

Penalties for Providing Alcohol to Minors
Mean, Median, and Range

Statistical Guide: The mean is the average that is the balance point in a distribution. It is calculated by summing all the scores and dividing by the number of scores. The mean is pulled toward extreme scores in an unbalanced distribution (i.e., a skewed distribution with extreme scores on one side without extreme scores on the other side to balance it). The median is the average that indicates the value below which half of cases lie. For example, if the median for a group is 10.0, then 50 percent of the cases lie below 10.0. The range is often defined as the difference between the highest score (maximum) and the lowest score (minimum) in a distribution, which is the definition you should use in this exercise. (Some statisticians add "1" to the difference.)

Excerpt from the Research Article¹: We selected four states for intensive study: Kentucky, Michigan, Montana, and Oregon. Selection was based on the availability of detailed enforcement data for both ABC [Alcoholic Beverage Control] agencies and local police departments, and on the diversity of the states in terms of their alcohol control systems. However, the states were not selected randomly, and generalizations to other states and localities must therefore be made cautiously.

Rates of youth drinking arrests across the 295 counties are highly skewed... Low levels of enforcement actions on underage drinking are clear in the number of actions per year in the average county (Table 2). The median country has no liquor license suspensions or revocations, 1 ABC action against an alcohol outlet, 8 arrests for possession, and a total of 26 liquor law arrests of 16-20-year-olds.

Table 2 *Descriptive statistics on enforcement of drinking age: Counts for 295 counties in Kentucky, Michigan, Montana, and Oregon*

| Statistic | Arrests for law violations | | ABC actions against persons for selling to persons younger than 21 | ABC suspensions of licenses for supplying to persons younger than 21 | ABC revocations for selling to persons younger than 21 |
|-----------|-------------------------------|----------------------------|---|--|--|
| | Total arrests (ages 16-20) | Possession (ages 16-20) | | | |
| Minimum | 0 | 0 | 0 | 0 | 0 |
| Maximum | 3,905 | 1,223 | 288 | 29 | 12 |
| Median | 26 | 7.7 | 1.0 | 0 | 0 |
| Mean | 220 | 52 | 6.0 | .59 | .25 |

Note: ABC = Alcoholic Beverage Control

We found that rates of enforcement of the legal minimum drinking age are very low, particularly in terms of actions taken against those who sell or provide alcohol to underage youth. Many counties give no attention to drinking age enforcement at all. Twelve percent of the counties examined had no arrests of youth younger than age 21 for illegal possession of alcoholic beverages across the entire 3-year period examined. When enforcement actions are taken, they typically are focused on the individual young drinker, rather than on the commercial outlet...that supplied the alcoholic beverages to youth.

Conversely, there are a small number of jurisdictions with very high rates of enforcement actions on underage drinking, suggesting that barriers to enforcement of this law are not insurmountable.

Questions for Exercise 9

Part A: Factual Questions

1. What is the largest number of arrests of 16-20-year-olds for possession in any county?

¹Source: Wagenaar, A. C., & Wolfson, M. (1995). Deterring sales and provision of alcohol to minors: A study of enforcement in 295 counties in four states. *Public Health Reports*, 110, 419-427.

2. What is the range of number of arrests for possession?
3. What is the largest number of ABC revocations in any one county?
4. What is the range for ABC revocations?
5. The excerpt states that the drinking arrests data are Ahighly skewed.@ When this is the case, which of the following should you expect?
 1. The mean and median will be very similar in value.
 2. The mean and median will be clearly different in value.
6. Do the statistics in Table 2 confirm your answer to question 5? Explain.
7. The data for arrests has what type of skew?
 - A. Skewed to the right (i.e., positive skew) with a small number of counties with large number of arrests.
 - B. Skewed to the left (i.e., negative skew) with a small number of counties with small numbers of arrests.
8. What percentage of the counties had fewer than 1 ABC action against persons for selling to persons younger than 21?
9. What percentage of the counties had more than 26 total arrests of those aged 16-20 for alcohol law violations?

Part B: Questions for Discussion

10. In Table 2, the mean for the total number of arrests of 16-20-year-olds is 220. Is it possible to determine from this the percentage of counties that had less than 220 by knowing the mean? Explain.
11. Suppose someone who had not studied statistics examined Table 2 and asked you, "What is the average number of ABC actions against persons for selling to persons younger than 21?" How would you answer the question?
12. The authors state that "generalizations to other states and localities must therefore be made cautiously." Do you agree? Explain.

Mean, Median, and Mode
Drawing Happy Faces on Restaurant Checks: Does It Increase Tips?²

Statistical guide: The three averages used in statistics are the mean, the median, and the mode. Researchers usually report the mean *except* when a distribution is skewed, in which case the mean is pulled in the direction of the skew. For skewed distributions, researchers usually report the median. The mode is infrequently reported in published research. The mean is the balance point in a distribution. It is a measure of “center” or “central tendency.” To calculate a mean, sum the scores and divide by the number of scores. The median is the “center score” in a distribution. To find it, put the scores in order and count to the middle of the distribution. (When there are ties in the middle of the distribution, this method will yield only the *approximate* median. Ask your professor whether he or she wants you to compute the approximate or *interpolated* median when there are ties). The mode is the most frequently occurring score. For example, if more people have a score of 10 than any other score, 10 is the mode. A distribution may have more than one mode, which is a disadvantage of this average.

Background Notes: A waitress, who worked in an upscale restaurant on a university campus at lunch time, drew a happy, smiling face on the checks of a random half of her customers. In Part A of this exercise, you will be computing the average percentage she was left as a tip under the two conditions (with a happy face and without a happy face). A waiter at the same restaurant did the same thing. In Part B of this exercise, you will be computing the average percentage he was left as a tip under the two conditions.

Making Predictions: Before examining the data below, predict the results you will obtain. (When scientists make predictions, they are hypothesizing.) Note that your predictions are *not* right or wrong. Rather, they represent your best guess as to the outcomes you will obtain. After you perform the calculations, you will be able to determine whether the data support your predictions.

1. Do you think that there was a difference in the average percentage of tips under the two conditions (happy face vs. no happy face) for the *waitress*? If yes, which condition results in larger tips on the average?
2. Do you think that there was a difference in the average percentage of tips under the two conditions (happy face vs. no happy face) for the *waiter*? If yes, which condition resulted in larger tips on the average?

Data for Part A (waitress): The percentages for the waitress are shown below.

These are the tip percentages the waitress received from 23 dining parties in the *control condition* (no happy face on the check):

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 45% | 39% | 36% | 34% | 34% | 33% | 31% | 31% |
| 30% | 30% | 28% | 28% | 28% | 27% | 27% | 25% |
| 23% | 22% | 21% | 21% | 20% | 28% | 8% | |

These are the tip percentages the waitress received from 22 dining parties in the *experimental condition* (happy face on the check):

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 72% | 65% | 47% | 44% | 41% | 40% | 34% | 33% |
| 33% | 30% | 29% | 28% | 27% | 27% | 25% | 24% |
| 24% | 23% | 22% | 21% | 21% | 17% | | |

²Data source: Bruce Rind, Department of Psychology, Temple University. For more information on this topic, see Rind, B., & Bordia, P. (1996). Effect on restaurant tipping of male and female servers drawing a happy, smiling face on the backs of customers' checks. *Journal of Applied Social Psychology*, 26, 218-225.

Calculations for Part A (waitress):

3. The mean, median, and mode for the *waitress in the control condition* are shown in the following table. Calculate the mean, median, and mode for the *experimental condition* and enter them in the appropriate cells in the table. (Keep in mind that a distribution can have more than one mode.)

Table 1 *Results for Part A (waitress)*

| | <u>Control Condition</u> | <u>Experimental Condition</u> |
|--------|--------------------------|-------------------------------|
| Mean | 28 | |
| Median | 28 | |
| Mode | 28 | |

Data for Part B (waiter): The percentages for the waiter are shown below.

These are the tip percentages the waiter received from 21 dining parties in the *control condition* (no happy face on the check):

48% 40% 38% 33% 31% 27% 23% 23%
 23% 22% 21% 21% 21% 20% 18% 16%
 15% 9% 0% 0% 0%

These are the tip percentages the waiter received from 23 dining parties in the *experimental condition* (happy face on the check):

31% 27% 26% 23% 23% 21% 21% 19%
 18% 18% 17% 17% 17% 16% 15% 15%
 15% 14% 14% 13% 12% 9% 9%

Calculations for Part B (waiter):

4. Calculate the means, medians, and modes for the *waiter* in the two conditions and enter them in the appropriate cells in the table. (Keep in mind that a distribution can have more than one mode.)

Table 2 *Results for Part A (waiter):*

| | <u>Control Condition</u> | <u>Experimental Condition</u> |
|--------|--------------------------|-------------------------------|
| Mean | | |
| Median | | |
| Mode | | |

Checking Your Predictions for Parts A (waitress) and B (waiter):

5. Based on the *means* for the two conditions, was your prediction in question 1 (*waitress*) correct?
6. Based on the *medians* for the two conditions, was your prediction in question 1 (*waitress*) correct?
7. Based on the *means* for the two conditions, was your prediction in question 2 (*waiter*) correct?
8. Based on the *medians* for the two conditions, was your prediction in question 2 (*waiter*) correct?

Questions for Discussion:

9. If you could select only one average to describe the results of this study for the *waitress*, would you pick the mean, median, or mode? Explain your choice.
10. If you were a waiter, would you draw happy faces on the checks you give to customers? Explain.