EPSY 5261 : Introductory Statistical Methods

Day 18

Confidence Intervals for a Single Proportion

Learning Goals

- At the end of this lesson, you should be able to…
  - Identify when to answer a research question with a confidence interval
  - Explain the need for creating a confidence interval to do statistical inference
  - Know how to calculate a confidence interval by hand and using R Studio for a mean
  - Interpret a confidence interval
  - Explain how the sample size we haves affects our interval

Confidence Intervals

- Sampling Variability = Samples vary
- We need something to quantify the uncertainty in our estimates

Confidence Intervals

Terminology

- 95% confidence interval:
  - Sample statistic +/- (2 x SE)
- Margin of error:
  - A specified number of standard errors that we add and subtract from the sample statistic to get a confidence interval.
  - Margin of error quantifies the amount of sampling error due to variation from sample to sample.

Assumptions needed to use z-distribution for single proportion

- Assumptions
  - $n\hat{p} \geq 10$
  - $n(1 - \hat{p}) \geq 10$
- We use $\hat{p}$ as a stand-in for p, which is unknown.

Formula

$$CI = \hat{p} \pm z * SE$$

Table 17.1 in text

studied in EPsy 5261.

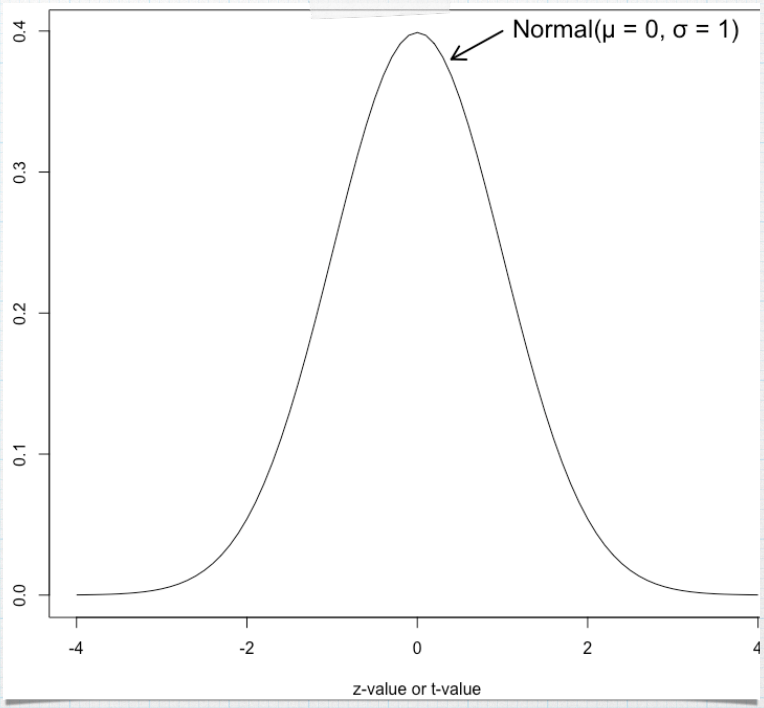
Situation	SE
Single Mean	$\frac{\text{SD}}{\sqrt{n}}$
Single Proportion	$\frac{\hat{p}(1-\hat{p})}{\sqrt{n}}$
Difference in Means	$\sqrt{\frac{\text{SD}_1^2}{n_1} + \frac{\text{SD}_2^2}{n_2}}$
Difference in Proportions	$\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

Formula

$$CI = \hat{p} \pm z * \frac{\hat{p}(1-\hat{p})}{\sqrt{n}}$$

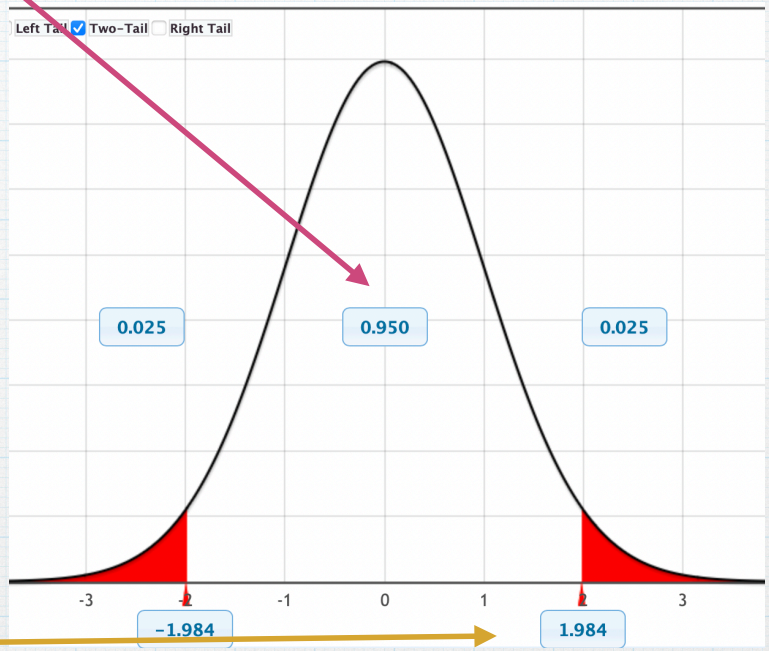
What is z*?

- Recall the z-distribution
- Use this to find the z* value based on the desired confidence level



For example 95% confidence

- The z-distribution us a standard normal bell curve with a mean of 0 and a standard deviation of 1
- To get 95% confidence for our estimate we need to look at how many standard deviations away from the mean we need to be to obtain that level of confidence
- z* = 1.96



T-distribution with sample size 100

Worry Activity

Write your final confidence interval interpretation on the white board for your group.

What was the relationship between the sample size and the interval?

Summary

- For a research question asking for an estimate, the best way to answer is with a confidence interval
- The confidence interval allows us to take into sampling account variability
- With a larger sample size we expect a smaller confidence interval.