CHAPTER 5

Sampling Methods

Does the sample represent the population?

OBJECTIVES

By the end of this chapter students will be able to:

- Compare and contrast probability and nonprobability sampling, and describe at least one example of each.
- Identify similarities and differences among simple random sampling, systematic sampling, stratified sampling, and cluster sampling.
- Identify sampling error, contrast it with sampling bias, and identify the effect of each.
- Explain why the central limit theorem is useful in statistics.
- Identify situations in which nonprobability sampling is utilized and what limits are created by doing so.
- Given a research proposal, compose inclusion and exclusion criteria.
- Evaluate sampling techniques' strengths and weaknesses in a current research article.

KEY TERMS

Cluster sampling
Probability sampling using a group or unit rather than an individual.

Convenience sampling
A form of nonprobability sampling that consists of collecting data from the group that is available.

Exclusion criteria
The list of characteristics that would eliminate a subject from being eligible to participate in a study.

Inclusion criteria
The list of characteristics a subject must have to be eligible to participate in a study.

Nonprobability sampling
Methods in which subjects do not have the same chance of being selected for participation (not randomized).

Probability sampling
Techniques in which the probability of selecting each subject is known (randomized).

Quota sampling
A form of nonprobability sampling in which you select the proportions of the sample for different subgroups, much the same as in stratified sampling but without random selection.

Sampling bias
A systematic error made in the sample selection that results in a nonrandom sample.

Sampling distribution
All the possible values of a statistic from all the possible samples of a given population.

Sampling error
Differences between the sample and the population that occur due to randomization or chance.

Sampling method
The processes employed to select the subjects for a sample from the population being studied.

Simple random sampling
Probability sampling in which every subject in a population has the same chance of being selected.

Stratified sampling
Probability sampling that divides the population into subsamples according to a characteristic of interest and then randomly selects the sample from these subgroups.

Systematic sampling
Probability sampling involving the selection of subjects according to a standardized rule.

SAMPLING METHODS

Let's look at the concepts of populations and samples. When you begin your nursing research, you develop a hypothesis that reflects what you think is occurring in a particular population. For example, your hypothesis might be: Men with heart disease die earlier than men without heart disease. Your population is the whole group that is of interest to you, in this case, all adult men. Although you are an amazing nurse researcher, measuring the life spans of all men is impossible. Instead, you decide to collect a representative sample of these men to study. To be representative of the population, the sample must reflect its important characteristics. For example, if 50% of adult men are over 60 years old, 50% of your sample should also be men over 60 years old. Your sample, then, is a group of subjects selected from the population for the purpose of conducting your research. Because your sample is representative, you can complete your study and then develop inferences about the impact of heart disease on the entire population of men from your sample of men.

The **sampling method** you will use consists of the processes of selecting the subjects for your sample from the population under study. Of the many kinds of sampling methods, the one you select depends a great deal on your population of interest and on the options available to you at the time. There are two main kinds of sampling methods: probability sampling and nonprobability sampling. Both methods are of value to researchers. Determining the best sampling method to utilize in a study involves determining the feasibility of the method, the best way to answer the research question, and the resources that are available to do so.

Probability Sampling

Probability sampling consists of techniques in which the probability of selecting each subject is known. Because this type of sampling requires the researcher to identify every member of the population, it is frequently not feasible with large populations. It can be accomplished in a number of ways, including simple random sampling, systematic sampling, stratified sampling, and cluster sampling. All of these methods of probability sampling involve randomization of some sort. That is a key idea in probability sampling.

Simple Random Sampling

With **simple random sampling**, every subject in a population has the same chance of being selected. Suppose you wish to determine the mean age of the nurses at your hospital. You could use a list of all hospital nurses ($n = 100$) and then *randomly* select 50 subjects from the list for your sample. As long as the selection is from all 100 nurses each time, the probability of selecting each individual is exactly the same (1/100). Although simple random sampling is ideal, it doesn't work without a limited and very well-defined population of interest.

Systematic Sampling

A similar approach, **systematic sampling**, involves *randomly* selecting your subjects according to a standardized rule. One way of doing this is to number the whole population again, pick a random starting point, and then select every *n*th person. For example, you might take the same list of 100 nurses from your hospital and randomly start with the 17th nurse on the list and then select every 9th one. When using this approach, you have to make sure the population list is not developed with any ranking order. For example, if your list is arranged by clinical track levels for each unit, the ninth person may fall into about the same track level consistently, and that may be an achievement related to age. Your sample would then not be representative of the population of nurses working at your hospital.

Stratified Sampling

Stratified sampling divides the population into subsamples according to a characteristic of interest and then *randomly* selects the sample from these subgroups. The purpose is to ensure representativeness of the characteristic. An example should make that clearer. You are still trying to determine the average age of the nurses in your hospital, but you know that how long the nurses have practiced is related to their age, and you want to make sure that your sample reflects this population characteristic. You are aware that 20% of the nurses have been practicing for 1 year or less, and the rest have more than 1 year of experience. You decide to use stratified random sampling to make sure your sample is representative of the population in terms of working experience. So you identify the nurses at the hospital with 1 year or less experience and *randomly* select 20% of your sample from this group and then *randomly* select 80% of your sample from the group of nurses who have more than 1 year of experience.

Cluster Sampling

Cluster sampling randomly selects a group or unit rather than an individual. It is used when it is difficult to find a list of the entire population. If, for example, you wanted to know the mean income of adults living in New York State, you may choose to select randomly four ZIP code areas, survey everyone over age 18 in each of those regions, and take a weighted-average score. Or if you wanted to know the mean age of nurses employed in hospitals in New York, you may decide to select randomly a sample of hospitals in New York (each hospital is a cluster or group) and then find out the age of all the nurses at those hospitals.

If that approach is too difficult, you can do two-staged cluster sampling. You would randomly select the four hospitals in New York, and then, rather than taking the age of each nurse at the cluster hospitals, you would again take a random sample of a group of nurses at each hospital. In effect, you randomly selected your clusters and then randomly selected your final sample from each of these clusters. Although less expensive than other methods, cluster sampling has its drawbacks in terms of statistics (greater variance), but it is sometimes a necessary approach (Pagano & Gauvreau, 1993).

Sampling Error versus Sampling Bias

No matter which random sampling technique you choose for your study, there will always be some **sampling error**, that is, some differences between the sample and the population that occur due to chance. Anytime you are examining a random sample and not the whole population, you will encounter some differences that are not under your control and that occur only because of randomization or chance. That is why inferences made from sample data about a population are always made as probability statements, not absolutes.

Sampling error is not the same as **sampling bias**, which is a systematic error made in the sample selection that results in a nonrandom sample. In the previous example, you decided to take a systematic sample from a list of nurses at your hospital to determine the mean number of years they worked at your hospital. Unfortunately, you did not realize that the list was arranged by clinical track levels for each unit. You chose to start at the beginning and sample every ninth person. Unfortunately, the ninth person fell in about the same track level consistently, and track levels are related to the number of years worked at the hospital. Your results had a significant amount of sampling bias and were not representative of the population of interest; therefore, your results should not be generalized to the original population.

Sampling Distributions

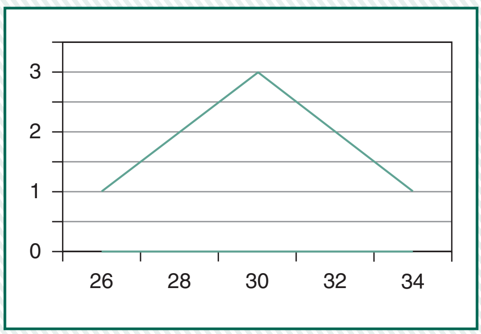
Talking about the benefits of random sampling can get a little statistical, but bear with me. Suppose you collect a random sample of nurses from a population of nurses, calculate the mean age, and keep doing this with other random samples of nurses from the same population. Eventually you will develop a distribution of the mean age. This is your **sampling distribution**, which consists of all the possible values of a statistic from all the possible samples of a given population (Corty, 2007). See **Table 5-1** and **Figure 5-1**.

The really useful thing about sampling distributions is that, if your sample size is large enough (usually at least greater than 30, some say 50), the distribution of the sample means is always normally distributed even if the original population is not (Sullivan, 2008). You can thank the central limit theorem. For the purposes of this text, you don't need to delve too much into the explanation. The takeaway message is that when a population is not distributed normally, you may need to use other methods to analyze it (see the Appendix for more information on working with small samples B).

TABLE 5-1 **Sampling Distribution for the Mean Age of Nurses**

Sample	Mean Age
One	28
Two	30
Three	30
Four	30
Five	28
Six	26
Seven	32
Eight	32
Nine	34

FIGURE 5-1 **Graph of Sample Distribution of Mean Age from Nine Samples.**



FROM THE STATISTICIAN *Brendan Heavey*

The Central Limit Theorem and Standardized Scores

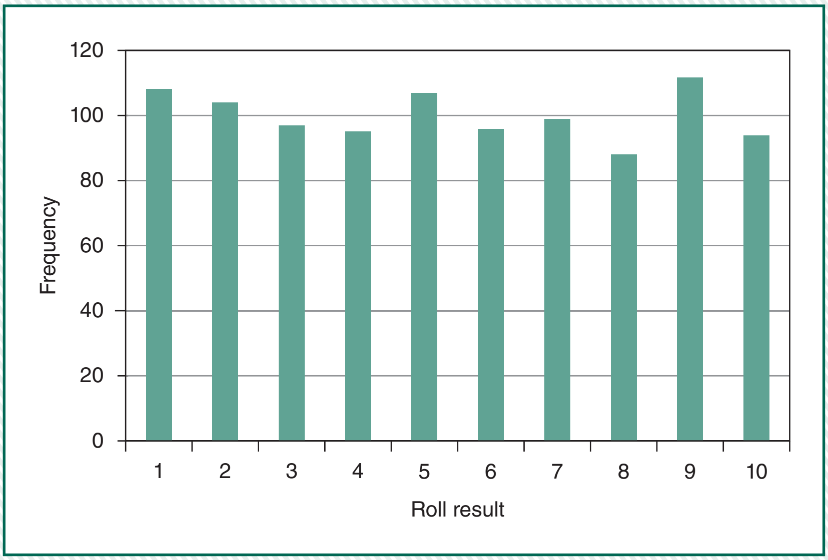
The central limit theorem is your friend. It makes a lot of analyses a lot simpler. It is a little tough to grasp, perhaps, but if you apply yourself just a little bit, you will be able to pick it up without a problem. Then you can apply it later anytime you want.

One way to understand the central limit theorem is to see what happens when you roll a bunch of 10-sided dice. You can apply this analogy to any random experiment that involves identically likely outcomes.

If you were to roll a 10-sided die 1,000 times and plot a histogram of your results, the graph could look something like the one in **Figure 5-2**. You could get a huge amount of possible bar charts, but they would all look something like the one in the figure. In fact, in the long run, this experiment would use what we call the *uniform distribution* because all cases are equally likely. If we were to roll a single die 1,000, 2,000, or even 10,000 times, all the bars would still look approximately the same.

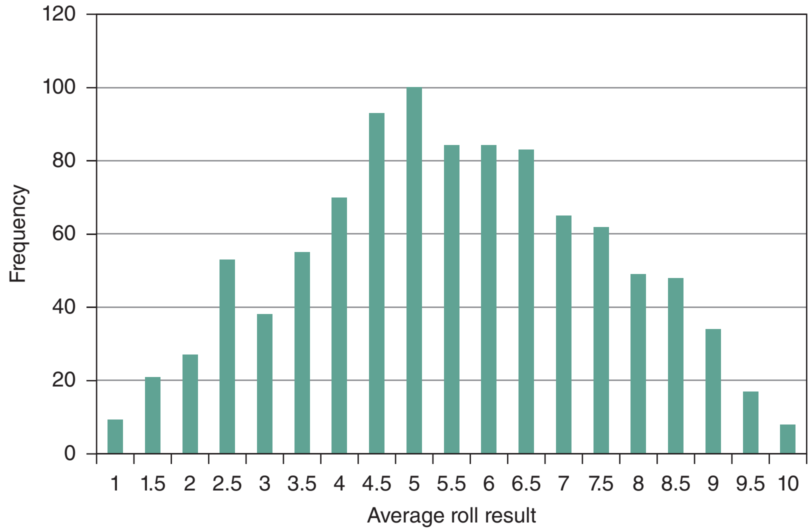
Now let's think about what would happen if you were to use two 10-sided dice, roll them 1,000 times, and calculate the average value shown on the faces. It just so happens I enjoy doing this sort of thing in my spare time, so I went ahead and did so. The result is shown in **Figure 5-3**. What do you notice? The bars tend to look more bell shaped, don't they? There were a

FIGURE 5-2 **Central Limit Theorem: One 10-Sided Die Rolled 1,000 Times.**



FROM THE STATISTICIAN *Brendan Heavey*

FIGURE 5-3 **Central Limit Theorem: Two 10-Sided Dice Rolled 1,000 Times and Averaged.**



whole lot more results between 4 and 6 than there were 1s and 10s. When you roll two dice, there are a lot more ways to get an average between 4 and 6 than there are to get a 1 or a 10. In fact, the only way to average a 1 is by having both dice come up with 1s.

Now let's look at what happens when you use six 10-sided dice and take the average. The bar graph in **Figure 5-4** looks even more bell shaped.

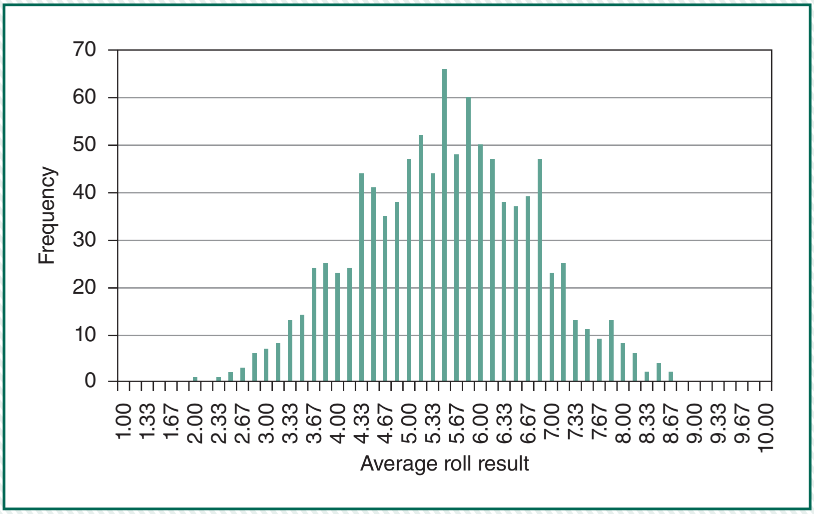
This progression demonstrates the central limit theorem. In fact, what the underlying distributions look like doesn't matter; you could use a 4-sided die, a 12-sided die, a 6-sided die, or a 20-sided die and plot the outcomes. As you take more and more samples, the resulting distribution of the averages of all the dice will tend to look more and more bell shaped.

Remember that we're talking about the mean value of all the rolls. You can't just roll a single die a million times and expect it to look more and more bell shaped as you increase the number of rolls. You have to look at the mean value across multiple experiments.

(*continues*)

FROM THE STATISTICIAN *Brendan Heavey*

FIGURE 5-4 **Central Limit Theorem: Six 10-Sided Dice Rolled 1,000 Times and Averaged.**



The central limit theorem is one of the most important in all of statistics. It can be proven, but it takes a whole lot of math that I'm sure you don't want to see. You can make some very important and very interesting deductions from this theorem, however. One is that when you take a sample in any experiment, the population variables can be distributed in any manner you want, but the mean of the sample measurement will always be distributed as a normal distribution in the long run. This becomes really important when you compare the means of two samples. (Curb your enthusiasm! I know I can't wait!)

NONPROBABILITY SAMPLING

The reality of research is that it has budgetary and time limits. In these situations, sometimes nonprobability sampling methods are necessary or simply more practical. **Nonprobability sampling** consists of methods in which subjects do *not* have the same chance of being selected for participation; it is *not randomized*. When you are reading nursing research, never assume a sample was randomly selected. You need to identify how the sample was selected before you can tell whether the claims that the researcher makes are valid or what their limitations may be.

Types of Nonprobability Sampling

Nonprobability sampling can be used in many different ways in both quantitative and qualitative research. Two of the most popular methods for quantitative research are convenience sampling and quota sampling, whereas qualitative research may employ network sampling or purposive sampling.

Convenience Sampling

The most popular form of nonprobability sampling in healthcare research is **convenience sampling**, which is simply collecting data from the available group. For example, suppose you were trying to determine the mean age of the nurses in your hospital. You go to the oncology unit and ask all the nurses working that shift their age. You would be taking a convenience sample. Convenience samples are usually relatively quick and inexpensive, but they may not be representative of the population and therefore may limit any inferences you may choose to make about the population.

Quota Sampling

In **quota sampling**, you select the proportions of the sample for different subgroups, as in stratified sampling. For example, if 50% of your population works the day shift, 30% works the evening shift, and 20% works the night shift, your sample will have those same proportions. I bet right now you are thinking, "But this doesn't seem to be different from stratified random sampling." Well, so far, you are right; nothing is different yet. The difference is after this point. Remember, if you need a final sample size of 100, with stratified random sampling, you would *randomly* select 50 subjects from day shift workers, 30 from evening shift workers, and 20 from night shift workers. Quota sampling, on the other hand, is nonprobability sampling, so it is *not* randomized. After you decide on the proportions of the sample, you collect subjects continuously until you have 50 day shift subjects, 30 evening shift subjects, and 20 night shift subjects.

Now suppose that you decide to collect the quota sample at 3:30 in the lobby of your hospital. Everyone who participates gets a free coffee coupon. Fifty day shift nurses participate on their way out, and 30 evening shift nurses participate on their way in. You have enrolled all your day and evening nurses but are still waiting for the night nurses. At 10:45 the night shift nurses start to come through the lobby. As you are surveying the night shift staffers, an evening nurse, ending her shift, comes over and volunteers to participate. You cannot include her because you already have your quota of evening shift nurses and are still collecting only night shift nurses. The evening shift nurse becomes irate because she really wants to be in your study (read "really wants the coffee"), and she calls several of her friends to come in and volunteer. (Nurses *will* do a lot for free coffee.) They, too, are upset because they were not working that day and were therefore never given the opportunity to participate. Because they worked the day and evening shifts, they are also not eligible to participate because you have already filled the quotas for these shifts.

You end up sitting in the lobby with several very upset day and evening nurses who don't understand why you can't let them participate, at the same time still asking the night shift nurses to join the study and giving them coffee. "The night shift gets everything!" the other nurses complain. Because you are exceptionally patient and have already had your extra coffee that day, you patiently explain that quota sampling does not give the same opportunity to everyone to participate. You are very sorry. You would love to give everyone free coffee, but you need only night nurses now. This is how quota sampling works. Once you have reached the quota for that particular group, no matter how many more subjects from that group arrive, you do not enroll them and collect data only from the groups for which you have not met your quota.

Of course, after such a stressful experience, you may also decide either to change your sampling method or to go to a different hospital to collect data next time. These nurses are intense!

Nonprobability Sampling in Qualitative Research

Many other nonprobability-based sampling methods are used more frequently with qualitative research. Network sampling, for example, utilizes the social networks of friends and families to gather information. This technique is frequently used when you need information about groups that hesitate to participate in research, such as youth gangs. Another technique, purposive sampling, includes subjects because they have particularly strong bases of information. You may decide to use network sampling to study youth gangs after you are able to gain the trust and support of a gang leader. She then refers other members of her gang to you, and you are able eventually to speak to a group of 10 youth gang members. You may then decide to collect a purposive sample (specific individuals are selected to participate because of the information they are able to contribute) and further study three of these young women because they are lifelong gang members and can give you the greatest insight into the characteristics and behaviors you are studying.

Inclusion and Exclusion Criteria

No matter which sampling method you select, as the researcher you need to develop sample inclusion and exclusion criteria.

- **Inclusion criteria** make up the list of characteristics a subject must have to be eligible to participate in your study. These criteria identify the target population and limit the generalizability of your study results to this population. For example, if you are studying the effect of taking a multivitamin on future prostate cancer development, the foremost inclusion criterion is male gender. (Only men have prostates, so it would be pointless to include women in this study.)
- **Exclusion criteria** are the criteria or characteristics that eliminate a subject from being eligible to participate in your study. Exclusion criteria frequently include the current or past presence of the outcome of interest. For example, in your study about the vitamin-mediated prevention of prostate cancer, having prostate cancer would be one of your exclusion criteria. If the subject already has or has had the disease, you can't determine whether the vitamin helps to prevent it.

Sample Size

We are going to spend some more time talking in detail about sample size in Chapter 7, but it is important to note that our sample collection method is only one aspect of ensuring we gather the information we are seeking in a study. Another critical piece is collecting the correct number of subjects for the purposes of your study. The larger your study, the better you will be able to find a difference that really exists. This is sometimes referred to as the power of a study. Larger samples make more powerful studies. Of course, larger samples cost more and can have other complicating factors, but generally speaking, researchers aim to enroll as many subjects as possible under the circumstances.

Summary

That was a lot of information to take in for one chapter, so take a deep breath and allow your brain to slow down. Let's highlight the main ideas.

A sampling method consists of the processes that help you pick the subjects for your sample from the population you are interested in studying. The two main kinds of sampling methods are probability sampling and nonprobability sampling. Probability sampling involves techniques in which the probability of selecting each subject is known; thus, subjects are selected randomly. Types of probability sampling include simple random sampling, systematic sampling, stratified sampling, and cluster sampling. Nonprobability sampling involves methods in which subjects do not have the same chance of being selected for participation. In other words, sampling is not randomized. Nonprobability sampling includes convenience sampling, quota sampling, network sampling, and purposive sampling.

When you are collecting samples, sampling error can occur; that is, some differences between the sample and the population should be expected to occur due to randomization or chance. Sampling bias can also occur, however; it is the result of a systematic error in the sample selection, rendering it nongeneralizable to the original population.

Finally, all research studies have inclusion and exclusion criteria. Inclusion criteria are characteristics that a subject must have to participate in your study. Exclusion criteria are the criteria or characteristics that eliminate a subject from being eligible to participate.

You are done with this chapter. Take a break. Drink some tea and unwind a bit. You've earned a break!

CHAPTER 5 REVIEW QUESTIONS

1. What is the difference between probability and nonprobability sampling?

2. Identify whether probability or nonprobability sampling is utilized for each entry in the following list:
    - Convenience sampling
    - Cluster sampling
    - Simple random sampling
    - Quota sampling
    - Systematic sampling
    - Stratified sampling

3. What is the difference between sampling error and sampling bias? Which one is very concerning to researchers?

Research Application

Questions 4–5: One study used a convenience sample drawn from clients utilizing two community-based obstetric offices in an area with lower socioeconomic status. The sample was drawn largely from the community surrounding the offices, and the findings may not be generalizable to this population or other populations that differ significantly from this sample.*

4. Why should a reader be careful about developing inferences about the population of interest from the article?

5. How could the researcher have designed this study differently so that developing inferences about the population of interest would be less of a concern?

6. Hemoglobin levels are usually 12–16 g/100 mL for women and 14–18 g/100 mL for men. If you have a sampling distribution of mean hemoglobin levels (collected from 60 hospitals) with a mean of 16 g/100 mL and a standard deviation of 2 g/100 mL, calculate the range of hemoglobin levels that would include 68% of your sample means.

7. What percentage of sample means would fall between 12 g/100 mL and 20 g/100 mL?

8. If one of the hospitals in your sample was a Veterans Affairs facility with 97% male patients, would you expect the mean hemoglobin level collected only from the patients at that hospital to be any different from those of other hospitals?

9. If one of the hospitals in your sample was the regional Women's and Children's Hospital, would you expect the mean hemoglobin level collected at that hospital to be different from that of the other hospitals?

10. You would like to compare the wait time at your clinic this year versus last year. Your electronic medical record database contains the check-in time and rooming time for all patients seen in the last 2 years. You import the data into your SPSS statistics program and program the computer to select randomly 500 patients seen last year and 500 patients seen this year. What type of sample is this? Is it a probability or nonprobability sampling method?

11. You decide to start again comparing the wait time at your clinic this year versus last year, this time programing SPSS to select every 14th patient each year. What type of sample is this? Is it a probability or nonprobability sample?

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12. A researcher examining drinking patterns in his county distributes his survey at a bar on the first Friday of three consecutive months. What type of sample is this? Is it a probability or nonprobability sample?

13. The researcher in Review Question 12 decides that he wants his sample of 200 to be 50% female and distributes his survey at the bar to the first 100 women who arrive and the first 100 men who arrive. This is what type of sample? Is it a probability or nonprobability sample?

14. You would like to know the average wait time of adult patients seen in federally funded health clinics in the United States. You randomly select 100 clinics and then collect the wait time for 100 randomly selected patient visits. What type of sample is this? Is it a probability or nonprobability sample?

15. You conduct a well-designed study involving a random sample. Your analysis shows this sample is normally distributed and representative of the population; however, the mean age in the sample is 29.4 years, and the mean age in the population is 30 years. What is this type of difference called, and what is the likely cause of the difference? Should the researcher be concerned?

16. A researcher wants to examine drinking patterns in men and women in bars in New York State. She randomly selects five bars and then randomly selects subjects at those bars to complete her surveys on four randomly selected weekends. However, she did not realize that two of the five bars selected were for gay men, and another bar was having a draft special for the football playoff games for three of the four weekends. Her sample ends up being 85% male, but the population who attends bars is only 65% male. Is this sample representative? Why or why not? Would this be an example of sample error or sample bias? Should the researcher be concerned?

Questions 17–20: You would like to ensure that your sample is representative of the racial mix seen in your population of interest. The population is 50% Asian, 20% African American, 20% Caucasian, and 10% other. You need a sample of 500 subjects. You program SPSS to select randomly 250 Asian subjects from your population, 100 African American subjects, 100 Caucasian subjects, and 50 subjects identified as other.

17. What type of sample is this? Is it a probability or nonprobability sample?

18. You are interested in how race may affect total cholesterol. Your study classifies race in the categories described above. What level of measurement is this variable?

19. What is your dependent variable?

20. Your sample is normally distributed with an average total cholesterol of 211 and a standard deviation of 7. In what range would you expect the total cholesterol to be for 68% of your sample?

Questions 21–25: A nurse researcher is studying the impact of social media usage on the quality of adolescent relationships. She identifies 22 teen subjects and asks about whom they contact on Facebook, via Twitter, and via text messaging. She then follows up with an interview with those who have the most contacts and examines these relationships further.

21. What is the independent variable in this study?

22. What is the dependent variable in this study?

23. If the quality of adolescent relationships is reported as poor, good, or excellent, what level variable is this?

24. Instead, the researcher asks these adolescents to rank the quality of their relationships on a scale of 0–10. What level of measurement would this variable be?

25. What type of sampling method is this? Is it probability or nonprobability sampling?

Questions 26–30: You conduct a well-designed study involving a random sample ($n = 84$). Age is measured in years. Your analysis shows that in this sample, age is normally distributed and representative of the population. The youngest subjects are 15 ($n = 2$), one subject is 16, and the oldest subject is 46 years old; the mean age is 29.4 years, and there is a standard deviation of 3 years.

26. What is the median age in this sample?

27. What age range would include 95% of the subjects in your sample?

28. What is the age range of the sample?

29. What percentage of your sample is 15 years of age or less?

30. If age is measured as 15–20 years, 25–35 years, and 35 years, what level of measurement is this variable?

31. If a variable is measured as eligible to vote and not eligible to vote, what level of measurement is this variable?

32. If you randomly select 250 individuals who are on a voter registration list and 72 report they will vote for an independent candidate, what percentage is planning to vote for an independent candidate?

Questions 33–35: You decide to interview all college athletic team captains at three state universities because of their direct knowledge of team initiation activities and hazing practices.

33. What type of sample is this? Is it a probability or nonprobability sampling method?

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34. Your subjects must have been team captains for at least 3 months, on a Division I university–affiliated sports team, who are eligible to play in the upcoming season. These subject characteristics are examples of what?

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35. Team captains currently on the injured or inactive list are not eligible to participate in the study. This is an example of what?

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36. A study examined the average daily activity level of children. Three observers recorded the activity level of 15 children each during the month of February in upstate New York. The children were all 6 to 9 years old. The observers reported that children are physically active for only 38 minutes a day (on average) and concluded that a public health intervention to increase the activity level of children was needed. What factors might concern you about this study and the researchers' conclusion?

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37. The observations in Review Questions 36 were all made between 10 a.m. and 3 p.m. on Mondays, Wednesdays, and Fridays. Do you think that is important to report in the study? Why? How might this information affect the results?

ANSWERS TO ODD-NUMBERED CHAPTER 5 REVIEW QUESTIONS

1. With probability sampling, the probability of selecting each subject is known and is the same. With nonprobability sampling, the subjects do not have the same chance of being selected.
3. Sampling error is random error due to chance. Systematic error results in a nonrandom sample and is very concerning to researchers.
5. A randomized sample improves representativeness and expands generalizability.
7. 95% (mean 16 $\pm$ 2 standard deviations)
9. Yes, hemoglobin levels are lower for women and children.
11. Systematic sample, probability sample
13. Convenience sample with quota sampling, nonprobability
15. A sampling error likely due to chance or randomization; the researcher does not have to be concerned.
17. Stratified, probability sample
19. Total cholesterol
21. Social media use

23. Ordinal
25. Network sampling, nonprobability
27. 23.4–35.4 years
29. 2/84 = 2.4%
31. Nominal
33. Purposeful sample, nonprobability sampling
35. Exclusion criteria
37. Yes, most children in the age group would be in school during this time and may not have the opportunity to be physically active until after they are done with school, which could bias the results; students' schedules may differ on Mondays, Wednesdays, and Fridays from the rest of the week; and so on.