

4.1: Variability

Statisticians use *measures of central tendency* and *measures of variability* to summarize variables in datasets. These two categories of measures focus on summarizing different aspects of the data in ways that can complement each other. The measures of central tendency summarize data by indicating where a set of scores tended to fall (see Chapter 3 for a full review of these measures). The mean is the most commonly used measure of central tendency for summarizing data from quantitative data measured using interval or ratio scales. However, measures of central tendency, such as the mean, do not provide information about how similar scores were to each other nor how similar scores were to the mean. Thus, they are more useful in meeting the goal of simplicity rather than specificity when summarizing data. Therefore, a separate but related set of techniques known as measures of variability are often used to bring some specificity into a summary.

Statisticians focus on measuring and analyzing data from variables, things which have the defining feature of variability. However, the measures of central tendency are limited by their inability to provide information about this important feature. Instead, measures of central tendency such as the mean are interpreted as describing what was generally true of the cases without being able to indicate the extent to which this tendency was *not* true. You may have noticed this limitation yourself when hearing descriptive summaries. For example, perhaps you have heard a professor say “The mean grade on the exam was 80 points.” You and a classmate might have looked at your own scores and found that neither of you had 80 points. Perhaps one of you had a score higher than 80 and the other had a score lower than 80 and you thought something along the lines of “Well, not everyone got an 80” or “The mean doesn’t represent my score.” This is the mean doing its job; it provides a simple summary of something that tended to be true but was not always true or exactly true for each case. If the mean was true of all cases, then the thing measured would be a constant and not a variable. Thus, it is best to think of any summary from a measure of central tendency as what was generally or approximately true but not what was exactly or always true.

The *measures of variability* bring specificity in by summarizing the dispersion of data. Dispersion focuses on the extent to which a group of scores tended to be similar (less disperse) or different (more disperse) from each other. Thus, **variability** in statistics refers to the dispersion or differences among scores or qualitative responses in a data set. Measures of variability are particularly useful when dealing with quantitative data. Quantitative data are often expected to follow patterns. Though there are options for summarizing variability for qualitative variables (such as the index of qualitative variation; IQV), the focus of this chapter will be four commonly used measures of variability for quantitative variables: exclusive range, inclusive range, standard deviation, and variance.

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