

Estimating a Population Proportion With Confidence

Reed Coots
Statistics Course Developer





Best Estimate ± Margin of Error





Best Estimate ± Margin of Error

Best Estimate = Unbiased Point Estimate



Best Estimate ± Margin of Error

Best Estimate = Unbiased Point Estimate

Margin of Error = "a few" Estimated Standard Errors



Best Estimate ± 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 ↔ 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.





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





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

Population - Parents with a toddler





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



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





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.



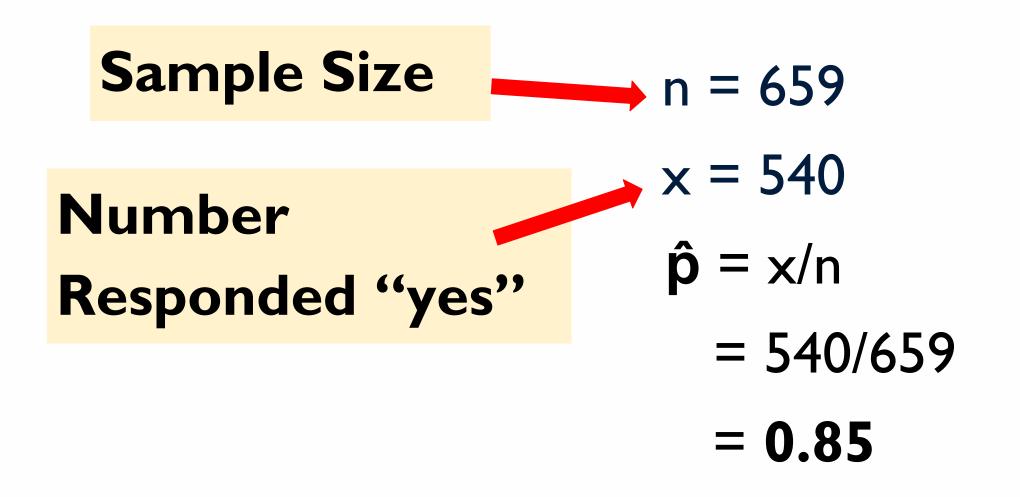
Best Estimate ± Margin of Error



Best Estimate ± Margin of Error p̂ ± Margin of Error



Best Estimate = p̂





Best Estimate ± Margin of Error p̂ ± Margin of Error



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Best Estimate ± Margin of Error

p̂ ± Margin of Error

p̂ ± "a few" · estimated se(p̂)
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Best Estimate ± Margin of Error p̂ ± Margin of Error

p̂ ± "a few" · estimated se(p̂)

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



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$$n=659$$



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

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

$$0.85 \pm 0.0273$$

(0.8227, 0.8773)

$$n=659$$



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