Understanding Confidence Intervals

Brenda Gunderson
Lecturer, Statistics
College of Literature, Science, and the Arts

Understanding Confidence Intervals

- How to **interpret** confidence **intervals**?
- What does that **confidence level** really mean?
- What if we want to be **99% confident instead**?

Car Seats for Toddlers Example

In a sample of 659 parents with a toddler, 540 (or **85%**) stated they **use a car seat** for all travel with their toddler.

95% confidence interval:

(0.8227, 0.8773) or about 82.3% to 87.7%

Confidence Interval for ___???___

We make a confidence interval for a __ **parameter** __.

parameter OR statistic

Car Seats for Toddlers Example

(0.8227, 0.8773) is a confidence interval for the **POPULATION PROPORTION** of all parents with toddlers who report they use a car seat for all travel with their toddler

Just reporting interval with **good context Improve?** more of interpretation that conveys is an estimate based on data, with confidence level

Interpreting the Confidence Interval

We estimate, **with 95% confidence**, the population proportion of parents with toddlers who report they use a car seat for all travel with their toddler is somewhere between 0.8227 and 0.8773.

OR

Based on our sample of 659 parents with toddlers, **with 95% confidence**, we estimate between 82.3% and 87.7% of all such parents report they use a car seat for all travel with their toddler

Think About It …

Does our confidence interval of (0.8227, 0.8773) contain the ***sample proportion*** of parents with toddlers who report they use a car seat for all travel with their toddler?

Yes, it most certainly does … our interval is centered at that sample proportion of 0.85 or 85%.

Think About It …

Does our confidence interval of (0.8227, 0.8773) contain the ***population proportion*** of parents with toddlers who report they use a car seat for all travel with their toddler?

We Don't Know…

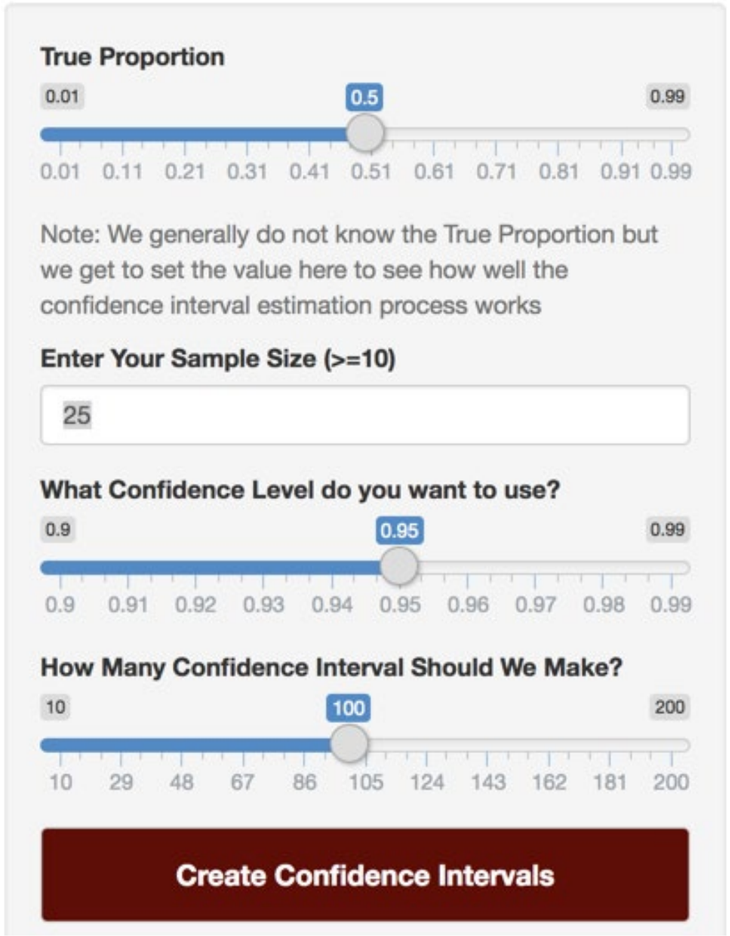
Wrong Understanding of Confidence Level

95% <u>chance</u> or **<u>probability</u>**
that the population proportion is in
this already computed interval of (0.8227, 0.8773)

Correct Understanding of Confidence Level

95% confidence level refers to our **confidence in the statistical procedure** that was used to make this interval

Understanding Confidence Level

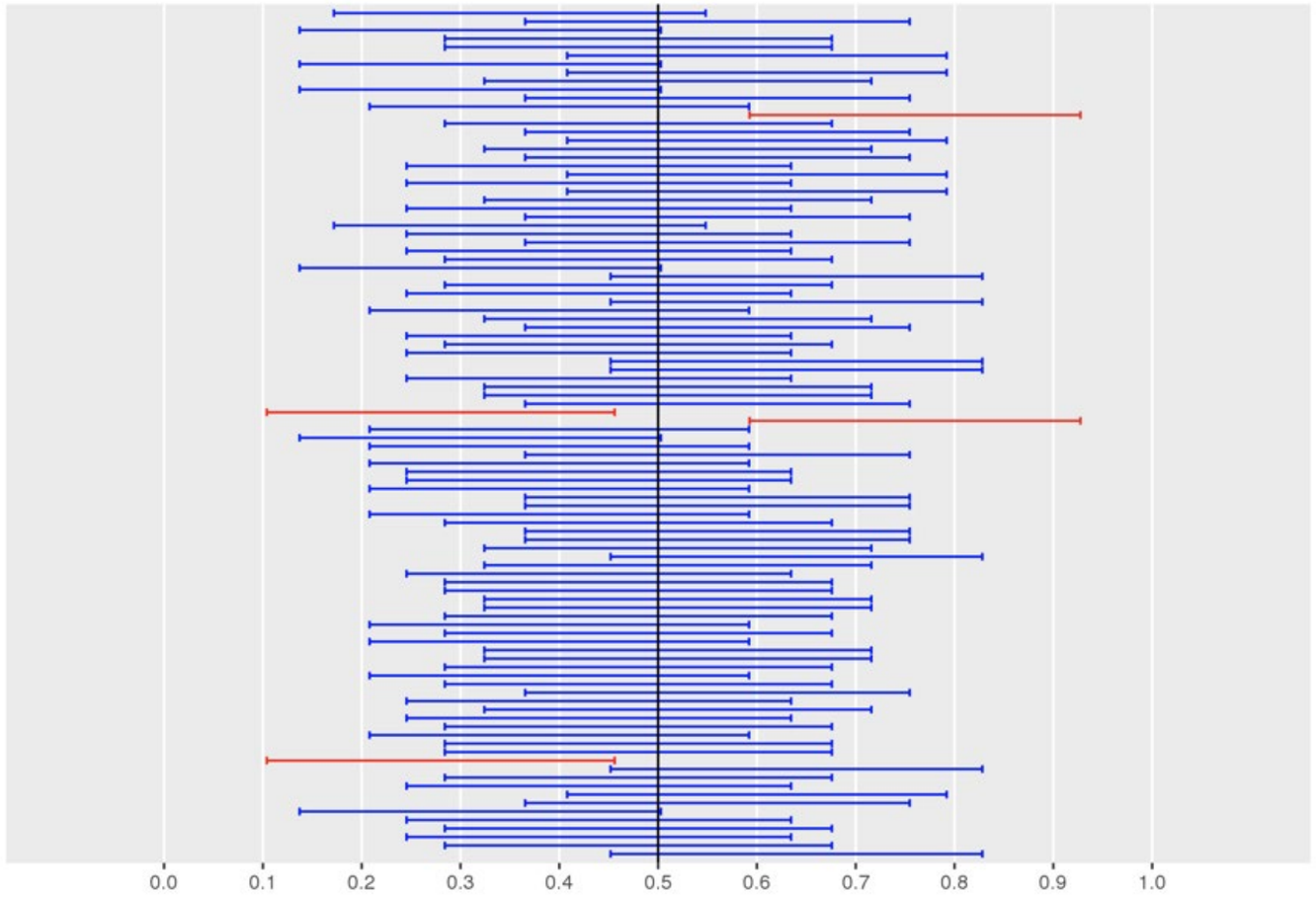


Population Proportion = 0.50

Take 100 samples each of size 25

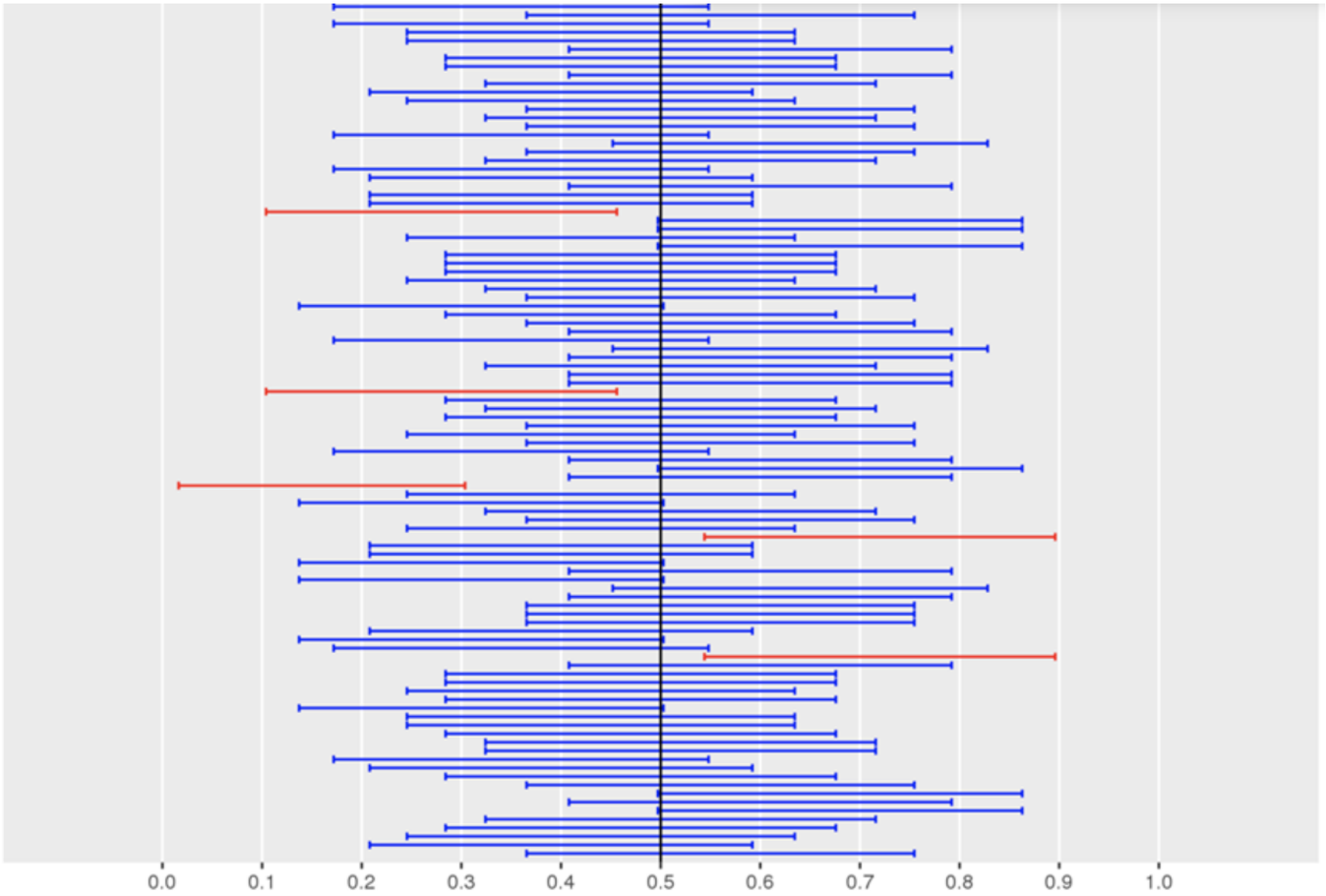
For each sample, create a 95% confidence interval for the population proportion

Understanding Confidence Level



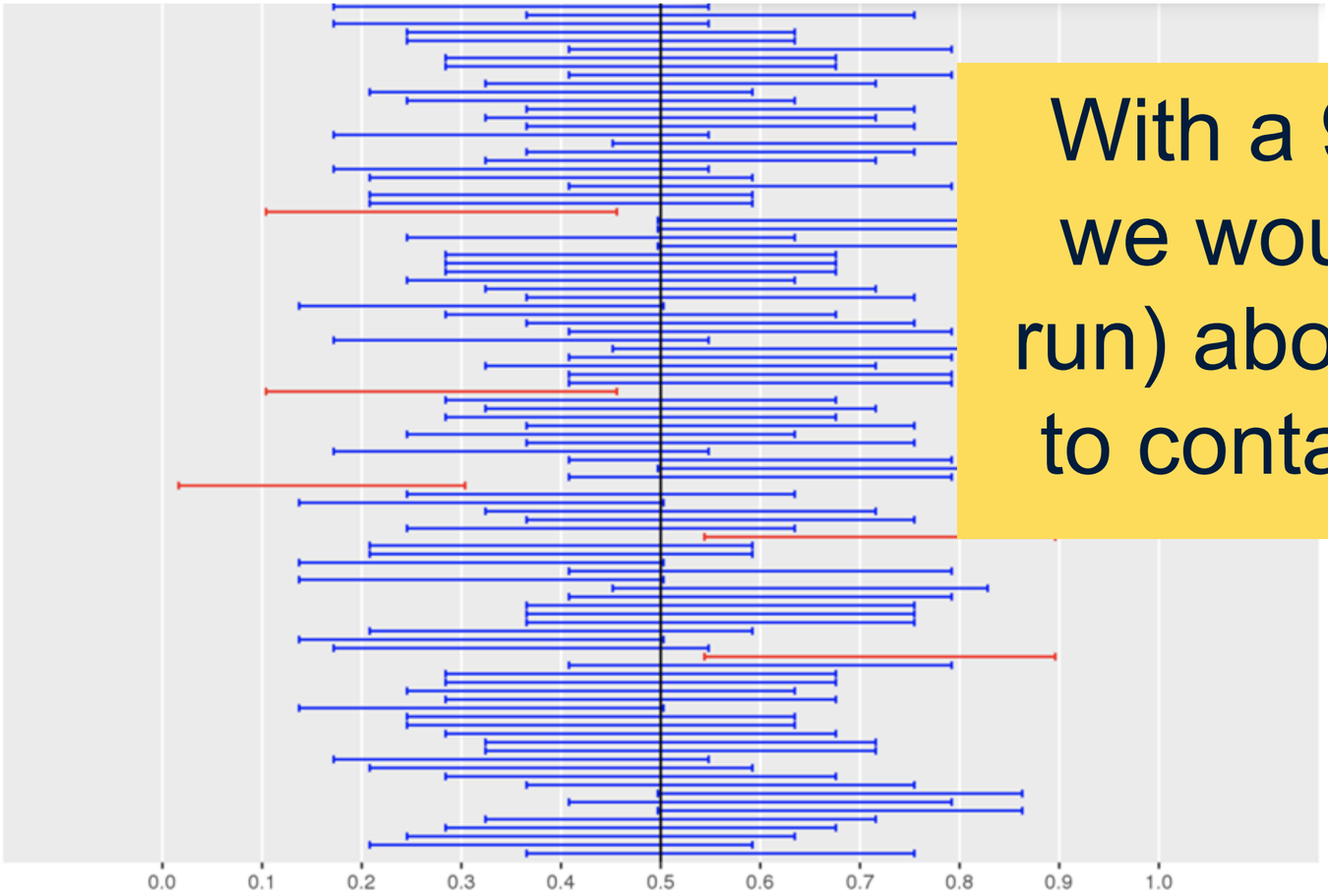
96 of these **100** generated intervals **did** contain the true proportion of **0.5** while **4** did not.

Understanding Confidence Level



95 of these **100** generated intervals **did** contain the true proportion of **0.5** while **5** did not.

Understanding Confidence Level



With a **95%** confidence level, we would expect (in the long run) about **95%** of the intervals to contain the true proportion.

Different Z Multipliers

90%	95%	98%	99%
1.645	1.96	2.326	2.576

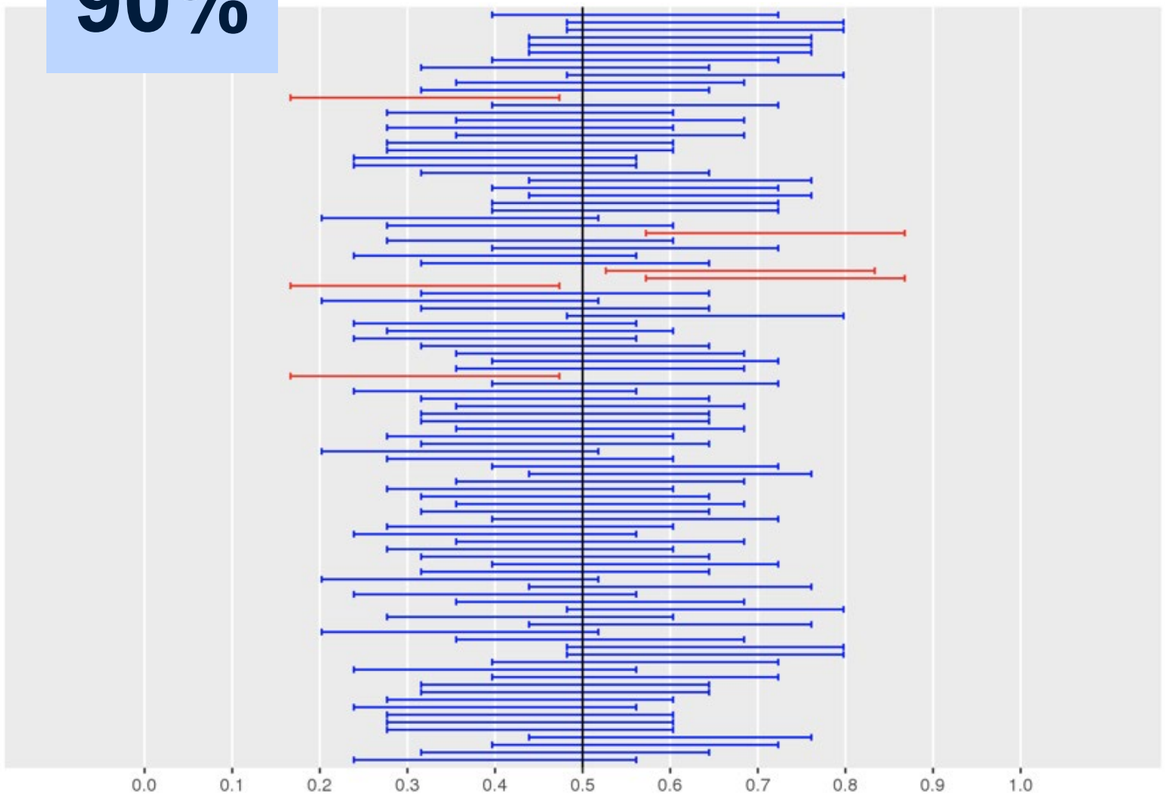
Best Estimate ± Margin of Error

Best Estimate ± “a few” (estimated) standard errors

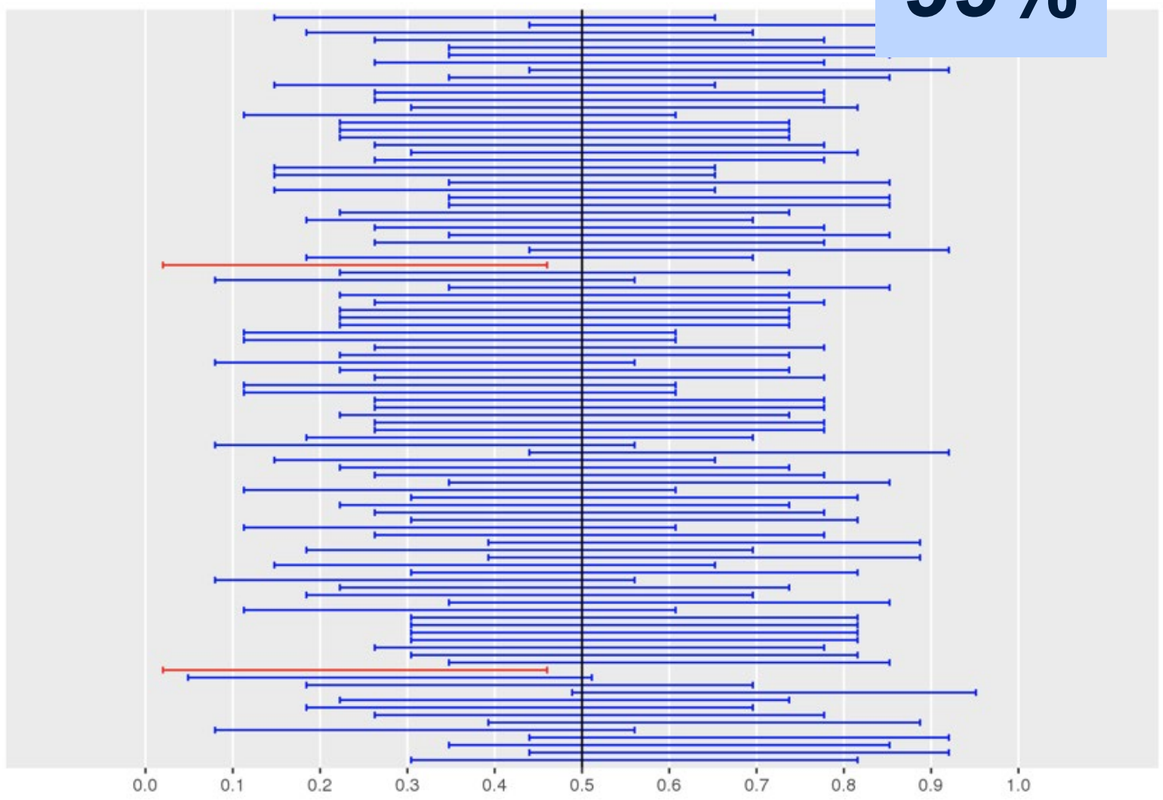
More confident → Larger Multiplier → Wider Interval

Changing Confidence Level

90%



99%



Car Seats for Toddlers Example

In a sample of 659 parents with a toddler, 540 (or **85%**) stated they **use a car seat** for all travel with their toddler.

90% CI:
0.85 ± 0.0229
82.7% to 87.3%

95% CI:
0.85 ± 0.0273
82.3% to 87.7%

99% CI:
0.85 ± 0.0358
81.4% to 88.6%

Understanding Confidence Intervals

- We know how to **interpret** confidence **intervals**
- We understand what that **confidence level** really means
- We have options for the desired **confidence level**