



Estimating a Population Proportion With Confidence

Reed Coots

Statistics Course Developer



Confidence Interval Basics

Best Estimate \pm Margin of Error

Confidence Interval Basics

Best Estimate \pm Margin of Error

Best Estimate = Unbiased Point Estimate

Confidence Interval Basics

Best Estimate \pm Margin of Error

Best Estimate = Unbiased Point Estimate

Margin of Error = “*a few*” Estimated Standard Errors

Confidence Interval Basics

Best Estimate \pm Margin of Error

Best Estimate = Unbiased Point Estimate

Margin of Error = “*a few*” Estimated Standard Errors

“*a few*” = multiplier from appropriate distribution
based on desired confidence level and sample design

95% Confidence Level \leftrightarrow 0.05 Significance

C.S. Mott Children's Hospital

A hospital based in Ann Arbor MI, C.S. Mott Children's Hospital frequently conducts national polls on children's health. We will be looking at an example of children's safety precautions that parents use when driving.

MottsPoll Background

What proportion of parents report they use a car seat for all travel with their toddler?

MottsPoll Background

What proportion of parents report they use a car seat for all travel with their toddler?

Population - Parents with a toddler

MottsPoll Background

What proportion of parents report they use a car seat for all travel with their toddler?

Population - Parents with a toddler

Parameter of Interest - A Proportion

MottsPoll Background

What proportion of parents report they use a car seat for all travel with their toddler?

Population - Parents with a toddler

Parameter of Interest - A Proportion

Construct a 95% Confidence Interval for the population proportion of parents reporting they use a car seat for all travel with their toddler

MottsPoll Background

A sample of 659 parents with a toddler was taken and asked if they used a car seat for all travel with their toddler.

540 parents responded 'yes' to this question.

95% Confidence Interval Calculations

Best Estimate \pm Margin of Error

95% Confidence Interval Calculations

Best Estimate \pm Margin of Error
 $\hat{p} \pm$ Margin of Error

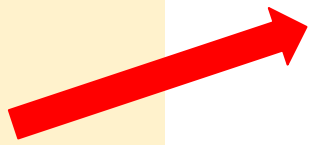
Best Estimate = \hat{p}

Sample Size



$$n = 659$$

**Number
Responded “yes”**



$$x = 540$$

$$\hat{p} = x/n$$

$$= 540/659$$

$$= \mathbf{0.85}$$

95% Confidence Interval Calculations

Best Estimate \pm Margin of Error
 $\hat{p} \pm$ Margin of Error

95% Confidence Interval Calculations

Best Estimate \pm Margin of Error

$\hat{p} \pm$ Margin of Error

$\hat{p} \pm$ “a few” \cdot estimated $se(\hat{p})$

95% Confidence Interval Calculations

Best Estimate \pm Margin of Error

$\hat{p} \pm$ Margin of Error

$\hat{p} \pm$ “a few” \cdot estimated $se(\hat{p})$

$$\hat{p} \pm 1.96 \cdot \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}}$$

95% Confidence Interval Calculations

$$\hat{p} \pm 1.96 \cdot \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}}$$

$$\hat{p}=0.85$$

$$n=659$$

95% Confidence Interval Calculations

$$\hat{p} \pm 1.96 \cdot \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}}$$

$$0.85 \pm 1.96 \cdot \sqrt{\frac{0.85(1 - 0.85)}{659}}$$

$$0.85 \pm 0.0273$$

$$(0.8227, 0.8773)$$

$$\hat{p}=0.85$$

$$n=659$$

Interpreting the Confidence Interval

“range of reasonable values for our parameter”

With 95% confidence, the population proportion of parents with a toddler who use a car seat for all travel is **estimated** to be between 82.27% - 87.73%.

Summary

- Confidence Intervals are used to give an *interval* estimate for our parameter of interest
- Center of the Confidence Interval = our best estimate
- Margin of Error (MoE) = “a few” (estimated) standard errors