POLS 5377 Scope & Method of Political Science

Week 11 Hypothesis Testing

The One-Sample Test

Healey. (2016) *Statistics: A Tool for Social Research,* Chapter 8

Key Questions:

- What is the logic behind hypothesis testing?
- What are the steps used to test hypotheses?
- How to interpret and report the results of hypothesis testing?
- What are the different formulas used for hypothesis testing?

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Outline

- Logic of Hypothesis Testing
- Five-Step Model of Testing Hypothesis
- One-Tailed and Two-Tailed Tests
- Hypothesis Testing – Proportion
- Interpreting Test Results

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Logic of Hypothesis Testing

Example:

- A researcher is studying the effectiveness of an influenza awareness campaign in Walker County that is designed to increase flu vaccination rate in the community.
- Since it is not feasible to survey each citizen, the research takes a random sample of 250 citizens who received the campaign messages.
- The researcher notes that citizens in the sample appear to have higher rate of receiving the flu vaccination.

Population All citizens in Texas	Sample 250 citizens drawn from those received the campaign messages
$\mu = 43\%$ flu vaccination rate $\sigma = 2.2$	$\bar{X} = 48\%$ flu vaccination rate N = 250

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Logic of Hypothesis Testing

- Question: are citizens who receive the influenza awareness campaign messages more likely to receive flu vaccination than are the citizens of Texas as a whole?
- There are two ways to interpret the difference between the 43% and the 48%.
  - First, there is **no difference** between citizens who received the campaign messages and the citizens in the state in general in terms of flu vaccination rate. The difference seen is trivial and due to the effects of random chance.
  - Second, the flue vaccination rate difference we see in our sample is **real**. These differences are statistically significant. The difference is very unlikely to have occurred by random chance. The awareness campaign works.
- How do we decide which interpretation is true? We set up a decision making process that enables us to choose the interpretation that is less likely to be incorrect.

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Logic of Hypothesis Testing

- A **Test of Significance**, or **Hypothesis Testing** is the process we use for make this decision.
- To test the two possible interpretations, we always assume the first one is correct – that there is **NO difference** (statistically significant difference) between the sample and the population.
- This is known as the ***null hypothesis***.
- When we begin to test our hypothesis, we actually test the null hypothesis.
- The null hypothesis always specifies that any relationship or difference found is due solely to chance.
- In other words, that there is no difference between the two groups.

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Logic of Hypothesis Testing

Two hypotheses:

- Null Hypothesis (H_0)
  - "The difference is caused by random chance" ; H_0 always states there is "no significant difference"
  - H_0: There is no difference between citizens in our sample and all citizens in the State as a whole in terms of flu vaccination rate.
- Alternative hypothesis (H_1)
  - "The difference is real"; H_1 always contradicts H_0
  - H_1 : There is a difference between citizens in our sample and all citizens in the State as a whole in terms of flu vaccination rate.
- One (and only one) of these explanations *must* be true, but which one?

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Logic of Hypothesis Testing

- Assume the H_0 is true
  - What is the probability of getting the sample mean (48%) if the H_0 is true and all citizens received the campaign messages really have a mean of 43% vaccination rate?
  - If the probability is less than 0.05, reject the null hypothesis – which means reject the idea of there is no difference between the two groups
- Use the 0.05 value as a guideline to identify if the difference is rare or not.
- Use the normal curve table to determine the probability of getting the observed difference.
- If the observed value falls into the 0.05 area ($z > 1.96$; $z < -1.96$), the difference is large enough, that only 0.05 chance the H_0 is true.
- Reject H_0