

### Answers to Chapter Review Exercises P.19–P.28

- P.19** (a) Available data were used. No treatments were imposed in order to observe various responses.  
 (b) The effects of these other variables are mixed up with and cannot be separated from the effect of watching TV. This is known as confounding.
- P.20** Answers will vary. See the *Teacher's Solutions Manual* for a possible response.
- P.21** **Who?** The individuals are motor vehicles produced in 2004.  
**What?** The categorical variables are: make and model; vehicle type; and transmission type. The quantitative variables are: number of cylinders (integer count); city MPG (miles per gallon); and highway MPG (miles per gallon).  
**Why?** The data were compiled to compare fuel economy.  
**When, where, how,** and **by whom?** Answers will vary. See the listed Web site or the *Teacher's Solutions Manual* for a possible response.

- Make a dotplot of the distribution of a quantitative variable. Describe what you see.
- Given a relationship between two variables, identify variables lurking in the background that might affect the relationship.

#### D. Probability

- Interpret probability as what happens in the long run.
- Use simulations to determine how likely an outcome is to occur.

#### E. Statistical Inference

- Use the results of simulations and probability calculations to draw conclusions that go beyond the data.
- Give reasons why conclusions cannot be certain in a given setting.

### Web Links

These sites are excellent sources for available data:

U.S. Census Bureau Home Page [www.census.gov](http://www.census.gov)

Data and Story Library [lib.stat.cmu.edu/DASL/](http://lib.stat.cmu.edu/DASL/)

### Chapter Review Exercises

**P.19 TV violence** A typical hour of prime-time television shows three to five violent acts. Linking family interviews and police records shows a clear association between time spent watching TV as a child and later aggressive behavior.<sup>11</sup>

(a) Explain why this is an observational study rather than an experiment.

(b) Suggest several other variables describing a child's home life that may be related to how much TV he or she watches. Explain why these variables make it difficult to conclude that more TV *causes* aggressive behavior.

**P.20 How safe are teen drivers?** Find some information to help answer this question. Start with the National Highway and Traffic Safety Administration Web site, [www.nhtsa.gov](http://www.nhtsa.gov). Keep a detailed written record of your search.

**P.21 Give it some gas!** Here is a small part of a data set that describes the fuel economy (in miles per gallon) of 2004 model motor vehicles:

Make and Model	Vehicle type	Transmission type	Number of cylinders	City MPG	Highway MPG
Acura NSX	Two-seater	Automatic	6	17	24
BMW 330i	Compact	Manual	6	20	30
Cadillac Seville	Midsized	Automatic	8	18	26
Ford F150 2WD	Standard pickup truck	Automatic	6	16	19



Answer the key questions (who, what, why, when, where, how, and by whom?) for these data. Visit the government's fuel economy Web site [www.fueleconomy.gov](http://www.fueleconomy.gov) for more information about how these data were produced. For each variable, tell whether it is categorical or quantitative. Be sure to identify the units of measurement for any quantitative variables.

**P.22 Wearing bicycle helmets** According to the 2003 Youth Risk Behavior Survey, 85.9% of high school students reported rarely or never wearing bicycle helmets. The table below shows additional results from this survey, broken down by gender and grade in school.

Grade	Rarely or never wore bicycle helmets		
	Female (%)	Male (%)	Total (%)
9	80.3	86.4	83.9
10	85.9	88.1	87.1
11	86.8	87.6	87.3
12	86.1	87.5	86.9

(a) Make a bar graph to show the percent of students in each grade who said they rarely or never wore bicycle helmets. Write a few sentences describing what you see.

(b) Now make a side-by-side bar graph to compare the percents of males and females at each grade level who said they rarely or never wore bicycle helmets. Describe what you see in a few sentences.

**P.23 Three of a kind** You read in a book on poker that the probability of being dealt three of a kind in a five-card poker hand is  $1/50$ . Explain in simple language what this means.

**P.24 Baseball and steroids** Late in 2004, baseball superstar Barry Bonds admitted using creams and ointments that contained steroids. Bonds said he didn't know that these substances contained steroids. A Gallup Poll asked a random sample of U.S. adults whether they thought Bonds was telling the truth: 42% said "probably not" and 33% said "definitely not."

(a) Why did Gallup survey a random sample of U.S. adults rather than a sample of people attending a Major League Baseball game?

(b) If Gallup had surveyed all U.S. adults instead of a sample, about what percent of the responses would be "probably not"? "Definitely not"? Explain.

(c) Can we conclude based on these results that Barry Bonds is lying? Why or why not?

**P.25 Magnets and pain, I** Refer to Case Closed! (page 26). Suppose the difference in the mean pain scores of the active and inactive groups had been 2.5 instead of 4.05. What conclusion would you draw about whether magnets help relieve pain in postpolio patients? Explain.

**P.26 Magnets and pain, II** Refer to the chapter-opening Case Study (page 3). The researchers decided to analyze the patients' final pain ratings. It also makes sense to

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**P.22** (a) See the *Teacher's Solutions Manual* for graph. The percent for ninth-graders is just a little lower than the percents for the older students, but all four percents are very high.

(b) See the *Teacher's Solutions Manual* for graph. The percent for males is higher than the percent for females in every grade level. However, all of the percents are above 80.

**P.23** If we kept dealing five-card hands over and over again, the proportion of hands that would contain three of a kind approaches 0.02.

**P.24** (a) Because they were interested in the opinions of all U.S. adults and not just MLB fans who support the athletes.

(b) Although there will be variation from sample to sample, we can assume that the population percentages would be about the same as the sample percentages obtained.

(c) No. We can not conclude that Barry Bonds is lying. These percentages reflect the opinions of U.S. adults, but public opinion can be much different than fact.

**P.25** The chance of getting a difference of 2.5 or something larger if there is no difference in the magnets is approximately 0.005. We have evidence that the active magnets relieve pain in polio patients.



- P.26** (a) See the *Teacher's Solutions Manual* for graph. The differences for the patients in the active group follow a distribution with a gap between 1 and 4. The differences ranged from 0 to 10.
- (b) See the *Teacher's Solutions Manual* for graph. The distribution of the differences for the patients in the inactive group is skewed to the right, with a center slightly above 1.
- (c) The average difference for the active group is 5.241, and the average difference for the inactive group is 1.095.
- (d) Figure P.8 shows that none of the 10,000 simulated differences was smaller than -4.146. Thus, a difference of -4.146 would be extremely unlikely if both types of magnets provided the same level of relief. We would reject the hypothesis of no treatment effect and conclude that the active magnets do provide relief for polio patients.

examine the *difference* between patients' initial pain ratings and their final pain ratings in the active and inactive groups. Here are the data:

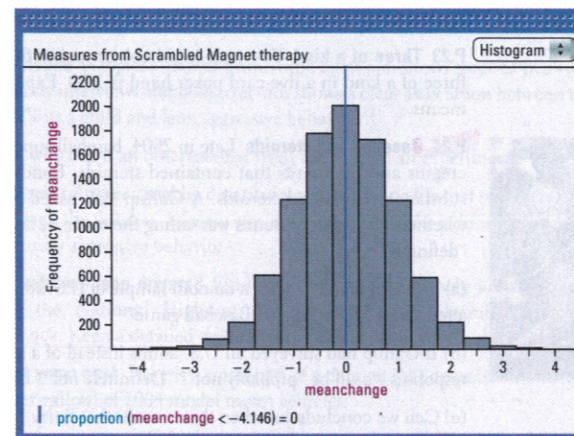
Active: 10, 6, 1, 10, 6, 8, 5, 6, 8, 7, 6, 4, 4, 7, 10, 6, 10, 6, 5, 1, 0, 0, 0, 1

Inactive: 4, 3, 5, 2, 1, 4, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1

- (a) Construct a dotplot for the active group's data. Describe what you see.
- (b) Now make a dotplot for the inactive group's data immediately beneath using the same scale as the graph you made in (a). Write a few sentences comparing the changes in pain ratings for patients in the active and inactive groups.
- (c) Calculate the mean (average) change in pain rating for each group.
- (d) Figure P.8 shows the results of 10,000 repetitions of a computer simulation. As in Case Closed! (page 26), the computer redistributed the patients into the active- and inactive-magnet groups 10,000 times. Each time, it computed the difference between the mean "decrease in pain" scores reported by the two groups. The graph displays the values of these 10,000 differences. If you were testing the claim that the active magnets did not help reduce pain any better than the inactive magnets, what would you conclude? Explain.

**Figure P.8**

Graph from Fathom statistical software displaying the difference in average decrease in pain for the two groups in the magnets and pain study for 10,000 trials of a computer simulation.



**P.27 Are you driving a gas guzzler?** Table P.2 displays the highway gas mileage for 30 model year 2004 midsize cars.



**Table P.2** Highway gas mileage for 2004 model midsize cars

Model	MPG	Model	MPG
Acura 3.5RL	24	Jaguar XJR	24
Audi A6 Quattro	25	Lexus GS300	25
BMW 745i	26	Lexus LS430	25
Buick Regal	30	Lincoln-Mercury LS	24
Cadillac Deville	26	Lincoln-Mercury Sable	26
Cadillac Seville	26	Mercedes-Benz E320	27
Chevrolet Malibu	34	Mercedes-Benz E500	20
Chrysler Sebring	30	Mitsubishi Diamante	25
Dodge Stratus	28	Mitsubishi Galant	26
Honda Accord	34	Nissan Maxima	28
Hyundai Sonata	27	Saab 9-3	28
Infiniti G35	26	Saturn L300	28
Infiniti Q45	23	Toyota Camry	33
Jaguar S-Type 3.0	26	Volkswagen Passat	31
Jaguar Vanden Plas	28	Volvo S80	28

Source: U.S. Environmental Protection Agency, *Model Year 2004 Fuel Economy Guide*, found online at [www.fueleconomy.gov](http://www.fueleconomy.gov).

Make a dotplot of these data. Describe what you see in a few sentences.

**P.28 Mozart and test scores** The Kalamazoo (Michigan) Symphony once advertised a “Mozart for Minors” program with this statement: “Question: Which students scored 51 points higher in verbal skills and 39 points higher in math? Answer: Students who had experience in music.”<sup>12</sup>

- How do you think these data were obtained—from an experiment, a survey, or an observational study that wasn’t a survey? Justify your answer.
- Can we conclude that the “Mozart for Minors” program *caused* an increase in students’ test scores? Explain. (*Hint*: Think of a variable lurking in the background.)
- Describe an experiment to test whether “Mozart for Minors” really leads to higher test scores.

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- P.27** See the *Teacher’s Solutions Manual* for graph. The distribution of MPG is roughly symmetric, with a center at about 27 miles per gallon. The range is 14, 34 – 20, with Chevrolet Malibu and the Honda Accord both getting the best mileage of 34 MPG. The Mercedes-Benz E500 had the worst gas mileage, 20 MPG.
- P.28** (a) These data were probably obtained from an observational study that wasn’t a survey.
- (b) No. Educational background of the parents, family income, neighborhood, and many other factors may influence test scores and participation in the music program.
- (c) Answers will vary. See the *Teacher’s Solutions Manual* for a possible solution.