Lesson 22: Evaluating Reports Based on Data from a Sample

Classwork

Exercises 1–5: Election Results

The following is part of an article that appeared in a newspaper:

> "With the election for governor still more than a year away, a new poll shows the race is already close. The Republican governor had 47%, and the Democratic challenger had 45% in a poll released Tuesday of 800 registered voters.
>
> 'That's within the poll's margin of error of 3.5 percentage points, making it essentially a tossup,' said the poll's director."

1. Why don't the two percentages add up to 100%?

2. What is meant by the margin of error of 3.5 percentage points?

3. Using the sample size of 800 and the proportion 0.47, calculate the margin of error associated with the estimate of the proportion of all registered voters who would vote for the Republican governor.

4. Why did the poll director say that the election is "essentially a tossup"?

5. If the sample size had been 2,500 registered voters, and the results stated 47% would vote for the Republican Governor and 45% said they would vote for the Democratic challenger, what would the margin of error have been? Could the director still say that the election was a tossup?
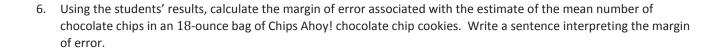
Exercises 6–8: Chocolate Chip Claim

The Nabisco Company claims that there are at least 1,000 chocolate chips in every 18-ounce bag of their Chips Ahoy! cookies. An article in a local newspaper reported the efforts of a group of students in their attempt to validate the Nabisco claim. The article reported that the students randomly selected 42 bags of cookies from local grocery stores and counted the number of chocolate chips in the cookies in each bag. The students found the sample mean was 1,261.6 chips, and the sample standard deviation was 117.6 chips. The article stated that the students' data supported the Nabisco Company claim.

6. Using the students' results, calculate the margin of error associated with the estimate of the mean number of chocolate chips in an 18-ounce bag of Chips Ahoy! chocolate chip cookies. Write a sentence interpreting the margin of error.

7. Do you agree that the student data supported the Nabisco Company claim? Explain.

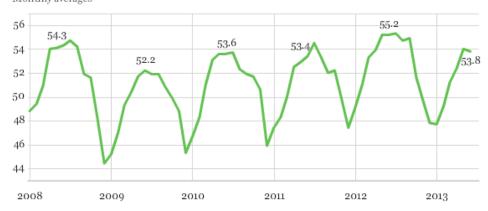8. Comment on the procedure that the students used to collect their data.

Exercises 9–15: Understanding a Poll

George Gallup founded the American Institute of Public Opinion (Gallup Poll) in 1935. The company is famous for its public opinion polls, which are conducted in the United States and other countries.

Gallup published the following graph in May 2013.

Percentage in U.S. Who Exercise for at Least 30 Minutes Three or More Days a Week
Monthly averages

April 2008-June 2013
Gallup-Healthways Well-Being Index

GALLUP

Source: http://www.gallup.com/poll/162194/americans-exercise-habits-worsen-slightly-2013.aspx

9. What percent of those surveyed said that they exercise at least 30 minutes three or more days a week at the start of 2013?

10. Describe the patterns that you observe in the graph.

11. Give some reasons why you think the graph follows the pattern that you described.

Following are the survey methods that Gallup used to collect the data:

> "Results are based on telephone interviews conducted as part of the Gallup-Healthways Well-Being Index survey June 1-30, 2013, with a random sample of 15,235 adults, aged 18 and older, living in all 50 U.S. states and the District of Columbia.

For results based on the total sample of national adults, one can say with 95% confidence that the maximum margin of sampling error is ± 1 percentage point."

12. Using the value of 0.538 for the proportion of those surveyed who said they exercise at least 30 minutes three or more days a week in the most recent poll, calculate the margin of error. How does your margin of error compare to the value reported by Gallup?

13. Interpret the phrase "margin of sampling error is ± 1 percentage point."

14. Why is it important that Gallup selects a random sample of adults?

15. If Gallup had used a random sample of 1,500, what would happen to the margin of error? Explain your answer.

> **Lesson Summary**
>
> ▪ The estimated margin of error when a sample proportion from a random sample is used to estimate a population proportion is $ME = 2\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$ where $\hat{p}$ is the sample proportion.
>
> ▪ The estimated margin of error when a sample mean from a random sample is used to estimate a population mean is $ME = 2\left(\frac{s}{\sqrt{n}}\right)$ where $\bar{x}$ is the sample mean.
>
> ▪ It is important to interpret margin of error in context.
>
> ▪ It is unlikely that the estimate of a population proportion or mean will be farther from the actual population value than the margin of error.

Problem Set

1. The British Medical Journal published a study whose objective was to investigate estimation of calorie content of meals from fast food restaurants. Below are the published results.

   Participants: 1,877 adults and 330 school age children visiting restaurants at dinnertime (evening meal) in 2010 and 2011; 1,178 adolescents visiting restaurants after school or at lunchtime in 2010 and 2011.

   Results: Among adults, adolescents, and school age children, the mean actual calorie content of meals was 836 calories (SD 465), 756 calories (SD 455), and 733 calories (SD 359), respectively. Compared with the actual figures, participants underestimated calorie content by means of 175 calories, 259 calories, and 175 calories, respectively.

   Source: http://www.bmj.com/content/346/bmj.f2907

   a. Calculate the margin of error associated with the estimate of the mean number of actual calories in the meals eaten by each of the groups: adults, adolescents, and school age children.
   b. Write a sentence interpreting the margin of error for the adult group.
   c. Explain why the margin of error for the estimate of the mean number of actual calories in meals eaten by adults is smaller than the margin of error of the mean number of actual calories in meals eaten by school age children.
   d. Write a conclusion that the researchers could draw from this study.

2. The Gallup organization published the following results from a poll that it conducted.

   "By their own admission, many young Americans, aged 18 to 29, say they spend too much time using the Internet (59%), their cell phones or smartphones (58%), and social media sites such as Facebook (48%). Americans' perceptions that they spend 'too much' time using each of these technologies decline with age. Conversely, older Americans are most likely to say they spend too much time watching television, and among all Americans, television is the most overused technology tested.

   Results are based on telephone interviews conducted as part of Gallup Daily tracking April 9-10, 2012, with a

random sample of 1,051 adults, aged 18 and older, living in all 50 U.S. states and the District of Columbia.

For results based on the total sample of national adults, one can say with 95% confidence that the maximum margin of sampling error is ± 4 percentage points."

Source: http://www.gallup.com/poll/153863/Young-Adults-Admit-Time-Cell-Phones-Web.aspx

a. Write a newspaper headline that would capture the main idea from the poll.

b. Use the phrase from the article "their cell phones or smartphones (58%), " to calculate the margin of error. Show your work.

c. How do your results compare with the margin of error stated in the article?

d. Interpret the statement "the margin of sampling error is ± 3 percentage points."

e. What would happen to the margin of error if Gallup had surveyed 100 people instead of the 1,051? The

3. Holiday Inn Resort Brand conducted the *Kid Classified* survey. 1,500 parents and children nationwide were interviewed via an online survey.

The results of the survey state:

"While many parents surveyed say they have some financial savings set aside specifically for vacation travel, **more than half of parents in the survey (52%) noted that saving enough money was the biggest challenge to planning a family vacation**, more so than coordination of family schedules (19%) or taking time off of work (12%)."

Source: http://www.lodgingmagazine.com/holiday-inn-resorts-catering-to-kids/

a. Calculate the margin of error associated with the estimate of the proportion of all parents who would say that saving enough money is the biggest challenge to planning a family vacation.

b. Write a sentence interpreting the margin of error.

c. Comment on how the survey was conducted.