

Margin of Error

The Margin of Error (MOE) is the maximum likely difference between the estimate and the actual value of the population mean for a given sample size

(Statistic) (parameter)

We can calculate the Margin of Error using this formula:

$$\frac{1}{\sqrt{n}}$$

When n is the sample size

Examples:

- Find the MOE given the following sample sizes: A) 100 B) 375 C) 4700
 A) $\frac{1}{\sqrt{100}} = \pm 0.1$ B) $\frac{1}{\sqrt{375}} = \pm 0.052$ C) $\frac{1}{\sqrt{4700}} = \pm 0.015$
- What did you notice about the MOE as the sample size got larger?
 It got smaller, decreased.

[NOTE]: Because the Margin of Error is a difference from the actual, we often write it as an interval since the sample difference could be above or below the actual.

- Find the appropriate sample size in order to have the following MOE: A) $\pm 8\%$ B) $\pm 3.5\%$
 A) 0.08 B) 0.035
 $0.08 = \frac{1}{\sqrt{n}}$ $n = 156.25$
 $0.035 = \frac{1}{\sqrt{n}}$ $n = 816.24$
- Given the sample statistic and the Margin of Error, write an interval that would likely contain the exact percent.
 A) Statistic: 65% MOE: $\pm 8\%$ B) Statistics 14% MOE: $\pm 3.5\%$
 A) $57\% - 73\%$ B) $10.5\% - 17.5\%$
 $65 - 8 = 57$ $65 + 8 = 73$
 $14 - 3.5 = 10.5$ $14 + 3.5 = 17.5$
- Given the Interval, determine the Sample Statistics and the Margin of Error:
 A) 63% - 81% B) 37% - 73%
 $81 - 63 = 18$ $\frac{18}{2} = \pm 9\%$ MOE
 $63 + 9 = 72\%$ sample
 $73 - 37 = 36$ $\frac{36}{2} = \pm 18\%$ MOE
 $37 + 18 = 55\%$ sample

Types of Bias

Bias - occurs when a sample systematically favors one outcome

- Undercoverage Bias - sample not representative of the population
- Response Bias - survey responses lie or misrepresent themselves
- Nonresponse Bias - when an individual refuses to participate
- Voluntary Response Bias - when people are asked to mail-in or call-in

Examples: Identify the type of bias in each of the the different scenarios.

- A political blog conducts an online poll to gauge the approval rating of a candidate for political office.
voluntary bias / undercoverage
- To investigate people's preference for different brands of toothpaste, a polling firm selects a random sample of telephone numbers from the phonebooks of several large cities.
undercoverage
- Students are asked by their teacher: "You haven't ever cheated on a test, have you?"
response
- To investigate the amount of energy drinks consumed by college freshmen, a student stands on campus sidewalk and interviews willing participants.
voluntary response
- A mail survey asks people's opinion on the preservation of wilderness areas. Only a small percentage of the surveys were completed and returned, and those mostly favored an increase in wilderness areas.
nonresponse