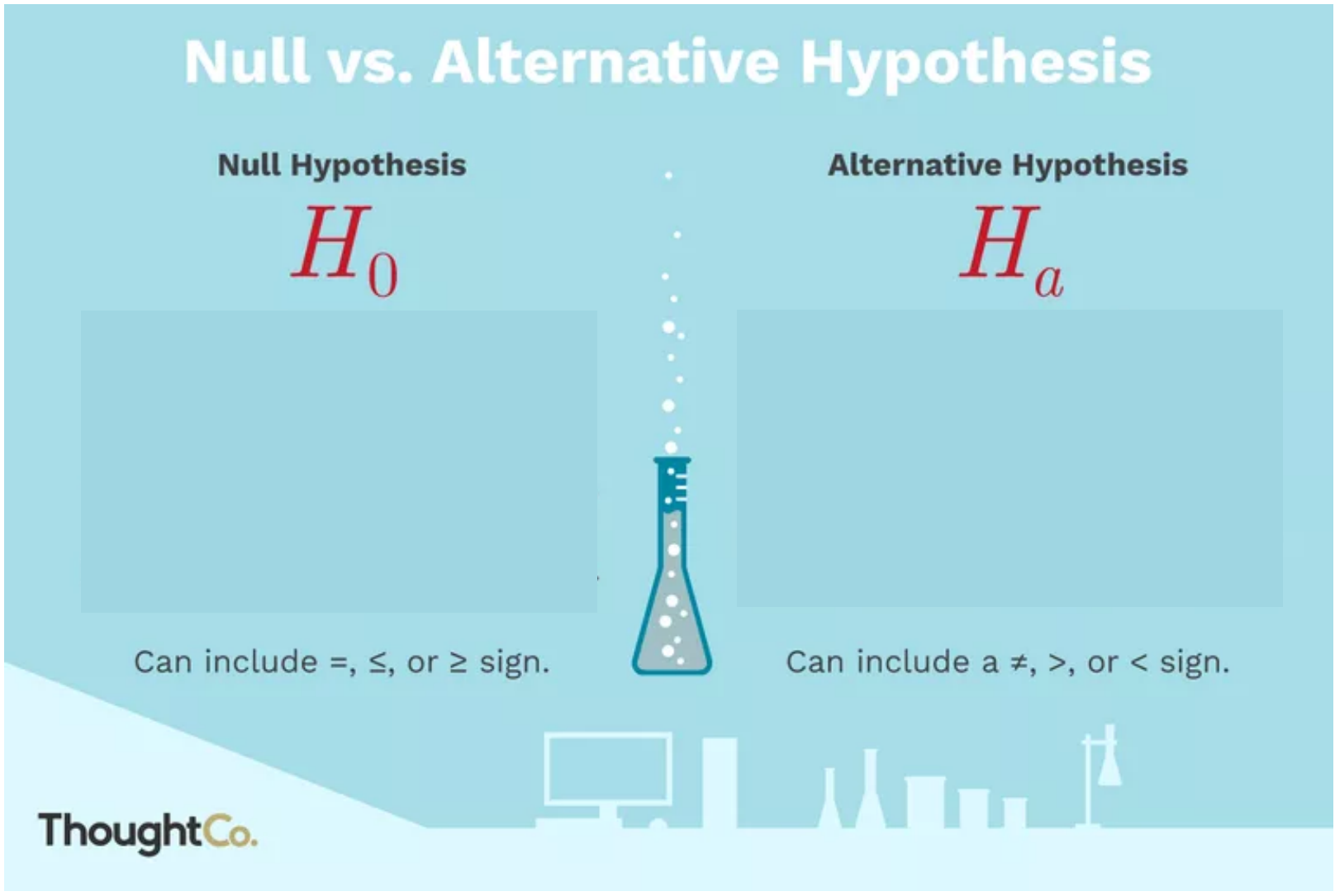
Null Hypothesis and Alternative Hypothesis

Courtney Taylor ThoughtCo. June 24, 2019

Hypothesis testing involves the careful construction of two statements: the null hypothesis and the alternative hypothesis. These hypotheses can look very similar but are actually different.



The Null Hypothesis

The null hypothesis is denoted by H0. In a mathematical formulation of the null hypothesis, there will typically be an equal sign (or a combined greater than/equal sign, ≥, or a combined less than/equal sign, ≤).

The null hypothesis is what we attempt to find evidence against in our hypothesis test. If the null hypothesis is not rejected, then we must be careful to say what this means. The thinking on this is similar to a legal verdict. Just because a person has been declared "not guilty", it does not mean that he is innocent. In the same way, just because we failed to reject a null hypothesis it does not mean that the opposite is true.

For example, we may want to investigate the claim that despite what convention has told us, the mean adult body temperature is not the accepted value of 98.6 degrees Fahrenheit. The null hypothesis for an experiment to investigate this is "The mean adult body temperature for healthy individuals is 98.6 degrees Fahrenheit."

If we are studying a new treatment, the null hypothesis is that participants receiving our treatment will not improve more than participants not receiving our treatment.

The Alternative Hypothesis

The alternative hypothesis is denoted by either Ha or by H1. The alternative hypothesis reflects that there will be an observed difference or relation. In a mathematical formulation of the alternative hypothesis, there will typically be an inequality, such as a not-equal-to symbol, ≠, or a greater than, >, or less than, <, sign.

If the null hypothesis is not rejected, then we do not accept the alternative hypothesis. Going back to the above example of mean human body temperature, the alternative hypothesis is "The average adult human body temperature is not 98.6 degrees Fahrenheit."

If we are studying a new treatment, then the alternative hypothesis is that participants receiving our treatment will improve more than participants not receiving our treatment.

Negation

The following set of negations may help when you are forming your null and alternative hypotheses.

Null hypothesis: "x is equal to y." Alternative hypothesis "x is not equal to y."
Null hypothesis: "x is equal to or greater than y." Alternative hypothesis "x is less than y."
Null hypothesis: "x is equal to or less than y." Alternative hypothesis "x is greater than y."

NOTE: This article has been modified.