randomly selected from the population. In the real world, this is almost never practiced. Indeed, most psychological research is based on first-year university students enrolled in introductory psychology courses. We knowingly violate this assumption because we are usually not interested in describing a population. Instead, our research goal is to test a theory. We do this by generating a testable research hypothesis, selecting participants, and conducting the study. Unless our theory somehow does not apply to the participants we have selected, we should be safe in using samples that are not randomly selected. On the other hand, if our research goal is to describe an entire population based on our sample (e.g., by surveying), then how we select our sample is critical. And if this is our goal, then the first step is to obtain a list of the population—a sampling frame.

The **sampling frame** is the list that is used to select from a population. For example, if you wanted to select students from a population of all the students at a university, your best sampling frame would be a list of all registered students. If you were interested in sampling from schools, then a list of all the schools in a certain district would be your sampling frame. Keep in mind that a sampling frame may not be complete. For example, a telephone directory will not include households with unlisted numbers or people without phones. Also, when a sampling frame exists, its use may be restricted. For example, it may be that the registrar's office will not allow access to student information. Finally, there are many populations for which a sampling frame simply does not exist.

SAMPLING METHODS

The various approaches to sampling can be broken down into two groups—namely, (1) probability and (2) nonprobability sampling.

Probability Sampling

These techniques are termed **probability sampling techniques** because you can specify the probability that a participant will be selected from a population. By obtaining your sample with probability techniques, you can be reasonably confident that your sample is representative of the population. At the very least, your selection procedure could be replicated by others to obtain similar samples.

Random Sampling

Random sampling is a procedure whereby a sample is drawn such that each member of the population has an equal probability of being included in that sample. The probability

that any one individual will be included in the sample is 1 divided by the size of the population i.e., $\frac{1}{\text{population size}}$. If we had a small population, we could put each member's name in a hat, shake it up, and draw out the number of names we need for our sample. Clearly, if our population is large, this is not going to work. Many statistics texts have a table of random numbers in the appendix. This table can be used to select the members of a sample from the population. Although few researchers use this procedure, many statistical techniques are based on the assumption that sampling has been random. As we discussed previously, this is not really a huge problem for social science researchers who are typically testing theories, not generalizing to entire populations. Our students often have difficulty distinguishing between random sampling or random selection of participants and random assignment of participants to groups. As we just said, random sampling rarely happens in psychological research, and this is not a huge problem, but random assignment of participants to groups is a very common procedure and is an important assumption of several statistical procedures. **Random assignment** means that participants have been independently assigned to groups. Imagine that we have selected 40 participants for a two-group experiment. We could use a table of random numbers to assign 20 participants to the experimental group and 20 to a control group. This would be an example of random assignment of participants to conditions. In Chapter 7, we will discuss experimental designs where random assignment will be used to create the groups in a study. Figure 6.1 illustrates the difference between random selection and random assignment.

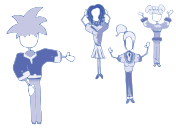
Systematic Sampling

Suppose we have a list of all the social workers employed by our city, 600 in all. We could obtain a sample of 100 by selecting every sixth person on the list (i.e., 600 divided by 100 = 6) (see Figure 6.2). The probability that any person will be included in this sample is 1 in 6. When using **systematic sampling**, be sure that the organization of your list cannot bias your sample. Imagine if you were to select every second person from a list of married couples that were organized man, woman, man, woman!

CONCEPTUAL EXERCISE 6A

A researcher randomly selects and telephones 250 homes listed in a city phone book and conducts a survey.

What is the sampling frame?



Stratified Sampling

Consider the example above where we selected every sixth social worker on our list. Imagine we were gathering opinions about government support for social workers. We might think that social workers with different amounts of experience in the field might have different opinions about this issue. One way to get a fairer assessment of the workers'

FIGURE 6.1 Random Selection and Random Assignment

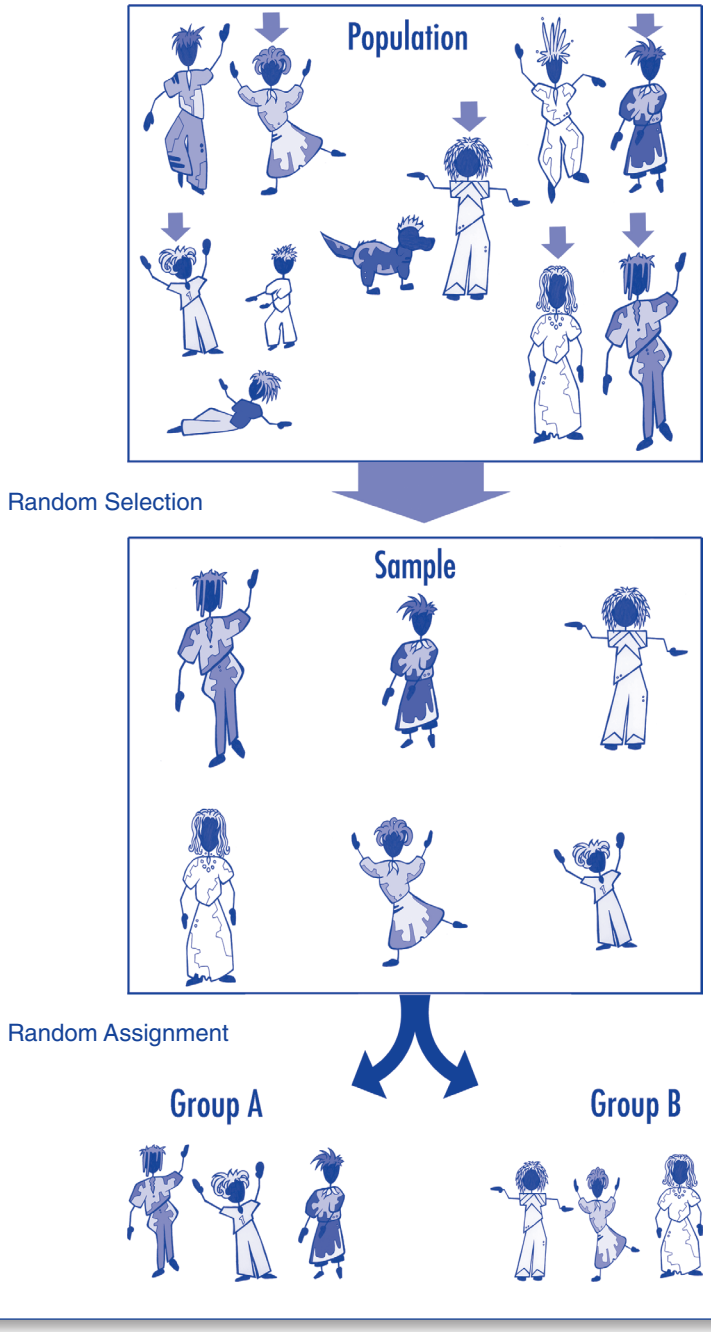


FIGURE 6.2 Systematic Sampling

opinions about this issue would be to stratify the sample by length of experience. Suppose you learn that 20% of the social workers in this population have 10 years or more of experience, 40% have 5 to 10 years, and 40% have less than 5 years of experience. With **stratified sampling**, you could randomly select 20% of your sample from the most experienced group (your first stratum) and 40% from the other two groups (or strata), respectively (see Figure 6.3). In this way, we guarantee that our sample reflects the numerical composition of the social worker population by purposely selecting from each stratum.

Cluster Sampling

What if you do not have a list of the members of your population? Perhaps a list of all social workers in your city is simply not available. You could identify all the agencies in your city employing social workers and randomly select a number of agencies, called *clusters*, for your sample (see Figure 6.4). You would include all the social workers in each agency/cluster in your sample.

Multistage Sampling

Cluster sampling is often done in multiple stages, going from larger to smaller clusters. Imagine that the city in which you are conducting your social work research is huge. You could begin by identifying boroughs or wards of your city as large clusters and randomly

FIGURE 6.3 Stratified Sampling

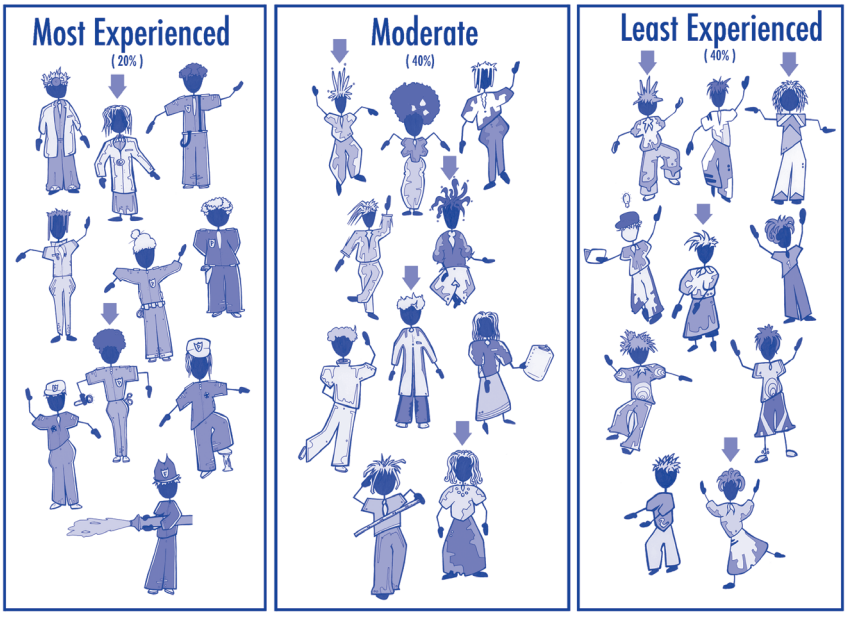
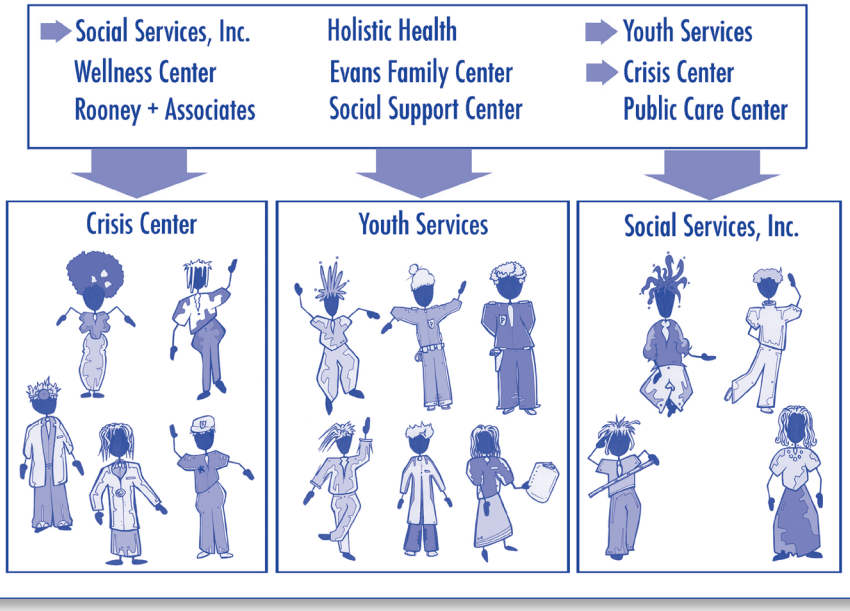


FIGURE 6.4 Cluster Sampling



select a number of those clusters. Then, within each borough/ward cluster you have chosen, you would randomly select a number of smaller clusters, or agencies, to include in your sample. Cluster sampling is a great way of obtaining a random sample when you do not have access to a list of all members of the population.

The above probability **sampling methods** are preferred by researchers but are not always practical. Nonprobability sampling methods are easier to use and often cheaper to carry out. No effort is made to ensure that the sample reflects the characteristics of the population.

CONCEPTUAL EXERCISE 6B

A researcher is interested in maximum-security inmates. What sampling procedure is she using in each of the following?

1. She obtains a list of all inmates in maximum-security prisons in the United States and selects every 50th name.
2. She groups inmates by type of crime, determines the percentage of the total in each crime category, and uses that to randomly select a representative proportion from each group.
3. She groups maximum-security prisons by state, randomly selects 10 states, and, from those 10, randomly selects three prisons. She includes all the inmates in those three prisons in her sample.

Nonprobability Sampling

These techniques are called **nonprobability sampling techniques** because it is impossible to specify the probability of selecting any one individual. You cannot say that everyone in the population has an equal chance of being selected because you do not know the probability of selection. This is important because it means that your sample may or may not be representative of the population, and this can influence the external validity of your study. This is not usually considered a problem in hypothesis testing, where our primary goal is not to describe a population but to test the prediction of a theory.

Convenience Sampling

Have you ever been approached by someone at the mall with a survey? We have. This approach of grabbing whoever is available is called **convenience sampling** (see Figure 6.5). You might be surprised to learn that convenience sampling is the most commonly used procedure in psychology research. Psychology researchers typically obtain their samples from introductory psychology classes. Why? Because it is convenient. The sample frame then is introductory psychology students.

When students do research projects, they usually just walk around campus and ask people to participate because that too is convenient. The sample frame here is people on

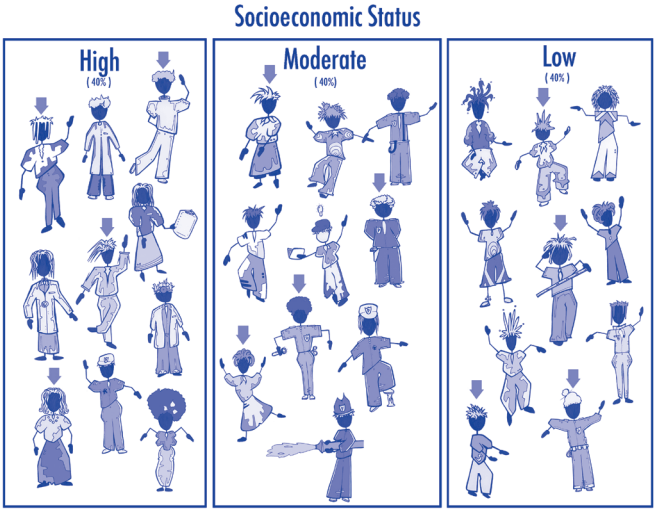
FIGURE 6.5 Convenience Sampling

campus. Although you might find this a bit peculiar, it is very common. The notion is that university students are fairly representative of young people at large. Of course, in some respects this is not true. University students may differ from the population in a number of ways; they may be more intelligent, have a higher socioeconomic status, and perhaps come from more supportive families. But remember, most psychological research is about investigating the relationships between manipulated variables and behavior, not about describing the characteristics of the population. As long as the variables in your study are not influenced by these biases, the research is probably valid. Even so, we need to be cautious in generalizing the results to populations that may differ from our sampled population. Convenience sampling is not appropriate for all research, of course. If you want to describe the attitudes of Americans about free trade, you should not just sample introductory psychology students. In descriptive research, it is critical that your sample is representative of the population, and you'll probably want to use a probability sampling technique.

Quota Sampling

Quota sampling is like convenience sampling, but the goal is to select participants with particular characteristics until you have enough. This would be used, for example, if you want an equal number of Black, White, and Asian participants in your sample. Or perhaps you have identified the population in terms of socioeconomic status, and you want to make sure that you have equal numbers of each socioeconomic status category in your sample (see Figure 6.6). This is a nonprobability analog to stratified random sampling.

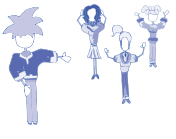
FIGURE 6.6 Quota Sampling



Referral Sampling

If the population you are interested in is difficult to locate, then once you have found one individual, you could ask him or her to refer others to you. This procedure is sometimes called *snowball sampling* because one participant tells his or her friends, and they tell their friends, and so on, and so on (see Figure 6.7). Let's say that you are interested in studying factors that prevent sex-trade workers from leaving the street. Obviously, you are not going to obtain a sampling frame, but a **referral sampling** method makes perfect sense.

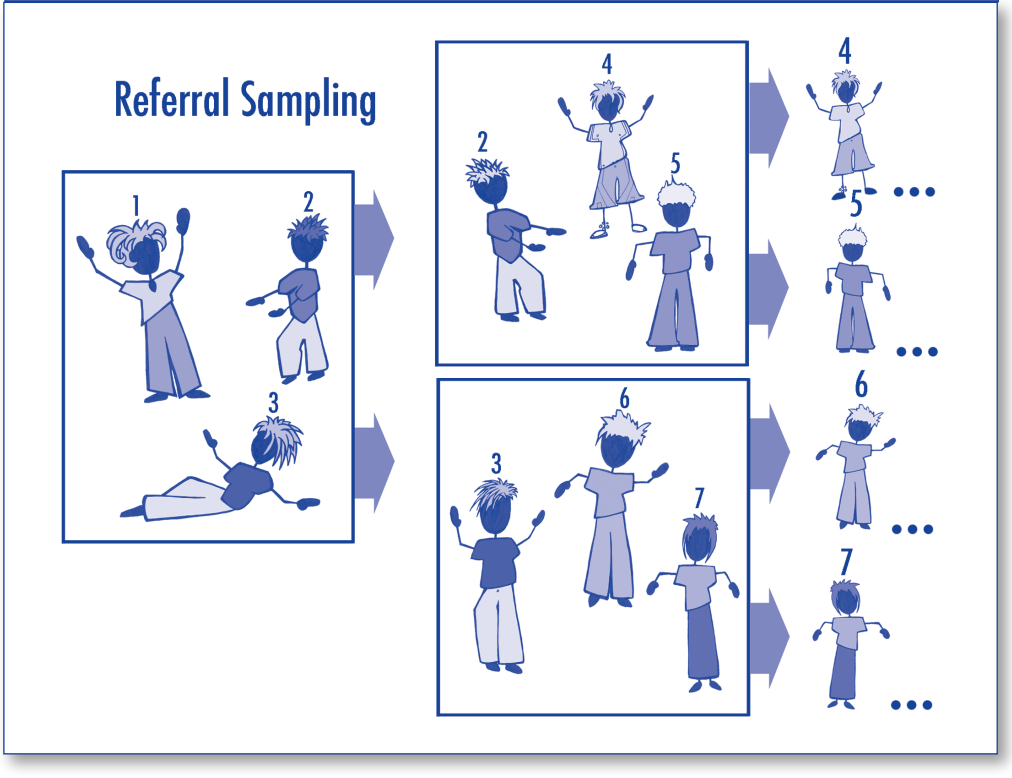
CONCEPTUAL EXERCISE 6C



A few years ago, we conducted a study trying to determine if technology enhanced learning outcomes in the teaching of psychology.

1. Had we identified all psychology classes and randomly selected four classes to use, what type of sampling would we have used?
2. We did not do that, however. We used the classes we were assigned to teach. What sampling method did we use?

FIGURE 6.7 Referral Sampling



SAMPLE AND EFFECT SIZE

Students always ask, "How many participants do I need?"

This depends on the power of their statistic. Parametric statistics such as the *t* test and analysis of variance (ANOVA) have a great deal of power, but chi-square, a nonparametric procedure, has relatively low power. Consequently, you will need a much larger sample if you are using chi-square.

Your sample size will also depend on your research design. If you want to perform a number of statistical comparisons, you will need a larger sample. For example, if your study has two independent variables, each with three levels, and you also want to compare women and men, you may have $3 \times 3 \times 2 = 18$ groups (three levels of the first independent variable × three levels of the second independent variable × two sexes); with only 10 participants in each group, you can do the math! Similarly, if your chi-square test has many categories, you will need a larger sample.

Students often report that a significant finding might have been more significant if the samples were larger. This is not necessarily the case. We need to consider the **size of the**

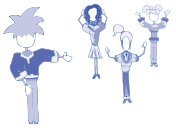
effect. If the relationship between the manipulated variable and the behavior was strong and control was tight, then a significant result might be found with quite small samples. In other words, effect size was large. On the other hand, if your manipulated variable has a subtle effect on the dependent variable, then you will require a larger sample to achieve statistical significance.

With larger samples, greater variability in the data may still lead to a significant result. This is why larger samples are used in field research, where we typically have less control than in the laboratory. A larger sample can compensate for greater variability.

The weaker the manipulation and the weaker the experimental control, the larger the samples must be for significance to be reached. In other words, when the effect size is small, larger samples are needed. When it is large, smaller samples are adequate. It is a bit of a trade-off, isn't it?

FYI

Many people think that sample size in a survey, for example, should be a percentage of the population. This is not true. A population of 2,000 and a population of 20,000 could be described as accurately with the same sample size. The important factor is that your sample is representative of the population you want to describe.



POWER REVISITED

One way to increase power is to increase the number of participants in your sample. Imagine that you have collected your data and calculated your statistics, only to find that your results only approach statistical significance. Perhaps your statistic has a p value of .06. It is not statistically significant at an alpha level of .05! What would you do? You do not want to make a Type II error and fail to reject a false null hypothesis! At the very least, you should replicate your study with a larger sample size. Kraemer (1987) provides methods for determining sample size.

We have discussed various sampling methods in this chapter. When you find yourself wondering which method to use, consider what all researchers consider when they ponder the same question: How much time do I have? How much money do I have? How much help can I get? Although the nature of the research question often dictates the best method, let's face it: Time and money must be taken into account. Few researchers have unlimited resources, and certainly, it is a rare student who does.

CHAPTER SUMMARY

Measuring entire populations is rarely possible in social science research. Rather, researchers study *samples* selected from *populations*. *Sampling methods* are techniques for

selecting samples from populations. The *sampling frame* is a list of the population from which the sample is drawn.

Probability sampling techniques are methods where the probability that a participant will be selected for inclusion in the sample is known. *Random sampling* is a procedure for selecting participants whereby each participant has an equal probability of being included in the sample. *Random assignment* of participants requires that the participants be independently assigned to groups. In *systematic sampling*, the population size is divided by your sample size to provide you with a number, *k*, for example; then, from a random starting point, you select every *k*th individual. For example, if your population size was 2,000 and you wanted a sample of 100, you would select every 20th individual. In *stratified sampling*, the population is divided into strata based on some population characteristic, and participants are randomly selected from each stratum. This ensures that each stratum is proportionally represented in the sample. *Cluster sampling* can be used when a population list is not available and researchers simply identify a number of clusters or groups and include all participants in the cluster in the sample. **Multistage sampling** is a cluster technique where smaller clusters are randomly selected from larger clusters previously randomly selected.

Nonprobability sampling methods are easier to use than probability sampling methods but do not provide any way of estimating the probability that an individual in the population will be included in the sample. *Convenience sampling* is the term used when we select any participant who is readily available. When we choose easily available participants who fit a particular criterion, we are using *quota sampling*. *Referral sampling* involves including participants in the sample who have been referred by other participants.

Determining how many participants are needed in a sample depends on several variables, including the *power* of the statistic, the *research design*, the *size of the effect*, and the variability of the data.

CHAPTER RESOURCES

ANSWERS TO CONCEPTUAL EXERCISES

Conceptual Exercise 6A

The sampling frame is the numbers listed in the phone book.

Conceptual Exercise 6B

1. Systematic
2. Stratified
3. Multistage

Conceptual Exercise 6C

1. Cluster sampling
2. Convenience sampling

FAQ

Q1: I just asked people in my class and people in the cafeteria to participate. What kind of sampling procedure is that?

A1: This haphazard method of selection is called convenience sampling.

Q2: I heard that I need more participants if I'm doing a chi-square analysis compared with a *t* test. Is that true?

A2: This is true. For both tests, the number of participants you will need depends on the size of your effect, but generally, the chi-square test is less powerful than a *t* test. A statistically significant *t* test depends on the difference between your group means and the variability within your groups. Although increasing your sample size will probably have no effect on your means, it will decrease your variability. However, in the case of chi-square, statistical significance depends entirely on the distribution of your measures and the number of participants. Even with a large effect size, it is difficult to get statistical significance with a small sample size.

Q3: How many participants is enough?

A3: There is no easy answer to this question because sample size is only one of a number of factors that influence your statistical power (your ability to reject a false null hypothesis). Probably the best way to determine your sample size is to collect pilot data. These preliminary data will give you an idea of your effect size, and you can calculate your inferential statistic and substitute various sample sizes into the calculation to get an idea of how many participants you will need. For more information on determining sample size, see Kraemer (1987).

Q4: How can you tell if your sample is unbiased?

A4: The only way to be sure that your sample is representative of the population is to compare your results with those from the whole population. In other words, the only way to be *sure* is to measure the population and compare your sample statistics with the parameters of the population. Of course, you would never do this, and you do not have to. The purpose of probability sampling is to maximize the probability that your sample is representative. For example, in simple random sampling, everyone has an equal chance of being selected; therefore, there is no bias in selection.

Q5: What is the difference between random sampling and random assignment?

A5: Although these concepts sound similar, they are totally different. Random assignment refers to the method used to form your treatment groups in your study. For example, forming experimental and control groups by randomly assigning participants to one condition or the other is random assignment. Random selection refers to the method used to select your participants for the study. For example, you may use random selection to obtain 60 participants by randomly selecting names from a list of the population. Random assignment is used to form groups of participants who are similar. Random selection is used to obtain a sample that is representative of the population.

Q6: How does increasing my sample size increase the power of my statistic?

A6: For parametric tests such as *t* tests and ANOVA, when you increase your sample size, you decrease the error variability of your statistic, and that translates into a larger *t* or *F* statistic. In the case of nonparametric tests such as chi-square, a larger sample size makes it more likely that your obtained frequencies will be different from the expected frequencies that the null hypothesis would produce. With few participants, there is little difference between the frequency you expect and the frequency you obtain, and this translates into a smaller chi-square statistic.

Q7: Is it possible to have a sample that is too large?

A7: This does not sound reasonable, but it is possible to have a statistical test that is so powerful that you are able to get statistical significance when you have a very small effect size. The result is a research project that makes a mountain out of a trivial molehill.

CHAPTER EXERCISES

1. What is wrong with the statement "a large sample is always better than a small one"?
2. Why is sampling so important in survey research?
3. Much research in psychology is conducted on students from introductory psychology classes. Is this a problem? Does it matter what type of research is being conducted?
4. Amanda is doing a survey of student opinion on the legalization of same-sex marriage. She believes that students may have different views depending on their area of study and program year. What type of sampling procedure would you recommend she use?
5. Andrew wants to interview homeless people in his city. What type of sampling procedure should he use?
6. A group of students wants to investigate whether men or women are more likely to butt in in a line. They chose to observe lines at a local ski hill. What type of sampling procedure did they use? Is their procedure adequate?
7. You have been asked by your employer to survey the staff on their ideas of how a budget surplus should be spent. With more than 1,000 employees, you have decided to select only a sample. Describe how you might obtain your sample.
8. As part of your work in a community outreach center, you want to survey sex trade workers in your area. How would you obtain your sample?

CHAPTER PROJECTS

1. Locate a research article by using one of the sampling procedures (e.g., stratified sampling, referral sampling) as a search term. Describe how the sample was obtained and the researcher's rationale for choosing that technique.
2. Locate three research articles using a probability sampling procedure. Describe the sampling frame and the sampling procedure they used.

ANCILLARIES

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