

10.10: Formula Review

10.2 Comparing Two Independent Population Means

Standard error: $SE = \sqrt{\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2}}$

Test statistic (*t*-score): $t_c = \frac{(\bar{x}_1 - \bar{x}_2) - \delta_0}{\sqrt{\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2}}}$

Degrees of freedom:

$$df = \frac{\left(\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2} \right)^2}{\left(\frac{1}{n_1 - 1} \right) \left(\frac{(s_1)^2}{n_1} \right)^2 + \left(\frac{1}{n_2 - 1} \right) \left(\frac{(s_2)^2}{n_2} \right)^2} \quad (10.10.1)$$

where:

s_1 and s_2 are the sample standard deviations, and n_1 and n_2 are the sample sizes.

\bar{x}_1 and \bar{x}_2 are the sample means.

10.3 Cohen's Standards for Small, Medium, and Large Effect Sizes

Cohen's d is the measure of effect size:

$$d = \frac{\bar{x}_1 - \bar{x}_2}{s_{\text{pooled}}} \quad (10.10.2)$$

where $s_{\text{pooled}} = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$

10.4 Test for Differences in Means: Assuming Equal Population Variances

$$t_c = \frac{(\bar{x}_1 - \bar{x}_2) - \delta_0}{\sqrt{S_p^2 \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}} \quad (10.10.3)$$

where S_p^2 is the pooled variance given by the formula:

$$S_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} \quad (10.10.4)$$

10.5 Comparing Two Independent Population Proportions

Pooled Proportion: $p_C = \frac{x_A + x_B}{n_A + n_B}$

Test Statistic (z-score): $Z_c = \frac{(p'_A - p'_B)}{\sqrt{p_C(1 - p_C) \left(\frac{1}{n_A} + \frac{1}{n_B} \right)}}$

where

p'_A and p'_B are the sample proportions, p_A and p_B are the population proportions,

P_C is the pooled proportion, and n_A and n_B are the sample sizes.

10.6 Two Population Means with Known Standard Deviations

Test Statistic (z-score):

$$Z_c = \frac{(\bar{x}_1 - \bar{x}_2) - \delta_0}{\sqrt{\frac{(\sigma_1)^2}{n_1} + \frac{(\sigma_2)^2}{n_2}}} \quad (10.10.5)$$

where:

σ_1 and σ_2 are the known population standard deviations. n_1 and n_2 are the sample sizes. \bar{x}_1 and \bar{x}_2 are the sample means.

μ_1 and μ_2 are the population means.

10.7 Matched or Paired Samples

Test Statistic (t-score): $t_c = \frac{\bar{x}_d - \mu_d}{\left(\frac{s_d}{\sqrt{n}}\right)}$

where:

\bar{x}_d is the mean of the sample differences. μ_d is the mean of the population differences. s_d is the sample standard deviation of the differences. n is the sample size.

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