Worked Example for Partially 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 the intervention condition (g), the number of members in the control condition (m_c), and the number of members in each group in the intervention condition (m_i), using the formula below.

$$\Delta = \sqrt{\left(\frac{\sigma_y^2\left(1 - R^2_{y \cdot x_m}\right)}{m_c} + \frac{\sigma_y^2(1 - ICC)\left(1 - R^2_{y \cdot x_m}\right) + m_i\sigma_y^2(ICC)\left(1 - R^2_{y \cdot x_g}\right)}{m_i g}\right)\left(t_{\alpha/2} + t_\beta\right)^2}$$

Here σ_y^2 is the variance of the outcome variable ignoring any expected intraclass correlation ICC, $R^2_{y \cdot x_m}$ is the proportion of variance explained by the member-level covariates, $R^2_{y \cdot x_g}$ is the proportion of variance explained by the group-level covariates, r_{yym} is the over-time correlation for the outcome variable at the member level, $t_{\alpha/2}$ 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_c = 50, m_i = 10, g = 5, with 4 degrees of freedom used for member-level covariates and 1 degree of freedom used for group-level covariates. Then

$$df = (m_c - 1) + (g - 1) - (4 + 1) = (50 - 1) + (5 - 1) - (4 + 1) = 48$$

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

$$t_{\alpha/2} = 2.0106 \text{ and } t_\beta = 0.8492$$

Let σ_y^2 = 1 and ICC = 0.05.

Let $R^2_{y \cdot x_m}$ = 0.30, $R^2_{y \cdot x_g}$ = 0.10, and r_{yym} = 0.70.

Then

$$\begin{aligned}\Delta &= \sqrt{\left(\frac{1(1 - 0.30)}{50} + \frac{1(1 - 0.05)(1 - 0.30) + 10(1)(0.05)(1 - 0.10)}{10 * 5}\right)(2.0106 + 0.8492)^2} \\ &= 0.5449\end{aligned}$$

The detectable difference given these parameter estimates is 0.4575 standard deviation units.