## Sophia

## Margin of Error

by Sophia

## WHAT'S COVERED

This tutorial will explain margin of error by focusing specifically on:

1. Margin of Error
2. Confidence Interval

## 1. Margin of Error

You may have seen something in your local newspaper stating that, for example, a political candidate leads the field by $5 \%$, and that there is a $3 \%$ margin of error in the poll. What does this mean?

When surveys are done, collecting the right amount of data is important to ensure the answer is correct. Samples are often reported with something called a margin of error, meaning that the results may be off by a little bit, though it can be estimated by how much. It explains to the reader that the right answer is not $100 \%$ accurate, but it is a close estimate.

## IN CONTEXT

Suppose you are an administrator of a school and you need to determine the overall percentage of left-handed students. Maybe 10\% of students in the school are left-handed, but when you take a sample, even though you were diligent about the way data was collected, you got $8 \%$. The answer was not accurate. What happened?

It's possible that the data obtained was not exactly the same as what the population would have obtained. Maybe only $8 \%$ of left-handed people were in the sample, even though the population actually contains $10 \%$ who are left-handed. You didn't do anything wrong, but samples might be inherently off the mark due to the random selection process.

## 目 TERMS TO KNOW

## Margin of Error

An amount by which we believe our sample's mean may deviate from the true mean of the population.

## Estimate

The mean value obtained from the sample. If the sample was well-collected, the estimate should be reasonably close to the true value.

## 2. Confidence Interval

The confidence interval uses both the estimate and margin of error. When we combine these two parts, it gives us a range of possible values that our estimate can be.

This confidence level tells us how sure we are that our interval contains the actual population value or how sure we are that our sample falls in that range.

## IN CONTEXT

Suppose a newspaper polled 500 voters and $48 \%$ responded that they were going to vote for Candidate X in the upcoming election. The newspaper might print a margin of error along with that $48 \%$ mark; perhaps they use four percentage points as their margin of error. It's not particularly important how this 4\% was calculated, but it is important to note that a margin of error was reported along with the percent value.

What does this 4\% margin of error mean? It means the researchers are pretty confident that the true amount of people that will vote for Candidate $X$ is within $4 \%$ of 48 , which means that it could be as low as $44 \%$, or as high as $52 \%$, or anywhere in between. This idea of creating some wiggle room on either side of $48 \%$ is the confidence interval.

Suppose on election day, $46 \%$ of the people voted for Candidate $X$. Since this falls into the range of $44 \%$ to $52 \%$, it is a close enough estimate to the right answer.

## SW THINK ABOUT IT

What happens to the margin of error as the sample size increases? Will the margin of error go up, down, or stay about the same?

As the sample size goes up, the margin of error goes down because a larger sample size gives a more accurate portrait of the population. What's happening is that you cast a wider net to include people that may be closer to representing the actual population.

If you had a sample size of 4 people and you want to generalize the findings to a population of 200 people, it's unlikely that just those four people have enough of the characteristics to represent the population.

However, when the sample size is increased, you get closer to achieving a representative sample, which means the confidence interval can be lower; in other words, the higher the sample size, the less wiggle is needed room on each side of the measurement.

## - TERM TO KNOW

## Confidence Interval

A range of potential values that the true value could be. It is obtained by adding and subtracting the margin of error from the value in the sample.

## SUMMARY

Most statistical results are reported alongside a margin of error, which is an amount by which the sample's mean may deviate from the true mean of the population. If the data is well-collected, then it's likely that the true population value is within the confidence interval created by the reported value, plus or minus the margin of error. It's a bad idea to compare two values within the same confidence interval since both would be accurate enough to be correct. That would be a statistical dead heat.

Good luck!

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