

A (fictitious) Example of a Power Analysis

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*Purpose of the study:*

The proposed study will assess the impact of a set of demographic (age and sex) and psychological predictors on the physical activity levels of adults diagnosed with chronic fatigue syndrome (CFS). Previous research by Freiberg, *et al* (2013) suggests that among individuals with CFS, elevated levels depression, anxiety, and life stress have a negative impact on physical activity levels – leading to increase lethargy and an increased likelihood for the development of comorbid symptoms, such muscle pain, headaches, multi-joint pain without redness or swelling, sore throat, tender lymph nodes in neck and armpits.

*Sampling Strategy:*

The multi-institutional NIMH funded study will recruit participants currently being treated at one of the five major research medical centers in the New York Metropolitan area - namely, NYU Langone Medical Center: Columbia University Medical Center, Albert Einstein Medical College, Stony Brook University Medical School, and SUNY Down State University Medical School.

Aggregated patient records from these five institutions indicate that approximately 1,200 (+/- 3%) adults are receiving treatment for CFS. To increase the likelihood that the study group is representative of CFS sufferers, a random sample will be recruited via targeted mailings and follow-up phone calls. Once recruited into the study, participants will complete a self-report questionnaire during their regular visit to their respective health care center or physicians office..

### *Study Measures:*

In addition to standard demographic information (age and sex), the questionnaire will include the Beck Depression Index-II (BDI-II; Beck, Steer & Brown, 1996), the Beck Anxiety Index (BAI; Beck, Epstein, Brown, & Steer, 1988), the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983), and the General Practice Physical Activity Questionnaire (GPPAQ; Heron, Tully, McKinley, & Cupples, 2014).

### *Acronyms*

*BDI-II: Depression*

*BAI: Anxiety*

*PSS: Perceived Stress*

*GPPAQ: Physical Activity Level*

*Age: Respondent's age*

*Sex: Sex of Respondent*

### *Parameter Estimates and Power Analysis Results:*

A multiple regression analysis will be employed to assess the unique impact (controlling for the other variables in the model) of the two demographic variables (age and sex) and the three psychological variables (BDI-II, BAI, and PS) on CFS patients levels of physical activity (GPPAQ). To estimate the statistically appropriate sample size, a power analysis was conducted to determine the required sample size employing GPower 3.1 statistical software (Faul, Erdfelder, Buchner, & Lang, 2009).

Based on Friedberg's (2013) study, in which approximately 9% ( $R^2 = .087$ ) of the variability in self reported fatigue severity ratings was accounted for in a multiple regression model which included measures of depression and anxiety – and represents moderate effect size based on Cohen's guidelines (1988) – the current power analysis will assume a moderate effect size. GPower 3.1 uses Cohen's  $f^2$  as an effect size measure for a multiple regression analysis.

Therefore, within GPower, Cohen's  $f^2$  was set to its medium effect size value of .15 (See Table 1 for effect size conventions). The desired power for the analysis was set to the conventional level of .80, and the significance (alpha) level was set to the conventional .05-level. The multiple regression model that will be tested includes five predictor variables (Age Sex, BDI-II, BAI, PSS), therefore the number of predictors was set to 5.

The overall significance of the model will be tested with an  $F$ -Ratio for  $R^2$ ; therefore the Test Family setting in GPower was F-tests. And because the analysis is being conducted in advanced of the actual study, the Type of Analysis was set to *a priori*. Using these parameter and analysis settings, the estimated minimum sample size for the study is 92 cases. Please see Table 2 for parameter settings (under the header Inputs) and the results for the power analysis (under the header Output).

Table 1. *Effect Size Guidelines*

	Effect Size Guideline		
	Small	Medium	Large
Cohen's $d$	.20	.50	.80
Pearson's $r^2$	.01	.09	.25
Squared Semi Partial Correlation, $sr^2$	.01	.09	.25
Multiple $R$ -Square, $R^2$	.01	.06	.14
Eta-Square, $\eta^2$	.01	.06	.14
Omega-Square, $\omega^2$	.01	.06	.14
Cohen's $f^2$	.02	.15	.35
Cramer's $V$ or Phi $\phi$	.10	.30	.50
Spearman's Rho	.10	.30	.50
Odds Ratio	1.44	2.47	4.25

Table 2. *Power Analysis Estimated Parameters and Results*

Analysis Inputs:		Statistic	
Test Family =	F-tests		
Statistical Test =	Linear multiple regression: Fixed model, $R^2$ deviation from zero		
Type of Power Analysis =	A priori: Compute required sample size		
Effect size $f^2$		=	0.15
(Significance Level) $\alpha$ err probability		=	0.05
Power (1- $\beta$ err probability)		=	0.80
Number of predictors		=	5
Analysis Output:			
	Noncentrality parameter $\lambda$	=	13.80
	Critical F	=	2.32
	Numerator df	=	5
	Denominator df	=	86
	Total sample size	=	92
	Actual power	=	0.80

## References:

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