EPSY 5261 : Introductory Statistical Methods

Day 16

Introduction to Confidence Intervals

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
  - Interpret a confidence interval

Confidence Intervals

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

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Confidence Intervals

Terminology

- Standard deviation:

Average distance from the mean, where each point in the data is an individual value

- Standard Error: standard deviation for a sample

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.

Table 17.1 in text

Formulas to compute the standard error (SE) for the different situations we have studied in EPsy 5261.

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

Interpretation

- When interpreting a CI you need to include:
  - Confidence level
  - Population parameter
  - Interval Estimate

Example:

We are 95% confident that the average price of a single-family house near the University of Minnesota is between $348K and $461K.

Music Library Activity

Compare Intervals on the Board
What do you notice?.....

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