Types of Statistical Inference

Single categorical variable

One-proportion z-interval and test (Chapters 19-21)

Single quantitative variable

One sample t-interval and test (Chapter 23)

Two quantitative variables

Regression inference (Chapter 27)

Two categorical variables

Two categories each:
Two proportion z-interval and test (Chapter 22)

More than two categories each:
Chi-square tests (Chapter 26)

One categorical, one quantitative variable

Two categories:
2-sample t-interval and test (Chapter 24)
Paired t-interval and test (Chapter 25)

More than two categories:
ANOVA test (Chapter 28)

Confidence intervals (two-proportion z-intervals)

observed value $\pm$ (critical value)(standard error)

$$(\hat{p}_1 - \hat{p}_2) \pm z^* SE(\hat{p}_1 - \hat{p}_2) \quad \text{or} \quad (\hat{p}_1 - \hat{p}_2) \pm z^* \sqrt{\frac{\hat{p}_1\hat{q}_1}{n_1} + \frac{\hat{p}_2\hat{q}_2}{n_2}}$$

The critical value z^* depends on the level of confidence (e.g. 95%).

The new standard error formula comes from the formula for the standard deviation of a difference between two random variables

$$\sqrt{SD(X)^2 + SD(Y)^2}$$

Hypothesis tests (two-proportion z-tests)

$$z = \frac{\text{observed} - \text{expected}}{\text{standard error}}$$

1. State the null and alternative hypotheses.
   The null hypothesis is always $H_0: p_1 = p_2$ i.e. $p_1 - p_2 = 0$.
   The alternative is $H_A: p_1 \neq p_2$ or $H_A: p_1 < p_2$ or $H_A: p_1 > p_2$. (Pick one.)
2. Find the z-score of the sample using the null hypothesis.
3. Convert the z -score to a P–value.
4. Compare the P-value to α=.05.
5. Retain the null if the P-value is greater than α, and reject the null hypothesis if the P-value is less than α. Report the P-value of the test.

$$\hat{p}_{pooled} = \frac{success_1 + success_2}{n_1 + n_2}$$

$$z = \frac{(\hat{p}_1 - \hat{p}_2) - 0}{SE_{pooled}(\hat{p}_1 - \hat{p}_2)}$$

$$z = \frac{(\hat{p}_1 - \hat{p}_2) - 0}{\sqrt{\frac{\hat{p}_{pooled}\hat{q}_{pooled}}{n_1} + \frac{\hat{p}_{pooled}\hat{q}_{pooled}}{n_2}}}$$