BIOSTATS 540
Summary of Standard Error Calculations

Single Sample of Univariate Measure from One Population

Standard Error of	When	Calculation	This is relevant to
$\bar{X}$	X is continuous and σ^2 is KNOWN	$SE(\bar{X})=\sqrt{\frac{\sigma^2}{n}}=\frac{\sigma}{\sqrt{n}}$	**Z-test**
$\bar{X}$	X is continuous and σ^2 is NOT known	Preliminary is to get $S^2=\frac{\sum_{i=1}^{n}\left(X_i-\bar{X}\right)^2}{(n-1)}$ Then estimate SE using: $\hat{SE}(\bar{X})=\sqrt{\frac{S^2}{n}}=\frac{S}{\sqrt{n}}$	**T-test**
$\bar{X}$	X's are discrete 0/1 and $\bar{X}$ = proportion	(1) For <u>confidence interval</u> of binomial event probability parameter π, use $\hat{SE}(\bar{X})=\sqrt{\frac{\bar{X}(1-\bar{X})}{n}}$ or $\hat{SE}(\bar{X})=\sqrt{\frac{.5(1-.5)}{n}}$ to be conservative (2) For <u>hypothesis test</u> of $H_O: \pi = \pi_{NULL}$, use $SE(\bar{X})_{NULL}=\sqrt{\frac{\pi_{NULL}(1-\pi_{NULL})}{n}}$	**Z-test**

Paired Data:
Single Sample of Bivariate Measure (e.g. "pre/post") from One Population

↓

Analysis focuses on Differences d = (X-Y) or d =(Y-X)

↓

Conceptualize data as a single sample $d_1, d_2, \ldots, d_n$

Standard Error of	When	Calculation	This is relevant to
$\bar{d}$	d is continuous and σ_d^2 is KNOWN	$SE(\bar{d})=\sqrt{\frac{\sigma_d^2}{n}}=\frac{\sigma_d}{\sqrt{n}}$	**Z-test**
$\bar{d}$	d is continuous and σ_d^2 is NOT known	Preliminary is to get $S_d^2=\frac{\sum_{i=1}^{n}\left(d_i-\bar{d}\right)^2}{(n-1)}$ Then estimate SE using: $\hat{SE}(\bar{d})=\sqrt{\frac{S_d^2}{n}}=\frac{S_d}{\sqrt{n}}$	**T-test**

Two Independent Samples, Two Populations

Standard Error of	When	Calculation	Relevant
$[\bar{X}-\bar{Y}]$	X, Y are continuous and σ_x^2 and σ_y^2 are KNOWN	$SE(\bar{X}-\bar{Y})=\sqrt{\frac{\sigma_x^2}{n_x}+\frac{\sigma_y^2}{n_y}}$	**Z-test**
$[\bar{X}-\bar{Y}]$	X, Y are continuous and σ_x^2 and σ_y^2 are NOT known AND Preliminary F test of $H_O:\sigma_x^2=\sigma_y^2$ rejects.	Estimate SE using: $\hat{SE}(\bar{X}-\bar{Y})=\sqrt{\frac{S_x^2}{n_x}+\frac{S_y^2}{n_y}}$	**T-test**
$[\bar{X}-\bar{Y}]$	X, Y are continuous and σ_x^2 and σ_y^2 are NOT known AND Preliminary F test of $H_O:\sigma_x^2=\sigma_y^2$ does NOT reject the null.	Preliminary is to get $S_{POOL}^2=\frac{\sum_{i=1}^{n}\left(X_i-\bar{X}\right)^2+\sum_{i=1}^{n}\left(Y_i-\bar{Y}\right)^2}{(n_x-1)+(n_y-1)}$ Then estimate SE using $\hat{SE}(\bar{X}-\bar{Y})=\sqrt{\frac{S_{POOL}^2}{n_x}+\frac{S_{POOL}^2}{n_y}}$	**T-test**
$[\bar{X}-\bar{Y}]$	X's are discrete 0/1 and Y's are discrete 0/1 and $\bar{X}$ = proportion and $\bar{Y}$ = proportion	(1)For confidence interval of difference in binomial event probability parameters $\pi_x - \pi_y$, use $\hat{SE}(\bar{X}-\bar{Y})=\sqrt{\frac{\bar{X}(1-\bar{X})}{n_x}+\frac{\bar{Y}(1-\bar{Y})}{n_y}}$ (2) For hypothesis test of $H_O: \pi_x = \pi_y = \pi_{common}$, First get $\hat{\pi}_{common}=\frac{X+Y}{n_x+n_y}$ Then estimate SE using $\hat{SE}(\bar{X}-\bar{Y})=\sqrt{\frac{\hat{\pi}_{common}(1-\hat{\pi}_{common})}{n_x}+\frac{\hat{\pi}_{common}(1-\hat{\pi}_{common})}{n_y}}$	**Z-test**