8.13: Hypothesis Test for a Population Proportion (1 of 3)

Learning Objectives

- Recognize when a situation calls for testing a hypothesis about a population proportion.
- Conduct a hypothesis test for a population proportion. State a conclusion in context.

Introduction

In the previous section, we introduced the concept of hypothesis testing. In a hypothesis test, we test competing claims about a population parameter or the difference between two population parameters.

We looked at four hypothesis testing situations:

- Testing a claim about a single population proportion.
- Testing a claim about a single population mean.
- Testing a claim about the difference between two population proportions.
- Testing a claim about the difference between two population means.

Although we follow the four steps we examined in the previous section, "Hypothesis Testing," for each of these situations, the specifics for each test are different. In this section, we look at the hypothesis test for a single population proportion. When we conduct a test about a population proportion, we are working with a categorical variable. Later in the course, after we have learned a variety of hypothesis tests, we will need to be able to identify which test is appropriate for which situation. Identifying the variable as categorical or quantitative is an important component of choosing an appropriate hypothesis test. We also have to distinguish between testing a claim about a population proportion and estimating a population proportion.

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Once we know that we are dealing with a single population proportion, we can conduct the hypothesis test. Recall that the first step of a hypothesis test is to determine the hypotheses. In the previous section, our hypotheses were in words. In this section, we use symbols. Recall that the symbol for the population proportion is p.

Example

Health Insurance Coverage

According to the Government Accountability Office, 80% of all college students ages 18 to 23 had health insurance coverage in 2006. The Patient Protection and Affordable Care Act passed in 2010 allowed young people under age 26 to stay on their parents' health insurance policy. Has the proportion of college students ages 18 to 23 who have health insurance increased since 2006? A survey of 800 randomly selected college students ages 18 to 23 indicated that 83% of them had health insurance coverage.

H_0: $p = 0.80$ (No change; the proportion of college students ages 18 to 23 who have health insurance is still 80%.)
H_a: $p > 0.80$ (The proportion of college students ages 18 to 23 who have health insurance is now greater than 80%.)

The results of the survey do not affect our hypotheses. We use the results to determine whether to reject the null hypothesis in favor of the alternative hypothesis.

Example

Internet Access

According to the Kaiser Family Foundation, 84% of U.S. children ages 8 to 18 had Internet access at home as of August 2009. Researchers wonder if this percentage has changed since then. They survey 500 randomly selected children ages 8 to 18 and find that 430 of them have Internet access at home. The research question helps us form our hypotheses:

H_0: $p = 0.84$ (No change; the proportion of children with Internet access at home is the same.)
H_a: $p \neq 0.84$ (The proportion of children with Internet access at home has changed since 2009.)

Again, the results of the survey do not affect our hypotheses.

Example

Jury Selection

Jefferson Parish is a suburb of New Orleans, Louisiana. Its population is about 23% African American. Is there evidence that African Americans are underrepresented on juries in murder trials in Jefferson Parish? According to a *New York Times* article (June 4, 2007), there were 18 murder trials in Jefferson Parish between 1986 and 2007 in which the ethnicity of the jurors was known. Ten of the juries had no black jurors, 7 juries had 1 black juror, and 1 jury had 2 black jurors. The research question helps us to form our hypotheses:

H_0: $p = 0.23$ (No difference; the proportion of African Americans on juries in murder trials is the same as the proportion of African Americans in the population.)
H_a: $p < 0.23$ (The proportion of African Americans on juries in murder trials is less than the proportion of African Americans in the population.)

Summary of Hypotheses

As a reminder, the null hypothesis is always a statement of equality. The alternative hypothesis is always a statement of inequality, using <, >, or ≠. So hypotheses take the form:

H_0: $p = p_0$
H_a: $p < p_0$ or $p > p_0$ or $p \neq p_0$

We use p_0 to represent the proportion from the null hypothesis.

College Students and Federal Grants

According to the American Association of Community Colleges, 23% of community college students receive federal grants. The California Community College Chancellor's Office anticipates that the percentage is smaller for California community college students. They collect a sample of 1,000 community college students in California and find that 210 received federal grants.

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