**Study Information**

1. Title
   1. A systematic review and meta-analysis of power surveys in psychology
2. Authorship
   1. Felix Singleton Thorn
3. Research Questions
   1. What is the average level of statistical power of psychology research at Cohen’s benchmark effect size estimates?
   2. Has the statistical power of psychology research increased over time?
   3. Are there differences is there in the levels of statistical power across fields of psychological research?
   4. What proportion of articles report a statistical power analysis, and has this number increased over time?
4. Hypotheses
   1. The median level of statistical power in psychology research is slightly below .5 for a medium effect of .5 Cohen’s d.
   2. The average level of statistical power of psychology research has increased over time.
   3. Areas where populations are more difficult to access (i.e., clinical and neuropsychology) will be lower than other areas of psychology research at benchmark effect size estimates.
   4. The number of articles reporting a power analysis will have increased over time, but is still low (i.e., below 10%).

**Sampling Plan**

1. Existing data

**Registration prior to analysis of the data**

1. Explanation of existing data

Literature search and initial abstract screening has been performed to identify 74 articles to be included in data collection and analysis.

An initial random pilot sample of 17 of these articles has been coded to allowing for analysis plans to be developed (i.e., to examine the proportion of power surveys which report various statistics).

Ten of the examined articles met inclusion criteria applicable, and will be included in the analysis. No summary statistics have been calculated, and no statistical analysis whatsoever has been performed on the data. Additional coding criteria have been added to the data set after pilot data collection. The initial pilot data set is available at <https://osf.io/c6u2g/>.

Fifteen additional articles have been found through hand searches of reference lists of the included articles. None of these additionally identified articles have been assessed. The first author has read a number of the articles included in this project in the past (i.e., 10-15), although no data extraction has been performed.

1. Data collection procedures.

*Database search*: A systematic review protocol was used to search the PsycInfo and Medline databases for all articles including the words “power\*” “sampl\*” in their title and "power analysis", "statistical Power" or "sample size" in the text of the article. All articles detailing analyses of the power of a body of psychiatry or psychology research (broadly defined, including general social, cognitive, occupational, management, clinical, developmental and social psychology, as well as psychiatry, educational and neuroscience research). This search was conducted on the 11th of September 2017. The initial database search included 1988 articles.

*Abstract screening*: Initial abstract screening was performed according to the inclusion criteria outlined below. After abstract screening, 74 applicable articles were identified.

*Full text screening*: Secondary screening of full texts will take place in randomized order during data collection. Any articles which do not meet the inclusion criteria developed below will be excluded from analyses. Some of these articles but may be presented in the research report (e.g., if power estimates were performed, but specific values not given, or if power estimates are presented for non-standard benchmarks). Seven articles have been excluded after pilot data collection (which examined seventeen articles). Separately, articles which assess the number of articles reporting a power analysis will also be identified during full text screening and included in a secondary analysis.

*Additional data sources*: Hand searches of reference lists will be performed to ensure that any papers detailing power surveys that may have been missed by the initial database search are included in data. Fifteen additional articles have been included after the pilot testing. One additional article was identified through google scholar search of “statistical power analysis psychology”.

*Inclusion/exclusion criteria*: All articles which examine the statistical power of bodies of literature in the psychology literature will be included (broadly defined, including general social, cognitive, occupational, management, clinical, developmental and social psychology, as well as psychiatry, educational and neuroscience research). Articles which analyzed the power of fewer than six articles will be excluded in order to exclude studies which targeted a particular underpowered technique or topic. Only articles with full texts available in English will be included. Dissertations/other grey will be included if they meet the inclusion criteria.

Only articles which provide specific point estimates of median power / sample size at standard effect size benchmarks (i.e., the benchmark values of Cohen 1988 or equivalent) will be included in meta-analysis and meta-regression. Articles which do not provide enough information for the calculation of standard errors (i.e., which do not provide interquartile ranges or minimum and maximum values) will be excluded from these main analyses.   
  
All articles which report the proportion of articles reporting a power analysis will be included in a secondary analysis.

1. Sample size
   1. The sample will include all previous studies of statistical power in the psychological research that meet the inclusion criteria detailed in 7, an expected sample of approximately 70 articles.
2. Sample size rationale
   1. The sample is intended to be comprehensive, including all studies that meet the inclusion criteria that can be identified.
3. Stopping rule

No further data collection will take place after any analysis has been performed, including descriptive statistics (i.e., if new studies of the statistical power of literatures are published and identified before data analysis has commenced, they will be included, but not afterwards).

**Variables**

1. Manipulated variables
   1. Not applicable.
2. Measured variables

* The zeroth (minimum value), first, second (median), third and fourth (maximum value) quantiles of statistical power at small, medium and large effect size benchmarks (Cohen, 1988)
* The zeroth (minimum value), first, second (median), third and fourth (maximum value) quantiles of sample size at each value.
* The number of articles included in each power survey
* Whether the unit of analysis was the article or individual statistical tests
* The range of years of the articles included covered in each power survey
* The area of research covered. The area of research will be coded as “clinical psychology/psychiatry”, “social/personality”, “education”, “general psychology” (i.e., those studies which look across fields of psychology research), “management/IO psychology”, “cognitive psychology” “neuropsychology”, “meta-analysis”.
* The effect size measure used

1. Indices
   1. If the years covered in each article are consecutive, they will be recoded to the median year included in analysis. If the years covered are non-consecutive, and individual numbers of articles are accessible for each year of years, then each year will be entered the model separately. If there are blocks of years (i.e., one article covers 2010-2013 and 2015-2016) then the blocks will be entered separately and recoded as the median year of each block, again if individual numbers of articles are reported for each block.

**Design Plan**

1. Study type
   1. Meta-Analysis - A systematic review of published studies.
2. Blinding
   * 1. No blinding is involved in this study.
3. Study design
   1. Systematic review, meta-analysis and meta-regression examining the effect of time and area of research on median levels of statistical power and sample size.

A secondary analysis of the reports detailing the number of studies which report a power analysis will also be conducted.

1. Randomization
   1. Order of article assessment will be randomized.

**Analysis Plan**

You may describe one or more confirmatory analysis in this preregistration. Please remember that all analyses specified below must be reported in the final article, and any additional analyses must be noted as exploratory or hypothesis generating.

1. Statistical models
   1. Random effects meta-analysis and meta-regression will be used.

*Primary analyses:*   
Meta-analytic estimates of the median statistical power and median sample size of psychology research.

Meta-regression also be performed estimating the impact of time on median statistical power and sample size. Independent variables:   
Time (i.e., years covered by power survey)   
Dependent variables: Estimated power/sample size.

*Secondary analysis:*  
A secondary meta-analysis and meta-regression will be performed examining the proportion of articles reporting a power analysis and the impact of time on the proportion of studies reporting a power analysis.

Predictors: Years covered in power surveys

Dependent variables: Proportion of articles reporting a power analysis

Meta-regression analyses will be performed to assess the degree to which levels of power differ among fields of research.

Predictors: Area of psychology research

Dependent variable: Estimated power/sample size

1. Transformations
   1. The proportion of studies reporting a power analysis will be Freeman-Tukey (double arcsine) transformed (Miller, 1978).
2. Follow-up analyses
   1. N/A
3. Inference criteria
   1. Parameter estimates and 95% confidence intervals will be interpreted as an indication of the median sample size/power of psychology research. Inferences in meta-regressions will be based 95% confidence intervals around the meta-regression coefficients.
4. Data exclusion
   1. Articles which do not provide enough information for the calculation of standard errors around median sample size/statistical power will be excluded.
5. Missing data

23.1 Missing data (either dependent or predictor variables or values necessary to calculate standard errors for medians) will lead to exclusion from confirmatory analyses.

References

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, New Jersey: Erlbaum.

Miller, J. J. (1978). The Inverse of the Freeman – Tukey Double Arcsine Transformation. *The American Statistician, 32*, 138-138. doi:10.1080/00031305.1978.10479283