

| Variable(s) of Interest   | Parameter of Interest   | Statistic of Interest   | Descriptive Method(s)  | Inferential Method(s)  | Assumption(s) for Inferential Methods  |
|---|---|---|--|--|--|
| <b>Single Categorical Variable</b><br><b>(Binary – 2 categories)</b>    | True Population Proportion ( $\pi$ )  | Sample Proportion ( $\hat{p}$ )                               | <ul style="list-style-type: none"> <li>Report <math>\hat{p}</math></li> <li>Bar chart</li> </ul>   | <ul style="list-style-type: none"> <li>Simulation</li> <li>Binomial test</li> <li>CI for <math>\pi</math></li> </ul> | Check the four conditions for the binomial   |
| <b>Single Categorical Variable</b><br><b>(More than two categories)</b> | True Population Proportion ( $\pi_1, \pi_2, \dots$ )                        | Sample proportions ( $\hat{p}_1, \hat{p}_2 \dots$ )           | <ul style="list-style-type: none"> <li>Report <math>\hat{p}_1, \hat{p}_2 \dots</math></li> <li>Stacked bar chart</li> </ul>                    | <ul style="list-style-type: none"> <li>Chi-square Goodness of Fit</li> </ul>   | <ul style="list-style-type: none"> <li>Observations are independent</li> <li>EXPECTED counts should be greater than 5</li> </ul> |
| <b>Two Categorical Variables</b><br><b>(in general)</b>                 | True Conditional Population Proportions ( $\pi_{1 G1}, \pi_{1 G2}, \dots$ ) | Sample Proportions ( $\hat{p}_{1 G1}, \hat{p}_{1 G2} \dots$ ) | <ul style="list-style-type: none"> <li>Report sample proportions</li> <li>Contingency table</li> <li>Stacked/Dodged/Filled Bar Plot</li> </ul> | <ul style="list-style-type: none"> <li>Chi-square test</li> </ul>  | <ul style="list-style-type: none"> <li>Observations are independent</li> <li>EXPECTED counts should be greater than 5</li> </ul> |

| Variables of Interest   | Parameter of Interest                                   | Statistic of Interest                                  | Descriptive Methods  | Inferential Methods  | Assumptions for Inferential Methods  |
|---|---|--|--|--|--|
| <b>Single Numerical Variable</b>  | True Population Mean ( $\mu$ )                          | Sample Mean ( $\bar{x}$ )                              | <ul style="list-style-type: none"> <li>▪ Report measures of center and variation</li> <li>▪ Dotplot, boxplot, histogram</li> <li>▪ Describe shape</li> <li>▪ Identify outliers</li> </ul>                              | <ul style="list-style-type: none"> <li>▪ One-sample t-test</li> <li>▪ CI for population mean</li> </ul>            | <ul style="list-style-type: none"> <li>▪ Either the sample size is fairly large or the data reasonably follow a normal distribution</li> </ul>   |
| <b>Comparing Numerical Variable across Two Categories of a Categorical Variable (DEPENDENT samples)</b>   | True Mean Difference ( $\mu_d$ )                        | Sample Mean Difference ( $\bar{x}_d$ )                 | <ul style="list-style-type: none"> <li>▪ Report measures of center and variation for the differences</li> <li>▪ Dotplot, boxplot, histogram of the differences</li> <li>▪ Describe shape, identify outliers</li> </ul> | <ul style="list-style-type: none"> <li>▪ paired t-test</li> <li>▪ CI for population mean difference</li> </ul>     | <ul style="list-style-type: none"> <li>▪ Independent differences</li> <li>▪ Either the number of pairs is fairly large or the differences reasonably follow a normal distribution</li> </ul>                             |
| <b>Comparing Numerical Variable across Two Categories of a Categorical Variable (INDEPENDENT samples)</b> | Difference in True Population Means ( $\mu_1 - \mu_2$ ) | Difference in Sample Means ( $\bar{x}_1 - \bar{x}_2$ ) | <ul style="list-style-type: none"> <li>▪ Report <math>\bar{x}_1, \bar{x}_2</math>, and <math>s_1, s_2</math></li> <li>▪ Side-by-side boxplots, faceted histograms</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Two-sample t-test</li> <li>▪ CI for <math>\mu_1 - \mu_2</math></li> </ul> | <ul style="list-style-type: none"> <li>▪ Observations are independent between groups</li> <li>▪ Either both sample sizes are fairly large or the data from each group reasonably follow a normal distribution</li> </ul> |

| Variables of Interest  | Parameter of Interest | Statistic of Interest | Descriptive Methods   | Inferential Methods                                  | Assumptions for Inferential Methods  |
|--|-----------------------|-----------------------|---|--|--|
| Comparing Numerical Variable across 2 or more categories of a Categorical Variable |                       |                       | <ul style="list-style-type: none"> <li>Group means, group standard dev.</li> <li>Side-by-side boxplots, faceted histograms</li> </ul>               | Analysis of Variance (ANOVA)<br><br>F-test statistic | <ul style="list-style-type: none"> <li>Independence <i>between</i> and <i>within</i> groups</li> <li>Equal variances</li> <li>Normality</li> </ul> |
| Comparing Two Numerical Variables  |                       |                       | <ul style="list-style-type: none"> <li>Correlation (r)</li> <li>Scatterplot</li> <li>Regression line (<math>\hat{y} = b_0 + b_1x</math>)</li> </ul> | Linear Regression Analysis<br><br>Slope = 0?         | <ul style="list-style-type: none"> <li>Linearity</li> <li>Independence</li> <li>Normality</li> <li>Equal Variance</li> </ul>                       |