

Manual for web application p -uniform*

<https://rvanaert.shinyapps.io/p-uniformstar>

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Meta-analysis based on p -uniform* can be conducted by means of this web application.¹ P -uniform* is a method for estimating effect size and between-study variance, testing the null hypothesis of no effect and no between-study variance, and testing for publication bias while taking into account publication bias. The p -uniform* method is based on the statistical theory that the distribution of p -values is uniform conditional on the population effect size. See van Aert and van Assen (2018) for more information.

The web application can currently handle three different effect size measures: one-sample mean, two-independent means, and raw correlation coefficients. The method can also be applied to effect sizes that are computed by the user (see below for more information).

Step-by-step guide for using the web application:

- 1) Select the effect size measure in the meta-analysis (one-sample mean, two-independent means, or one raw correlation) or select User-specified effect sizes.
- 2) Select the alpha level which is used in the primary studies. The default alpha level is .05. Note that p -uniform* assumes that two-tailed tests were conducted in the primary studies. If one-tailed hypothesis tests were used in the primary studies, the alpha level has to be multiplied by two before applying p -uniform*.
- 3) Select whether the effect sizes in the primary studies are in the right-tail of the distribution (i.e., positive effects) or in the left-tail of the distribution (i.e., negative effects).
- 4) Three different methods are currently implemented for the p -uniform* method. The ML method refers to maximum likelihood estimation of the effect size and the between-study variance. Profile likelihood confidence intervals are computed by means of inverting the likelihood-ratio test. Likelihood-ratio tests are used for testing the null hypotheses of no effect and no between-study variance. The ML method is the recommended method for applying p -uniform*.

The two other methods (P and LNP) are moment based estimators. The method P is based on the distribution of the sum of independent uniformly distributed random variables (Irwin-Hall distribution) and the LNP method refers to Fisher's method (1950, Chapter 4). The test of no effect is not available for the methods P and LNP.

¹ This web application is based on the R package `puniform` which can be downloaded from GitHub by running the following lines of code in R: `devtools::install_github("RobbievanAert/puniform")`; `library(puniform)`

- 5) Upload the data as a comma separated file (CSV) with a comma as separator and a period indicating the decimal point. The first row should *exactly* match the names below that depend on the effect size measure that has been selected:

For one-sample mean based on *t*-statistics:

- *tobs* → *t*-statistic of each primary study
- *ni* → sample size of each primary study

For one-sample mean based on descriptive statistics:

- *mi* → group mean of each primary study
- *ni* → sample mean of each primary study
- *sd* → standard deviation of each primary study

For two-independent means based on *t*-statistics:

- *tobs* → *t*-statistic of each primary study
- *n1i* → sample size in group 1 of each primary study
- *n2i* → sample size in group 2 of each primary study

For two-independent means based on descriptive statistics:

- *m1i* → mean in group 1 of each primary study
- *m2i* → mean in group 2 of each primary study
- *n1i* → sample size in group 1 of each primary study
- *n2i* → sample size in group 2 of each primary study
- *sd1i* → standard deviation in group 1 of each primary study
- *sd2i* → standard deviation in group 2 of each primary study

For one correlation:

- *ri* → raw correlation coefficient of each primary study
- *ni* → sample size of each primary study

For user-specified effect sizes:

- *yi* → effect size of each primary study
- *vi* → sampling variance of each primary study

For example, the CSV file for two-independent means should like like:

For *t*-statistics:

	A	B	C
1	<i>tobs</i>	<i>n1i</i>	<i>n2i</i>
2	4	200	200
3	4	200	200

For descriptive statistics:

	A	B	C	D	E	F
1	m1i	m2i	n1i	n2i	sd1i	sd2i
2	0.2	0	200	200	1	1
3	0.2	0	200	200	1	1

6) By clicking the “Analyze” button p -uniform is applied to your data.

References

van Aert, R. C. M., & van Assen, M. A. L. M. (2023). Correcting for publication bias in a meta-analysis with the p -uniform* method. Manuscript submitted for publication.