

Scenario	One Categorical Response	Two Categorical Variables	Paired Differences	Two Quantitative Variables	Quant. Response and Categ. Explanatory (independent samples)
Type of plot	Bar plot	Segmented bar plot, Mosaic plot	Dotplot, histogram, boxplot	Scatterplot	Side-by-sided boxplots, Stacked dotplots or histograms
Summary measure	Proportion	Difference in proportions	Mean Difference	Slope or correlation	Difference in means
Parameter notation	$\pi$	$\pi_1 - \pi_2$	$\mu_d$	$\beta_1$ or $\rho$	$\mu_1 - \mu_2$
Statistic notation	$\hat{p}$	$\hat{p}_1 - \hat{p}_2$	$\bar{x}_d$	$b_1$ or $r$	$\bar{x}_1 - \bar{x}_2$
Null hypothesis	$H_0: \pi = \pi_0$	$H_0: \pi_1 - \pi_2 = 0$	$H_0: \mu_d = 0$	$H_0: \beta_1 = 0$ or $H_0: \rho = 0$	$H_0: \mu_1 - \mu_2 = 0$
Conditions for simulation methods	Independent cases;	Independence (within and between groups);	Independent cases;	Independent cases; Linear form;	Independence (within and between groups);
Simulation test (how to generate a null distn)  p-value = proportion of null simulations at or beyond ( $H_A$ direction) the observed statistic	Spin spinner with probability equal to $\pi_0$ , $n$ times or draw with replacement $n$ times from a deck of cards created to reflect $\pi_0$ as probability of success. Plot the proportion of successes. Repeat 1000's of times. Centered at $\pi_0$	Label cards with response values from original data; mix cards together; shuffle into two new groups of sizes $n_1$ and $n_2$ . Plot difference in proportion of successes. Repeat 1000's of times. Centered at 0.	Shift the original data by adding $(0 - \bar{x}_d)$ . Sample with replacement from the shifted data $n$ times. Plot sample mean difference. Repeat 1000's of times. Centered at 0.	Hold the $x$ values constant; shuffle new $y$ 's to $x$ 's. Find the regression line for shuffled data; plot the slope or the correlation for the shuffled data. Repeat 1000's of times. Centered at 0.	Label cards with response variable values from original data; mix cards together; shuffle into two new groups of sizes $n_1$ and $n_2$ . Plot difference in means. Repeat 1000's of times. Centered at 0.
Bootstrap CI (how to generate a boot. distn)  X% CI: $\left(\frac{1-X}{2}\right)\%tile,$ $\left(X + \frac{1-X}{2}\right)\%tile$	Label $n$ cards with the original responses. Randomly draw with replacement $n$ times. Plot the resampled proportion of successes. Repeat 1000's of times. Centered at $\hat{p}$ .	Label $n_1 + n_2$ cards with the original responses. Randomly draw with replacement $n_1$ times from group 1 and $n_2$ times from group 2. Plot the resampled difference in proportion of successes. Repeat 1000's of times. Centered at $\hat{p}_1 - \hat{p}_2$	Label $n$ cards with the original responses. Randomly draw with replacement $n$ times. Plot the resampled mean difference. Repeat 1000's of times. Centered at $\bar{x}_d$ .	Label $n$ cards with the original (response, explanatory) values. Randomly draw with replacement $n$ times. Plot the resampled slope or correlation. Repeat 1000's of times. Centered at $b_1$ or $r$ .	Label $n_1 + n_2$ cards with the original responses. Randomly draw with replacement $n_1$ times from group 1 and $n_2$ times from group 2. Plot the resampled difference in means. Repeat 1000's of times. Centered at $\bar{x}_1 - \bar{x}_2$ .
Theory-based distribution	Standard Normal	Standard Normal	$t$ - distribution with $n - 1$ df	$t$ - distribution with $n - 2$ df	$t$ - distribution with min of $n_1-1$ or $n_2-1$ df
Conditions for theory-based hypothesis tests and confidence intervals	Independent cases; Number of successes and number of failures in the sample both at least 10.	Independence (within and between groups); Number of successes and number of failures in EACH sample all at least 10. (All four cell counts at least 10.)	Independent cases; $n < 30$ with no clear outliers OR $30 \leq n < 100$ with no extreme outliers OR $n \geq 100$	Linear form; Independent cases; Nearly normal residuals; Variability around the regression line is roughly constant.	Independent cases (within and between groups); In each sample, $n < 30$ with no clear outliers OR $30 \leq n < 100$ with no extreme outliers OR $n \geq 100$
Theory-based standardized statistic (test statistic)	$z = \frac{\hat{p} - \pi_0}{SE_0(\hat{p})}$  $SE_0(\hat{p}) = \sqrt{\frac{\pi_0 \times (1 - \pi_0)}{n}}$	$z = \frac{\hat{p}_1 - \hat{p}_2 - 0}{SE_0(\hat{p}_1 - \hat{p}_2)}$  $SE_0(\hat{p}_1 - \hat{p}_2) = \sqrt{\widehat{p_{pool}} \times (1 - \widehat{p_{pool}}) \times \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$	$t = \frac{\bar{x}_d - 0}{SE(\bar{x}_d)}$  $SE(\bar{x}_d) = \frac{s_d}{\sqrt{n}}$	$t = \frac{b_1 - 0}{SE(b_1)}$  $SE(b_1)$ is the reported standard error (std. error) of the slope term in the lm() output from R.	$t = \frac{\bar{x}_1 - \bar{x}_2 - 0}{SE(\bar{x}_1 - \bar{x}_2)}$  $SE(\bar{x}_1 - \bar{x}_2) = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$
Theory-based confidence interval	$\hat{p} \pm z^* \times SE(\hat{p})$  $SE(\hat{p}) = \sqrt{\frac{\hat{p} \times (1 - \hat{p})}{n}}$	$\hat{p}_1 - \hat{p}_2 \pm z^* \times SE(\hat{p}_1 - \hat{p}_2)$  $SE(\hat{p}_1 - \hat{p}_2) = \sqrt{\frac{\hat{p}_1 \times (1 - \hat{p}_1)}{n_1} + \frac{\hat{p}_2 \times (1 - \hat{p}_2)}{n_2}}$	$\bar{x}_d \pm t^* \times SE(\bar{x}_d)$  $SE(\bar{x}_d) = \frac{s_d}{\sqrt{n}}$	$b_1 \pm t^* \times SE(b_1)$  $SE(b_1)$ is the reported standard error (std. error) of the slope term in the lm() output from R.	$\bar{x}_1 - \bar{x}_2 \pm t^* \times SE(\bar{x}_1 - \bar{x}_2)$  $SE(\bar{x}_1 - \bar{x}_2) = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$