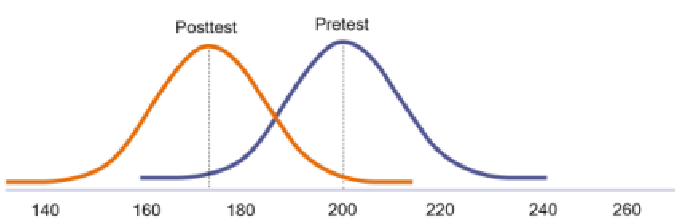
6.2: One-Tailed vs. Two-Tailed Tests

Tests of many hypotheses can be categorized as one-tailed or two-tailed dependent upon whether the hypotheses themselves are directional or non-directional. Generally, directional hypotheses require one-tailed tests and non-directional hypotheses require two-tailed tests.

The names one-tailed and two-tailed refer to whether one or both tail regions of the normal curve are being considered in the stated hypothesis. Think of it this way: if you start at the center of the normal curve there are two directions you can look to see if there are patterns or groups of data elsewhere. There could be groups of data to the left (lower tail) or to the right (upper tail) of the center. If your hypothesis is directional and states that data are expected to be lower (or lesser), it means you only need to look in one direction which is to the left (lower tail) to see if the data are there. If your hypothesis is directional and states that a group of data are expected to be higher (or greater), it means you only need to look in one direction which is to the right (upper tail) to see if the data are there. However, if a hypothesis is non-directional it means that a group of data is expected to be somewhere other than the middle; it could be to the left or it could be to the right of the center meaning that you must look both directions to check each of the two tails for those data. Thus, when a direction is given to a test using the normal distribution and only one-tail needs to be checked, the test is called one-tailed and when it is non-directional such that both tails need to be checked, it is called two-tailed.

Let's review an example using a directional hypothesis. Suppose it is hypothesized that cholesterol levels will be *lower* after eating oatmeal daily for six weeks compared to before. In this example the population parameter of interest is the mean cholesterol level. Data would be collected about cholesterol to start and graphed as a normal curve. These are known as *pretest* data. Then data would be collected about cholesterol again at the end of the six weeks; these are known as *posttest* data and would be graphed as a normal curve to see if there has been any change. The mean which is the center of the posttest normal curve is expected to have shifted to the left compared to the pretest normal curve when both are plotted over the same x-axis. Therefore the alternative hypothesis indicates that the posttest mean is expected to be to the left of the pretest mean. The null hypothesis counters this and, thus, expects that either the posttest mean will be the same as the pretest mean or that the posttest mean will actually be higher (to the right) of the pretest mean.



Directional, alternative hypothesis: Cholesterol levels will be lower after (post) eating oatmeal daily for six weeks compared to before (pre).

$$H_a : \mu_{\text{post}} < \mu_{\text{pre}}$$

Null hypothesis: Cholesterol levels will not be lower after (post) eating oatmeal daily for six weeks compared to before (pre).

$$H_0 : \mu_{\text{post}} \geq \mu_{\text{pre}}$$

Reading Review 6.1

1. The three names which can be used for an alternative hypothesis are alternative hypothesis, __________________________, or simply _____________.
2. What is the difference between an alternative hypothesis and a null hypothesis?
3. Which hypothesis is presumed to be true until refuted by evidence?
4. What is the difference between a directional and a non-directional hypothesis?
5. For which hypotheses would a one-tailed test be used instead of a two-tailed test?