Standard Error

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Standard error

- The standard error of the mean, or simply **standard error**, indicates how different the population mean is likely to be from a sample mean.
- It tells you how much the sample mean would vary if you were to repeat a study using new samples from within a single population.
- The standard error of the mean (SE or SEM) is the most commonly reported type of standard error.
- But you can also find the standard error for other statistics, like medians or proportions.
- The standard error is a common measure of sampling error—the difference between a population parameter and a sample statistic.
- Standard error matters because it helps you estimate how well your sample data represents the whole population.

… **Standard error**

- A high standard error shows that sample means are widely spread around the population mean—your sample may not closely represent your population.

- A low standard error shows that sample means are closely distributed around the population mean—your sample is representative of your population.

- You can decrease standard error by increasing sample size.

- Using a large, random sample is the best way to minimize sampling bias.

Standard error vs standard deviation

Standard error and standard deviation are both measures of variability:

- The **standard deviation** describes variability **within a single sample**.

- The **standard error** estimates the variability **across multiple samples** of a population.

- The standard deviation is a <u>descriptive statistic</u> that can be calculated from sample data.

- In contrast, the standard error is an <u>inferential statistic</u> that can only be estimated (unless the real population parameter is known).

Standard error formula

When population parameters are known

When the population standard deviation is known, you can use it in the below formula to calculate standard error precisely.

Formula	Explanation
$SE = \dfrac{\sigma}{\sqrt{n}}$	SE is standard error σ is population standard deviation n is the number of elements in the sample

When population parameters are unknown

When the population standard deviation is unknown, you can use the below formula to only estimate standard error. This formula takes the sample standard deviation as a point estimate for the population standard deviation.

Formula	Explanation
$SE = \dfrac{s}{\sqrt{n}}$	SE is standard error s is sample standard deviation n is the number of elements in the sample

Standard error of standard deviation Formula

$$SE_\sigma = \frac{SD}{\sqrt{2N}}$$

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