Worked Example for An Analysis of a Simple Difference

The calculator will use the parameter estimates you have provided to calculate power for the intervention effect (Δ) 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.

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

Here σ_y^2 is the variance of the outcome variable ignoring any expected ICC, $R_{y\cdot x_m}^2$ is the proportion of variance explained by the member-level covariates, m_c is the number of members in the control condition, ICC is the intraclass correlation in the intervention condition, m_i is the number of members in each group or cluster in the intervention condition, $R_{y\cdot x_g}^2$ is the proportion of variance explained by the group-level covariates, g is the number of groups or clusters in the intervention condition, $t_{\alpha/2}$ is the t-value selected based on the two-tailed alpha level and available degrees of freedom, and 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 x_m=4 df used for member-level covariates and x_g=1 df used for group-level covariates. Then

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

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

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

Let $\sigma_{y_c}^2$ = 1.0 and ICC=0.05.

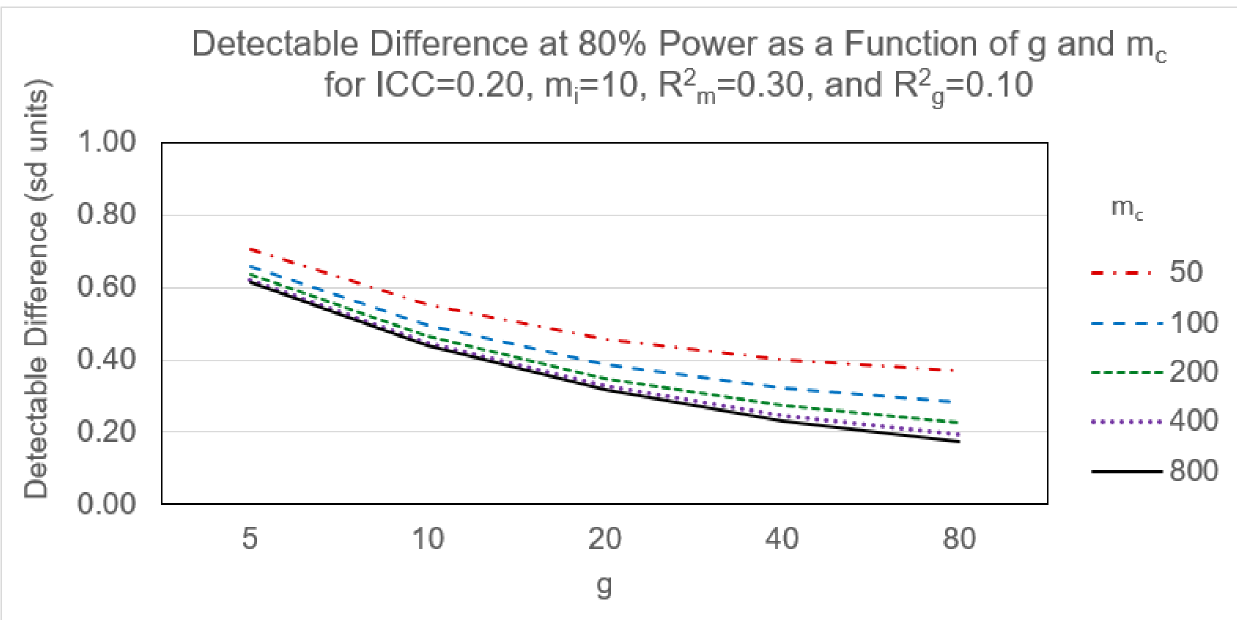
Let $R_{y\cdot x_m}^2 = 0.30$ and $R_{y\cdot x_g}^2 = 0.10$.

Then

$$\Delta = \sqrt{\left(\left(\frac{1(1-0.30)}{50}\right)+\left(\frac{(1.00(1-0.05)(1-0.30)+(10*1.00*0.05(1-0.10)))}{10*5}\right)\right)(2.0106+0.8492)^2}$$
$$= 0.5449$$

The detectable difference given these parameter estimates is 0.5449 standard deviation unit.

These figures provide illustrative detectable simple differences for a range of values of g, m_c, and ICC. They show, quite generally, that to obtain 80% power for modest effects (e.g., 0.2 sd units) with plausible values for the other parameters, the study may require 20-40 independent groups in the intervention condition and a large number of observations in the control condition. Conversely, they show that if the study has only 5 independent groups in the intervention condition and only 50 observations in the control condition, 80% power is available only for effects of 0.55-0.70 sd units depending on the magnitude of the ICC. Such effect sizes are uncommon in public health and medicine and investigators should be cautious when contemplating such small studies.



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