Chapter 11 Comparisons Involving Proportions

use $(\bar{p}_1 - \bar{p}_2)$ to estimate $(p_1 - p_2)$

Hypothesis Tests for p_1-p_2

- $(p_1$-$p_2)$ is estimated by $(\bar{p}_1 - \bar{p}_2)$
- How could we compare the proportion of honor students at SCC vs. ASU?
- Common to test that there is no difference between population proportions
  - H_0: $p_{SCC} - p_{ASU} = 0$ vs. H_A: $p_{SCC} - p_{ASU} \neq 0$
- Can test any hypothesized difference
  - eg: the proportion of honors students at SCC is at least 15% points higher than at ASU
  - H_0: p_{SCC}-$p_{ASU} \geq .15$ vs. H_A: p_{SCC}-$p_{ASU} < .15$

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Hypothesis Tests for p_1-p_2

- Follow the same 6-step process
- Sampling Distribution of the Difference Between Proportions
  - describes possible values for $(\bar{p}_1 - \bar{p}_2)$
  - follows the BINOmial distribution but can use z when:
  - 1) $np \geq 5$ for each sample AND
  - 2) $n(1-p) \geq 5$ for each sample

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Hypothesis Tests for p_1-p_2

- Standard Error of the Difference Between Proportions
  - measures the ROSE when testing the difference between population proportions with difference between sample proportions

$$\sigma_{\bar{p}_1-\bar{p}_2} = \sqrt{\frac{p_1(1-p_1)}{n_1} + \frac{p_2(1-p_2)}{n_2}}$$

- Estimated Std Error of Difference Between Proportions

$$s_{\bar{p}_1-\bar{p}_2} = \sqrt{\frac{\bar{p}_1(1-\bar{p}_1)}{n_1} + \frac{\bar{p}_2(1-\bar{p}_2)}{n_2}}$$

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Special Case: Hypothesis Test for p_1=p_2

- When testing that there is no difference between population proportions (H_0: p_1-p_2=0), the standard error is based on a pooled estimate of the common proportion:

$$\bar{p} = \frac{n_1\bar{p}_1 + n_2\bar{p}_2}{n_1 + n_2}$$

- Estimated Std Error of Difference Between Proportions

$$s_{\bar{p}_1-\bar{p}_2} = \sqrt{\frac{\bar{p}(1-\bar{p})}{n_1} + \frac{\bar{p}(1-\bar{p})}{n_2}} = \sqrt{\bar{p}(1-\bar{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

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Hypothesis Tests for p_1-p_2

- Test statistic is $(\bar{p}_1 - \bar{p}_2)$

$$z = \frac{(\bar{p}_1 - \bar{p}_2) - (p_1 - p_2)}{s_{\bar{p}_1 - \bar{p}_2}}$$

- Textbooks America
  - Connection: Contingency Table

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