**Null Hypothesis Definition and Examples, How to State**

1. [What is the Null Hypothesis?](https://www.statisticshowto.com/probability-and-statistics/null-hypothesis/#whatis)
2. [How to State the Null Hypothesis](https://www.statisticshowto.com/probability-and-statistics/null-hypothesis/#state)

**Alternate Hypothesis in Statistics: What is it?**

What is null hypothesis?

The **null hypothesis**, H0 is the commonly accepted fact; it is the opposite of the [alternate hypothesis](https://www.statisticshowto.com/what-is-an-alternate-hypothesis/). Researchers work to reject, nullify or disprove the null hypothesis. Researchers come up with an alternate hypothesis, one that they think explains a phenomenon, and then work to [reject the null hypothesis](https://www.statisticshowto.com/probability-and-statistics/hypothesis-testing/support-or-reject-null-hypothesis/).

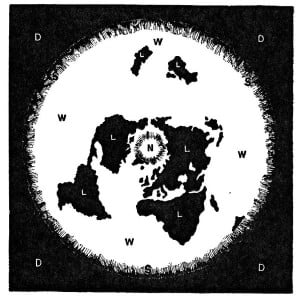
Why is it Called the “Null”?

The word “null” in this context means that it’s a commonly accepted fact that researchers work to *nullify*. It doesn’t mean that the statement is null (i.e. amounts to nothing) itself! (Perhaps the term should be called the “nullifiable hypothesis” as that might cause less confusion).

Why Do I need to Test it? Why not just prove an alternate one?

The short answer is, as a scientist, you are *required to*; It’s part of the scientific process. Science uses a battery of processes to prove or disprove theories, making sure than any new hypothesis has no flaws. Including both a null and an alternate hypothesis is one safeguard to ensure your research isn’t flawed. **Not including the null hypothesis in your research is considered very bad practice by the scientific community.**If you set out to prove an alternate hypothesis without considering it, you are likely setting yourself up for failure. At a minimum, your experiment will likely not be taken seriously.

Example

Not so long ago, people believed that the world was flat.  
[](https://www.statisticshowto.com/what-is-the-null-hypothesis/)

* **Null hypothesis**: H0: The world is flat.
* **Alternate hypothesis:** The world is round.

Several scientists, including [Copernicus](http://plato.stanford.edu/entries/copernicus/), set out to disprove the null hypothesis. This eventually led to the rejection of the null and the acceptance of the alternate. Most people accepted it — the ones that didn’t created the [Flat Earth Society](http://www.theflatearthsociety.org/)!. What would have happened if Copernicus had not disproved the it and merely proved the alternate? No one would have listened to him. In order to change people’s thinking, he first had to prove that their thinking was *wrong*.

How to State the Null Hypothesis

How to State the Null Hypothesis from a Word Problem

You’ll be asked to convert a word problem into a**hypothesis**statement in statistics that will include a null hypothesis and an [**alternate hypothesis**](https://www.statisticshowto.com/what-is-an-alternate-hypothesis/). Breaking your problem into a few small steps makes these problems much easier to handle.

How to State the Null Hypothesis

**Example Problem**: A researcher thinks that if knee surgery patients go to physical therapy twice a week (instead of 3 times), their recovery period will be longer. [Average](https://www.calculushowto.com/average-value-of-a-function/#def) recovery times for knee surgery patients is 8.2 weeks.

[](https://www.statisticshowto.com/wp-content/uploads/2009/10/knee-surgery.jpg)

*Hypothesis testing is vital to test patient outcomes.*

**Step 1:** *Figure out the hypothesis from the problem*. The hypothesis is usually hidden in a word problem, and is sometimes a statement of what you expect to happen in the experiment. The hypothesis in the above question is “I expect the average recovery period to be greater than 8.2 weeks.”

**Step 2:** *Convert the hypothesis to math*. Remember that the average is sometimes written as μ.

H1: μ > 8.2

Broken down into (somewhat) English, that’s H1(The hypothesis): μ (the average) > (is greater than) 8.2

**Step 3:** *State what will happen if the hypothesis doesn’t come true.* If the recovery time isn’t greater than 8.2 weeks, there are only two possibilities, that the recovery time is equal to 8.2 weeks or less than 8.2 weeks.

H0: μ ≤ 8.2

Broken down again into English, that’s H0(The null hypothesis): μ (the average) ≤ (is less than or equal to) 8.2

How to State the Null Hypothesis: Part Two

But what if the researcher doesn’t have any idea what will happen?

**Example Problem:** A researcher is studying the effects of radical exercise program on knee surgery patients. There is a good chance the therapy will improve recovery time, but there’s also the possibility it will make it worse. Average recovery times for knee surgery patients is 8.2 weeks.

**Step 1:** *State what will happen if the experiment doesn’t make any difference.* That’s the null hypothesis–that nothing will happen. In this experiment, if nothing happens, then the recovery time will stay at 8.2 weeks.

H0: μ = 8.2

Broken down into English, that’s H0(The null hypothesis): μ (the average) = (is equal to) 8.2

**Step 2:** *Figure out the*[*alternate hypothesis*](https://www.statisticshowto.com/what-is-an-alternate-hypothesis/). The alternate hypothesis is the opposite of the null hypothesis. In other words, what happens if our experiment makes a difference?

H1: μ ≠ 8.2

In English again, that’s H1(The  alternate hypothesis): μ (the average) ≠ (is not equal to) 8.2

That’s How to State the Null Hypothesis!

**What is Alternate Hypothesis?**

In order to understand what an **alternate hypothesis** (also called an *alternative hypothesis*) is, you first need to understand what the [null hypothesis](https://www.statisticshowto.com/probability-and-statistics/null-hypothesis/) means. The word *hypothesis* means *a working statement.* In statistics, we’re interested in proving whether a working statement (the null hypothesis) is true or false. Usually, these working statements are things that are expected to be true —some kind of known or fact or perhaps a historical value. The word “null” can be thought of as “no change”. With the null hypothesis, you get what you expect, from a historical point of view.

The Alternate Hypothesis

The alternate hypothesis is just an *alternative*to the null. For example, if your null is “I’m going to win up to $1,000” then your alternate is “I’m going to win $1,000 or more.” Basically, you’re looking at whether there’s enough change (with the alternate hypothesis) to be able to [reject the null hypothesis](https://www.statisticshowto.com/probability-and-statistics/hypothesis-testing/support-or-reject-null-hypothesis/).  
[](https://www.statisticshowto.com/wp-content/uploads/2013/08/binomial-distribution-lottery-ticket.jpg)  
In many cases, the alternate hypothesis will just be the**opposite of the null hypothesis.** For example, the null hypothesis might be “There *was no* change in the water level this Spring,” and the alternative hypothesis would be “There *was* a change in the water level this Spring.”

In other cases,**there might be a change** in the amount of something. For example, let’s say a [Gallup poll](https://news.gallup.com/home.aspx) predicts an election will re-elect a president with a 5 percent majority. However, you, the researcher, has uncovered a secret grassroots campaign composed of hundreds of thousands of minorities who are going to vote the *opposite* way from expected.

* **Null hypothesis**: President re-elected with 5 percent majority
* **Alternate hypothesis:** President re-elected with 1-2 percent majority.

Although the outcome hasn’t changed (the President is still re-elected), the majority [percentage](https://www.statisticshowto.com/calculate-percentages/) has changed—which may be important to an electoral campaign.

The alternate hypothesis is usually what you will be testing in hypothesis testing. It’s a statement that you or another researcher) thinks is true and one that can ultimately lead you to [reject the null hypothesis](https://www.statisticshowto.com/probability-and-statistics/hypothesis-testing/support-or-reject-null-hypothesis/) and replace it with the alternate hypothesis.

Alternate Hypothesis Examples

**Example 1:** It’s an accepted fact that ethanol boils at 173.1°F; you have a theory that [ethanol](https://pubchem.ncbi.nlm.nih.gov/compound/702?from=summary)actually has a different boiling point, of over 174°F. The accepted fact (“ethanol boils at 173.1°F”) is the [null hypothesis](https://www.statisticshowto.com/probability-and-statistics/null-hypothesis/); your theory (“ethanol boils at temperatures of 174°F”) is the alternate hypothesis.

**Example 2:** A classroom full of students at a certain elementary school is performing at lower than [average](https://www.statisticshowto.com/arithmetic-mean/)levels on standardized tests. The low test scores are thought to be due to poor teacher performance. However, you have a theory that the students are performing poorly because their classroom is not as well ventilated as the other classrooms in the school. The accepted theory (“low test scores are due to poor teacher performance”) is the [null hypothesis](https://www.statisticshowto.com/probability-and-statistics/null-hypothesis/); your theory (“low test scores are due to inadequate ventilation in the classroom”) is the alternative hypothesis.