

### Explore It!

Jackson and his brother Levi watch Jewel Geyser erupt one afternoon. They record the time intervals between eruptions. The dot plot shows their data.

Jackson estimates that the average time between eruptions is 8 minutes. Levi estimates that the average time between eruptions is  $8\frac{1}{2}$  minutes.

#### Lesson 8-4

### Make More Comparative Inferences About Populations

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**I can...**  
compare populations using the mean, median, mode, range, interquartile range, and mean absolute deviation.

**A. Construct Arguments** Construct an argument to support Jackson's position.

**B. Construct Arguments** Construct an argument to support Levi's position.

**Focus on math practices**

**Reasoning** How can you determine the best measure of center to describe a set of data?

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### Essential Question

How can dot plots and statistical measures be used to compare populations?

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#### EXAMPLE 1 Use Dot Plots to Compare Populations

Quinn collects data from a random sample of 20 seventh-grade students who participate in a youth fitness program. She compares the number of curl-ups each student completed in thirty seconds last year and this year. What can Quinn infer from her comparison of the data sets?

Number of Curl-Ups That 20 Students Completed	
Last Year	20 27 21 26 22 25 23 23 26 23 24 24 25 24 22 24 23 24 21 25
This Year	21 30 22 24 29 26 28 26 30 27 29 27 28 25 28 28 25 28 29 23

**STEP 1** Display the two data sets in dot plots.

**Model with Math** Why are dot plots an appropriate representation for the data sets?

**Curl-Ups Completed Last Year**

**Curl-Ups Completed This Year**

**STEP 2** Use the dot plots to compare the two data sets.

**Curl-Ups Completed Last Year**

**Curl-Ups Completed This Year**

The number of curl-ups completed this year is generally greater than last year. But, based on the shape of the data, not all students made the same progress.

Quinn can infer that most of her classmates were able to do more curl-ups this year.

**Try It!**

Quinn also collects data about push-ups. Does it appear that students generally did more push-ups last year or this year? Explain your reasoning.

**Push-Ups Completed Last Year**

**Push-Ups Completed This Year**

**Convince Me!** How does the range of these data sets affect the shape of the dot plots?

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**EXAMPLE 2** Use Measures of Center and Variability to Compare Populations

Quinn computes the mean and mean absolute deviation (MAD) for each data set. How do these measures support Quinn's inference from the data displays?

	Mean	MAD
Curl-Ups Completed Last Year	23.6	1.4
Curl-Ups Completed This Year	26.6	2.1

The mean can be used to describe the data because the data sets do not have outliers.

The mean number of curl-ups completed this year is greater than the mean number of curl-ups completed last year. This supports Quinn's inference.

The mean absolute deviation is greater for the number of curl-ups completed this year. This suggests that not all students made the same progress.

**EXAMPLE 3** Use Statistical Measures to Make Predictions

Rafi, one of Quinn's classmates, reported the numbers of curl-ups he completed this year and last year. He did not tell Quinn which number is for which year. Based on the data that Quinn gathered, which number most likely represents the curl-ups he completed last year?

Based on the data that Quinn gathered, she inferred that most students could complete more curl-ups this year than last year.

So, Rafi most likely completed 19 curl-ups last year and 23 curl-ups this year.

**Try It!**

Peter surveyed a random sample of adults and a random sample of teenagers about the number of hours that they exercise in a typical week. He recorded the data in the table below. What comparative inference can Peter make from the data sets?

Hours of Exercise	Mean	MAD
Adults	4.4	3.0
Teenagers	7.9	2.8

**KEY CONCEPT**

You can use dot plots to make informal comparative inferences about two populations. You can compare the shapes of the data displays or the measures of center and variability.

	Mean	Mean Absolute Deviation (MAD)
Data Set A	15.04	1.9648
Data Set B	18.56	2.1024

The modes of Data Set B are greater than the modes of Data Set A.  
The mean of Data Set B is greater than the mean of Data Set A.  
You can infer that data points are generally greater in Data Set B.  
The ranges and the MADs of the data sets are similar. You can infer that the variabilities of the two data sets are about the same.

**Do You Understand?**

- Essential Question** How can dot plots and statistical measures be used to compare populations?
- Reasoning** How can you make predictions using data from samples from two populations?
- Construct Arguments** Two data sets have the same mean but one set has a much larger MAD than the other. Explain why you may want to use the median to compare the data sets rather than the mean.

**Do You Know How?**

For 4 and 5, use the information below.

Coach Fiske recorded the number of shots on goal his first-line hockey players made during two weeks of hockey scrimmage.

	Week 1	Week 2
Day 1	5	8
Day 2	4	7
Day 3	6	9
Day 4	8	5
Day 5	2	5
Day 6	5	7
Day 7	7	8

- Find the mean number of shots on goal for each week.
- a. Based on the mean for each week, in which week did his first line take more shots on goal?  
b. Based on the comparison of the mean and the range for Week 1 and Week 2, what could the coach infer?

Name: \_\_\_\_\_

### Practice & Problem Solving

**Leveled Practice** In 6 and 7, complete each statement.

6. A study is done to compare the fuel efficiency of cars. Cars in Group 1 generally get about 23 miles per gallon. Cars in Group 2 generally get about 44 miles per gallon. Compare the groups by their means. Then make an inference and give a reason the inference might be true.

The mean for Group 1 is less than the mean for Group 2.

The cars in Group 2 generally are more fuel-efficient.

The cars in Group 2 may be smaller.

7. The dot plot shows a random sample of vertical leap heights of basketball players in two different basketball camps. Compare the mean values of the dot plots. Round to the nearest tenth.

Vertical Leap Samples	
Camp	Mean
1	$303 \div 11 \approx 27.5$
2	$\div 11 =$

The mean values tell you that participants in Camp 1 jump higher in general.

27.5454... 0

how spread out both are equally spread out

The average mass of marbles in Set 2 is slightly higher than that of Set 1, and the values are equally spread out.

9. **Generalize** Brianna asks 8 classmates how many pencils and erasers they carry in their bags. The mean number of pencils is 11. The mean number of erasers is 4. The MAD of both data sets is 2. What inference could Brianna make using this data?

10. **Higher Order Thinking** Two machines in a factory are supposed to work at the same speed to pass inspection. The number of items built by each machine on five different days is recorded in the table. The inspector believes that the machines should not pass inspection because the mean speed of Machine X is much faster than the mean speed of Machine Y.

Number of Items Built					
Machine X	20	16	21	18	19
Machine Y	23	2	18	21	19

- Which measures of center and variability should be used to compare the performances of each machine? Explain.
- Is the inspector correct? Explain.

### Assessment Practice

11. The dot plots show the weights of a random sample of fish from two lakes. Which comparative inference about the fish in the two lakes is most likely correct?
- There is about the same variation in weight between small and large fish in both lakes.
  - There is less variation in weight between small and large fish in South Lake than between small and large fish in Round Lake.
  - There is less variation in weight between small and large fish in Round Lake than between small and large fish in South Lake.
  - There is greater variability in the weights of fish in Round Lake.



