Worked Example for Fully Nested Analysis of a Simple Difference

The calculator will use the parameter estimates you have provided to calculate power for the intervention effect that you specified.

In addition, the calculator will use the other parameter estimates to calculate the detectable difference (Δ) that is available with the level of power that you specified as a function of the number of groups in each study condition (g) and the number of members in each group (m), using the formula below.

$$\Delta = \sqrt{2\left(\frac{\sigma_y^2(1-ICC)\left(1-R_{y\cdot x_m}^2\right)+m\sigma_y^2(ICC)\left(1-R_{y\cdot x_g}^2\right)}{mg}\right)\left(t_{\alpha/2}+t_\beta\right)^2}$$

Here σ_y^2 is the variance of the outcome variable ignoring any expected intraclass correlation ICC, $R_{y\cdot x_m}^2$ is the proportion of variance explained by the member-level covariates, $R_{y\cdot x_g}^2$ is the proportion of variance explained by the group-level covariates, $t_{\alpha/2}$ is the t-value selected based on the two-tailed alpha level and available degrees of freedom, t_β is the t-value selected based on the desired power and available degrees of freedom.

As an example, consider the following set of parameter estimates:

Let m = 10, g = 5, with 1 degree of freedom used for group-level covariates. Then

$$df = 2(g-1)-1 = 2(5-1)-1 = 7$$

For a two-tailed type 1 error rate of 5%,

$$t_{\alpha/2} = 2.3646 \text{ and } t_\beta = 0.8960$$

Let σ_y^2 = 1 and ICC = 0.05.

Let $R_{y\cdot x_m}^2$ = 0.30 and $R_{y\cdot x_g}^2$ = 0.10.

Then

$$\begin{aligned}\Delta &= \sqrt{2\left(\frac{1(1-0.05)(1-0.30)+10(1)(0.05)(1-0.10)}{10*5}\right)(2.3646+0.8960)^2} \\ &= 0.6886\end{aligned}$$

The detectable difference given these parameter estimates is 0.6886 standard deviation units.