

Supplementary material 1. Manuscript appendices.

Appendix 1

Example of sample size estimation with G*Power

We need to identify the sample size for a study that aims to find out if there are gender differences in levels of depression.

Step 1

Select the test family: In this option we select the family of the statistical test to be used, in this example, since this is a study that seeks to identify sex differences, we choose “T test”.

G*Power 3.1.9.7

File Edit View Tests Calculator Help

Central and noncentral distributions Protocol of power analyses

Test family

- t tests
- Exact
- F tests
- t tests
- χ^2 tests
- z tests

Statistical test

Correlation: Point biserial model

Analysis

a priori: compute required sample size - given α , power, and effect size

Determine =>

Tail(s) One

Effect size $|p|$ 0.3

α err prob 0.05

Power $(1-\beta$ err prob) 0.95

Output Parameters

Noncentrality parameter δ ?

Critical t ?

Df ?

Total sample size ?

Actual power ?

X-Y plot for a range of values Calculate

Step 2

Select the statistical test: Now we choose the statistical test, in this case it corresponds to “mean differences between two independent groups”.

The screenshot shows the G*Power 3.1.9.7 application window. The 'Protocol of power analyses' tab is active. The 'Test family' is set to 't tests'. The 'Type of power analysis' is 'A priori: Compute required sample size'. The 'Input Parameters' section includes a 'Determine =>' button. The 'Statistical test' dropdown menu is open, showing a list of tests. The test 'Means: Difference between two independent means (two groups)' is selected and highlighted in blue. Below the dropdown, the 'Allocation ratio N2/N1' is set to 1. The 'Sample size group 2' is marked with a question mark. The 'Total sample size' and 'Actual power' are also marked with question marks. At the bottom right, there is a 'Calculate' button.

Central and noncentral distributions | Protocol of power analyses

Test family: t tests

Type of power analysis: A priori: Compute required sample size

Input Parameters: Determine =>

Statistical test: Means: Difference between two independent means (two groups)

Correlation: Point biserial model

Linear bivariate regression: One group, size of slope

Linear bivariate regression: Two groups, difference between intercepts

Linear bivariate regression: Two groups, difference between slopes

Linear multiple regression: Fixed model, single regression coefficient

Means: Difference between two dependent means (matched pairs)

Means: Difference between two independent means (two groups)

Means: Difference from constant (one sample case)

Means: Wilcoxon signed-rank test (matched pairs)

Means: Wilcoxon signed-rank test (one sample case)

Means: Wilcoxon-Mann-Whitney test (two groups)

• Generic t test

Allocation ratio N2/N1: 1

Sample size group 2: ?

Total sample size: ?

Actual power: ?

X-Y plot for a range of values

Calculate

Step 3

Select the type of power analysis: Select the type of power analysis: In this case we want to determine the sample size as part of the planning of an investigation, therefore, we select "A priori".

G*Power 3.1.9.7

File Edit View Tests Calculator Help

Central and noncentral distributions Protocol of power analyses

Test family: Exact

Statistical test: Correlation: Bivariate normal model

Type of power analysis:

- A priori: Compute required sample size – given α , power, and effect size
- A priori: Compute required sample size – given α , power, and effect size
- Compromise: Compute implied α & power – given β/α ratio, sample size, and effect size
- Criterion: Compute required α – given power, effect size, and sample size
- Post hoc: Compute achieved power – given α , sample size, and effect size
- Sensitivity: Compute required effect size – given α , power, and sample size

α err prob	0.05	Total sample size	?
Power ($1 - \beta$ err prob)	0.95	Actual power	?
Correlation ρ H0	0		

Options X-Y plot for a range of values Calculate

Step 4

We select the parameters: We enter the effect size identified in previous research, in this example, a mean effect size was found (Cohen's $d = 0.50$). Alpha corresponds to 0.05, and the power can be considered between 0.80 and 0.95. As this is comparative research, both groups are expected to have the same number of participants, therefore, the allocation ratio is 1.

G*Power 3.1.9.7

File Edit View Tests Calculator Help

Central and noncentral distributions Protocol of power analyses

Test family: t tests

Statistical test: Means: Difference between two independent means (two groups)

Type of power analysis: A priori: Compute required sample size - given α , power, and effect size

Input Parameters

Determine =>

Tail(s): One

Effect size d : 0.5

α err prob: 0.05

Power ($1 - \beta$ err prob): 0.91

Allocation ratio $N2/N1$: 1

Output Parameters

Noncentrality parameter δ : ?

Critical t : ?

Df: ?

Sample size group 1: ?

Sample size group 2: ?

Total sample size: ?

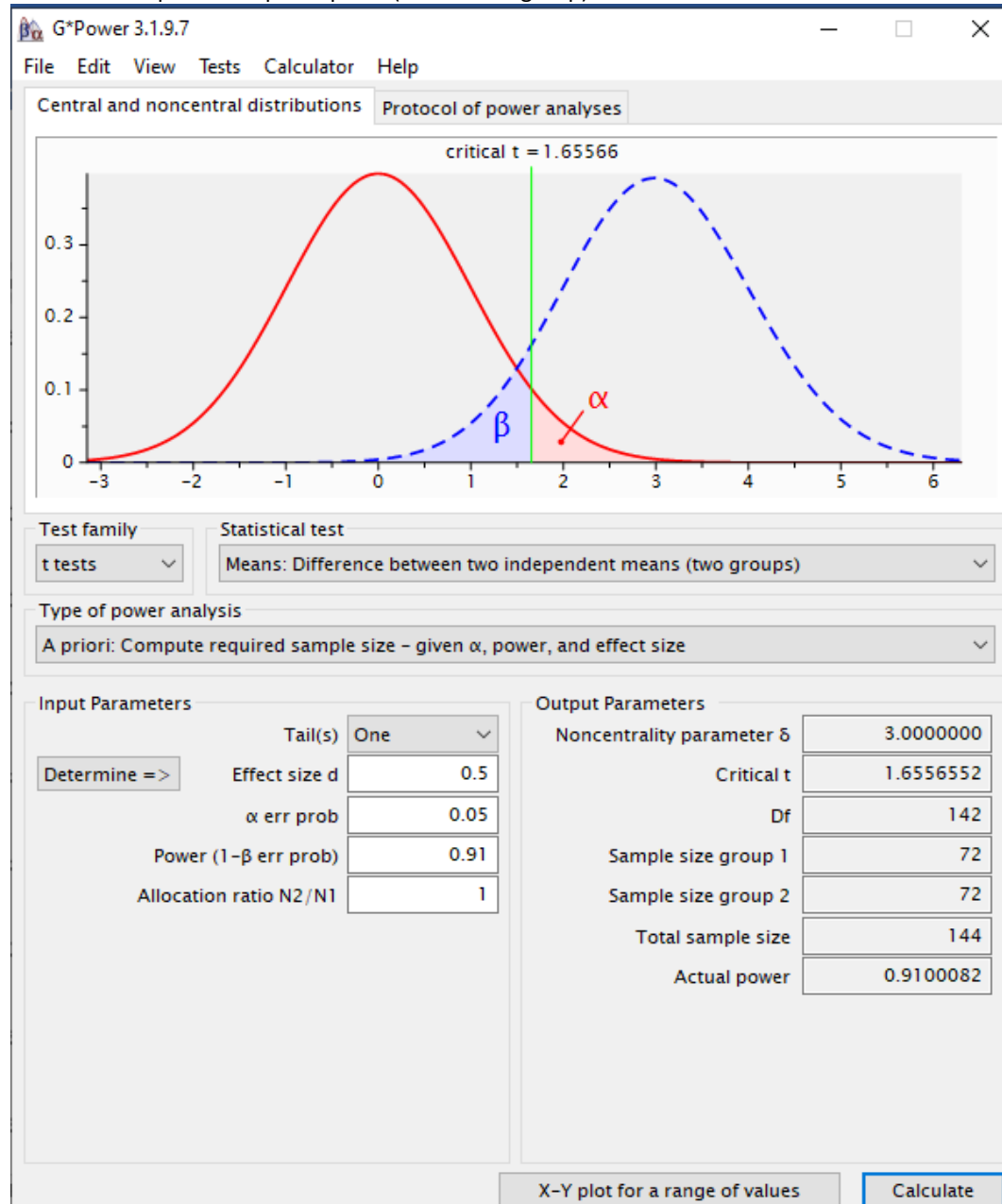
Actual power: ?

X-Y plot for a range of values

Calculate

Step 5

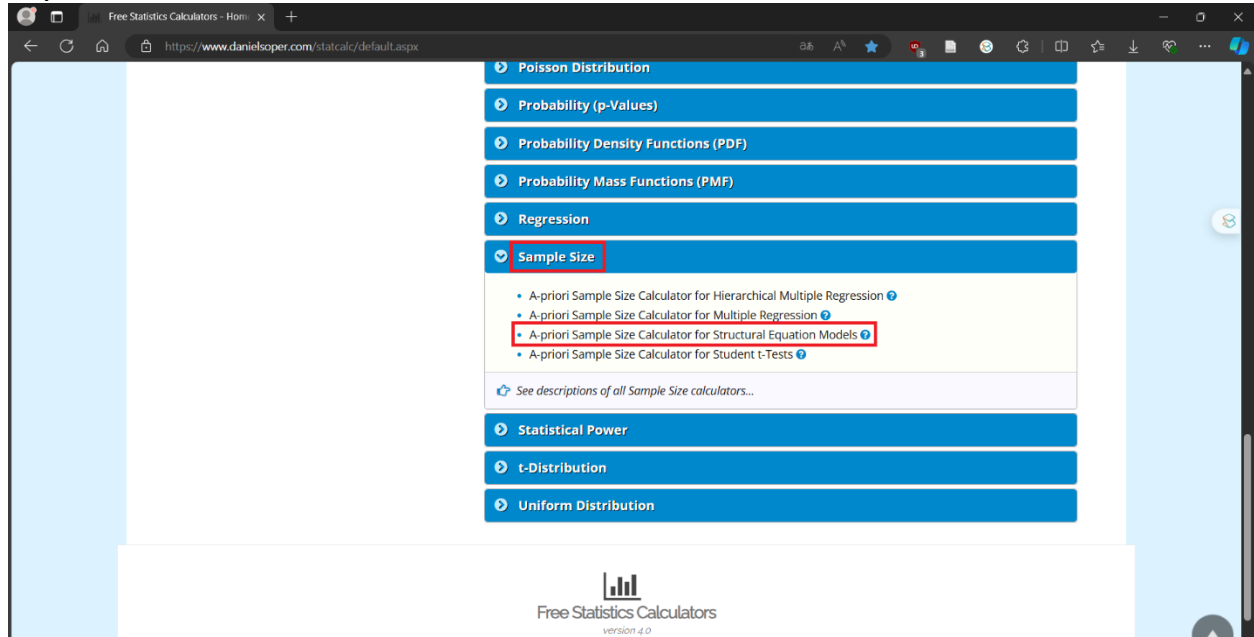
Results: A sample of 144 participants (72 for each group) was obtained.



Appendix 2

Example of sample size estimation to validate an instrument that measures “anxiety”

Step 1



Go to <https://www.danielsoper.com/statcalc/default.aspx> and locate the *Sample Size* option, click and go to *A priori Sample Size Calculator for Structural Equation Models*.

Step 2

When the selected interface opens, we will be asked for the following values: *Anticipated effect size*, which is the effect size expected to be obtained with the study; in this case, we will enter 0.2.

For *Desired statistical power level*, we will enter the statistical power that we would like to find, which should be between 0.8 and 0.95; in this case, we will enter 0.8.

As for *Number of latent variables* and *Number of observed variables*, they refer to the number of dimensions and items, respectively, of the structure of the instrument. For example, we have placed 4 latent variables (dimensions) and 24 observed variables (items).

Finally, in *Probability level*, we left it at 0.05.

Free A-priori Sample Size Calculator

Free Statistics Calculators: Home > A-priori Sample Size for Structural Equation Models Calculator

A-priori Sample Size Calculator for Structural Equation Models

This calculator will compute the sample size required for a study that uses a structural equation model (SEM), given the number of observed and latent variables in the model, the anticipated effect size, and the desired probability and statistical power levels. The calculator will return both the minimum sample size required to detect the specified effect, and the minimum sample size required given the structural complexity of the model.

Please enter the necessary parameter values, and then click 'Calculate'.

Anticipated effect size: 0.2

Desired statistical power level: 0.8

Number of latent variables: 4

Number of observed variables: 24

Probability level: 0.05

Calculate!

Minimum sample size to detect effect: 342

Minimum sample size for model structure: 200

Recommended minimum sample size: 342

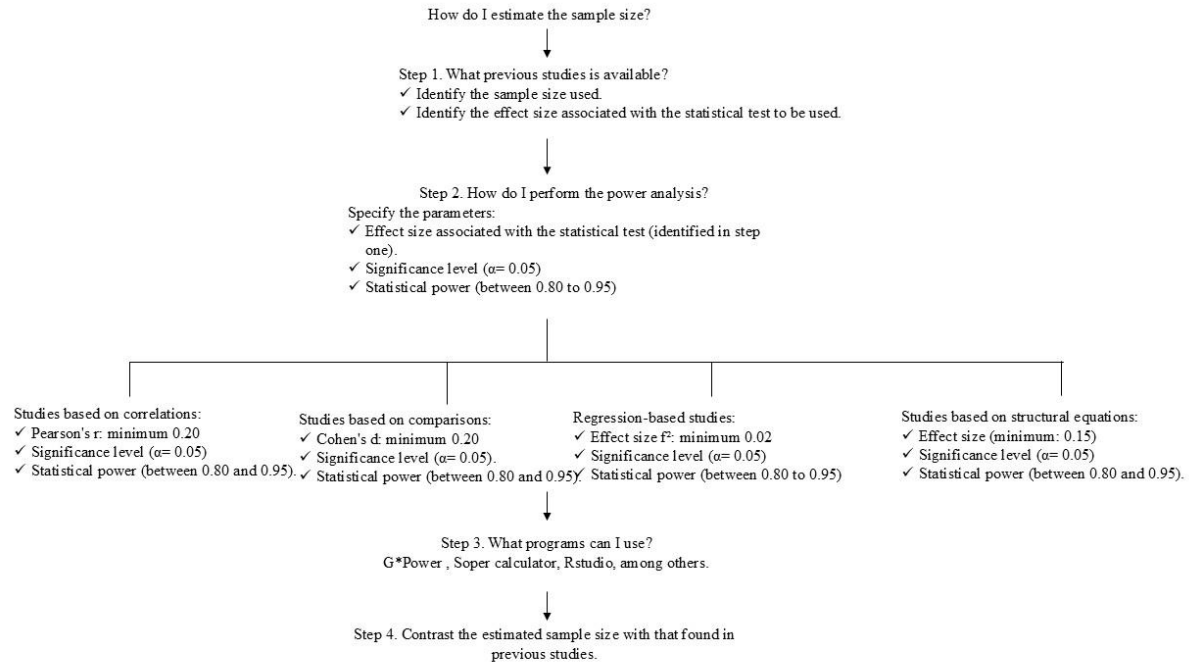
Related Resources

Formulas References Related Calculators Search

Clicking on *Calculate!* will give us three results, of which it is recommended to visualize the one located in *Recommended minimum sample size*; in this case, we obtained that the minimum sample size for the structure of the proposed instrument is 342 participants.

Appendix 3

Flowchart to decide sample size estimates



Appendix 4

Sample size recommendations according to type of study

Study type	Recommended sample size (indicative)	Key considerations for estimation
Descriptive studies (proportions or means)	100–400 participants (minimum 30 per subgroup)	- Confidence level (typically 95%)- Acceptable margin of error (5%, 3%) - Expected variability ($p = 0.5$ is conservative) - Population size (if finite)
Comparative studies (2 groups)	64–128 participants (32–64 per group)	- Expected group difference (effect size) - Significance level ($\alpha = 0.05$) - Statistical power (≥ 0.80) - Type of test (t-test, Mann–Whitney U, etc.)
Correlational studies	≥ 85 participants (to detect $r = 0.3$)	- Expected correlation magnitude - Significance level (α) - Desired power ($1 - \beta$)
Regression studies (linear or logistic)	10–15 participants per predictor	- Number of independent variables - Expected effect size (R^2) - Potential multicollinearity - Significance level and power
Experimental studies / clinical trials	≥ 30 –50 per group (ideally >100 per arm)	- Expected effect size - Significance level and power - Anticipated participant loss - Design type (parallel, crossover, factorial, etc.)
Instrument development / validation studies	5–10 participants per item (minimum 100–200)	- Number of items- Type of analysis (EFA, CFA)- Estimation method (ML, WLSMV, etc.) - Model complexity (in CFA)
Repeated measures / longitudinal studies	≥ 30 –50 per group with 3+ measurements	- Number of measurements- Within-subject correlation - Expected interaction effect size- Attrition rate
Modeling studies (SEM, multilevel models)	≥ 200 (absolute minimum), ideally >300	- Model complexity - Number of estimated parameters - Data type (continuous, ordinal) - Distribution and normality assumptions

Note. Own elaboration