

2.1: p Values

Learning Objectives

At the end of this section you should be able to answer the following questions:

- What is a p value?
- How can you interpret a p value?
- What question can p value answer?

An important area of statistics is probability, and it is the basis for all of the tests we will be reviewing in this textbook. One important kind of probability is a conditional probability. For example, given the weather forecast for today, what is the likelihood that it will rain?

The p value itself is a figure or numeral – typically represented by a number between 0 and 1.00 – that provides the probability of a result (for a particular test statistic) being due to a true effect rather than chance. The p value is a conditional probability and relies on a number of assumptions about the test statistics used.

Here is an example from psychology that provides an illustration of the p value:

Psychological scientists at your university are evaluating a clinical therapy that is believed to reduce anxiety in young adults. In a field study, these scientists use two groups to test the therapy – one group receives the clinical therapy and a second group that does not receive the clinical therapy – which are respectively known as the experimental and control groups. Anxiety in participants is then measured in both groups after the therapy takes place (or not). Using a T-test statistic – which examines the different means for anxiety between two groups – the result of the test statistic is $t(18) = 2.7$, $p = .01$.

The p value is indicated by the statement of $p = .01$ that appears after the 2.7, which is the value of the T-test statistic. You interpret the significance of a p value based on a critical value for p values, which is often designated as .05. You also note that p values less than .05 are considered significant in most research. In our example $p = .01$ which is below .05. This means that the test statistic of $t(18) = 2.7$ provides evidence for a difference between the control and experimental groups.

When concluding there is a difference between the control and experimental groups, a researcher is really referring back to the populations from which the two groups are assumed to be drawn. Hence, there is an inference from the samples back to the populations.

It is critical to remember that a p value does NOT answer “What is the probability that the difference is due to chance?” A p value does answer: ‘Assuming that there is no real difference in the populations (that correspond to the two groups), what is the probability that the difference between the means of randomly selected subjects will be as large as or larger than actually observed?’ This distinction might sound academic, but it is very important.

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