

Type I and Type II Errors

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WHAT'S COVERED

This lesson discusses Type I and Type II errors. By the end of this lesson, you should be able to identify Type I and Type II errors and know the difference between them. This lesson covers:

1. Errors and the Experimental Method
2. Type I and Type II Errors
3. Examples
 - 3a. Sleep and Height
 - 3b. Building Materials

1. Errors and the Experimental Method

Recall that when it comes to the experimental method, the null hypothesis states that there is no cause-and-effect relationship between two variables, whereas an alternative hypothesis states that there might be some cause-and-effect relationship between these variables. When there is an actual cause-and-effect relationship between two variables, you can expect a significant result from an experiment.

While you may carefully perform experiments to establish whether or not these two variables are related, you still need to be careful to prevent an error that might come from the results of the experiment. The two major errors that are possible when conducting experiments are rejecting the null hypothesis when it is actually true, and failing to reject the null hypothesis when it is actually wrong.

2. Type I and Type II Errors

When two variables are not actually related in terms of a cause-and-effect relationship, it is still possible to see a significant result from an experiment. An example of such errors could be when a doctor orders a lab to conduct blood work for a specific medical condition for a specific patient.

Since the test is unlikely to be perfect, there exists a chance that the person interpreting the results rejects the null hypothesis when they shouldn't. In a case like this, the null hypothesis is that the patient does not have the condition. This means that the test is erroneously interpreted as the patient having the condition. This is also known as a **Type I error**, or a false positive. It is possible that the error could lead to a misdiagnosis and treatment for a condition that the patient simply doesn't have.

In other words, we can say: Type I Error = Rejecting a true null hypothesis.

On the flip side, it is possible that the blood test is not rejected when, in fact, it should be. It could lead to a lack of a diagnosis where the patient actually has a condition but winds up not being treated for it due to such an error. An error such as this is referred to as a **Type II error**, or a false negative.

In other words, we can say: Type II Error = Failing to reject an incorrect alternative hypothesis.

It is very helpful for a researcher to know if they run the risk of committing either type of error. It can have a major impact on whether or not the results are being communicated accurately.



BIG IDEA

		Reality	
		Null Hypothesis Is True	Null Hypothesis Is False
Decision	Reject Null Hypothesis	Type I Error	Correct Decision
	Fail to Reject Null Hypothesis	Correct Decision	Type II Error



TERMS TO KNOW

Type I error

False positive.

Type II error

False negative.

3. Examples

3a. Sleep and Height

Consider two variables, such as an individual's height and the number of hours they sleep per night on average. A null hypothesis in this instance states that there is not a cause-and-effect relationship between height and the amount someone sleeps. We would expect the null hypothesis to be true in this case.

Suppose that a researcher conducted a study that showed a result as being significant. This is a clear indicator that the variables are related, when in fact, they really aren't. This is an example of a Type I error. Such an error would lead the researcher to believe that the sleeping habits of people may, in fact, be influenced by how tall they are.

3b. Building Materials

Take a look at two different variables such as the size of a home and the amount of materials required to build it. There is a clear cause-and-effect relationship. Larger homes require a lot more building materials than smaller homes do. The null hypothesis would state that larger homes do not require more building materials than smaller homes, which is incorrect.

Suppose that a researcher conducted an experiment to test this relationship and discovered that the results were not significant. This would be a possible indicator that a Type II error, or a false negative, occurred. This could lead to the conclusion that larger homes don't actually take more building materials to construct. This is something that could turn out to be quite costly to a builder.



SUMMARY

In this lesson, you looked at **errors and the experimental method**. No matter how carefully an experiment is conducted, errors are still possible. **Type I and Type II errors** are the possible types of errors that can occur. A false positive is a Type I error, and a false negative is a Type II error. You then looked at some **examples** involving **sleep and height** and **building materials** to help you understand these possible errors.

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TERMS TO KNOW

Type I Error

False positive.

Type II Error

False negative.