Evidence-Based Mental Health: supplementary materials for

"metaumbrella: the first comprehensive suite to perform data analysis in umbrella reviews with stratification of the evidence"

Corentin J. Gosling[1,2,3‡*], PhD, Aleix Solanes[4,5‡], PhD,
Paolo Fusar-Poli[6,7], MD, PhD & Joaquim Radua[4,6,8,9], MD, PhD

[1]Paris Nanterre University, DysCo Laboratory, F-92000 Nanterre, France

[2]Université de Paris, Laboratoire de Psychopathologie et Processus de Santé, F-92100 Boulogne-Billancourt, France.

[3]Centre for Innovation in Mental Health, School of Psychology, University of Southampton, UK

[4]Institut d'Investigacions Biomediques, August Pi I Sunyer, Barcelona, Spain

[5]Department of Psychiatry and Legal Medicine, Autonomous University of Barcelona, Barcelona, Spain

[6]Department of Psychosis Studies, Institute of Psychiatry, Psychology, and Neuroscience, King's College London, London, UK

[7]University of Pavia, Italy

[8]Centro de Investigacion Biomedica en Red de Salud Mental (CIBERSAM), Barcelona, Spain

[9]Department of Clinical Neuroscience, Centre for Psychiatric Research and Education, Karolinska Institutet, Stockholm, Sweden

[‡]Joint first authorship

*Correspondence concerning this article should be addressed to: Corentin J. Gosling, 200 Avenue de la République, Paris Nanterre University, 92000, Nanterre, France. Email: cgosling@parisnanterre.fr

Introduction

The 'metaumbrella' tools are regularly updated to improve existing features or to develop new ones. This tutorial describes the use of version 1.0.5 of the tools.

If you are using a more recent version of these tools, you can find an updated version of this tutorial here :

https://corentinjgosling.github.io/EBMH_2022_METAUMBRELLA/

Table of Content

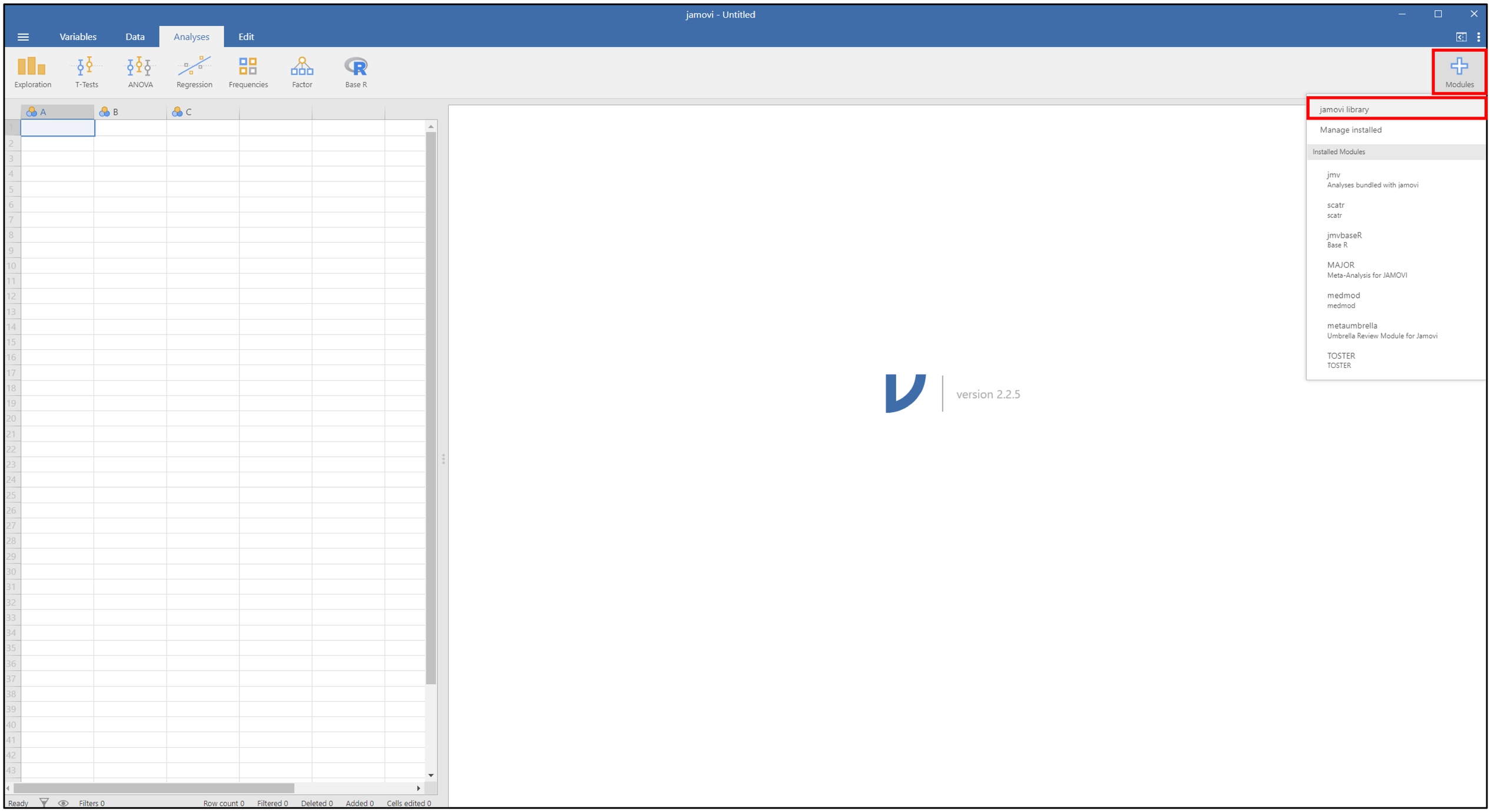
Supplement 1.

Tutorial of the metaumbrella JAMOVI module

1. Installation of the module

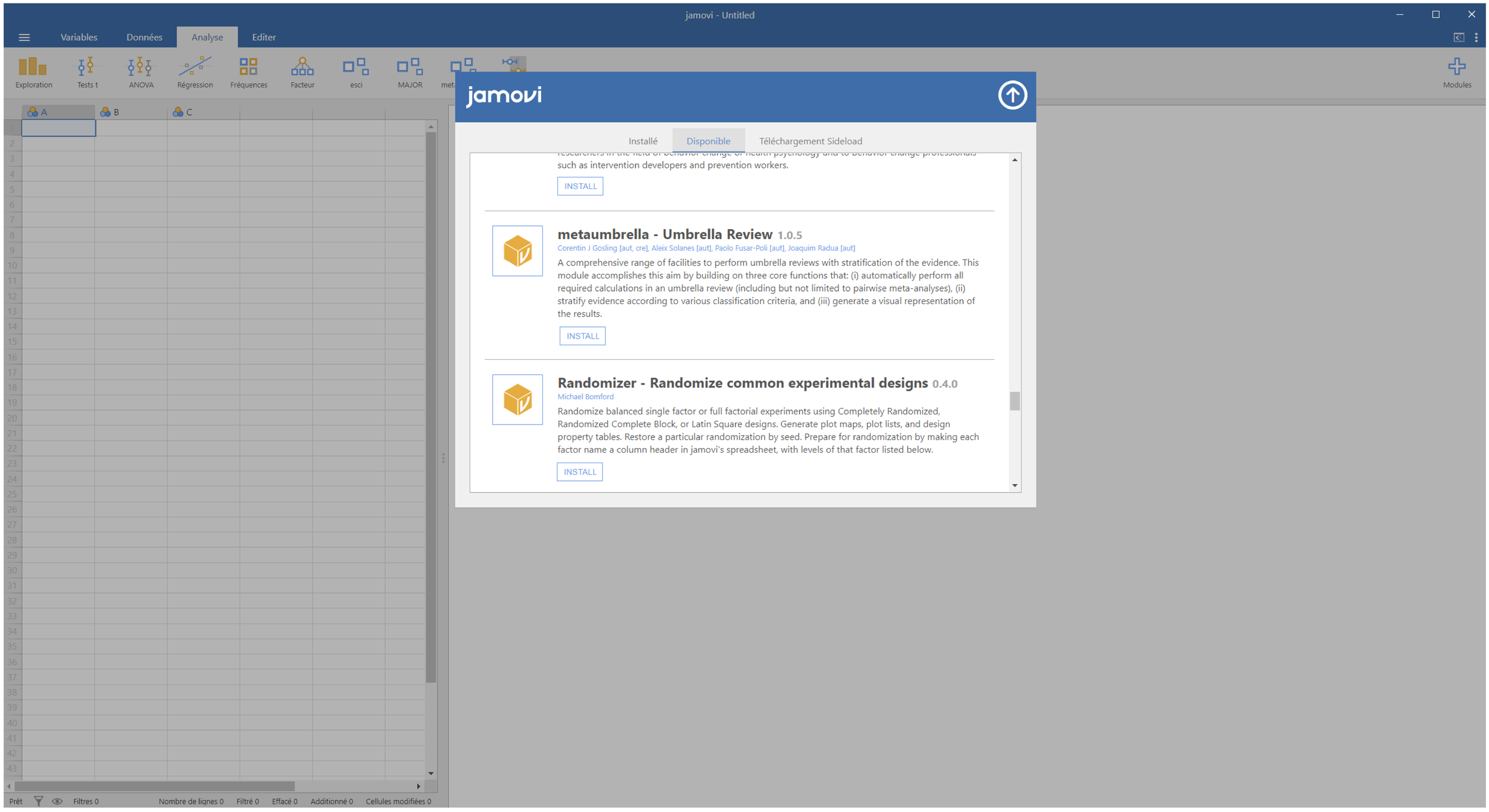
In JAMOVI as in R, modules must be installed before they can be used. Our module, which is called 'metaumbrella' can be obtained as follows.

Start by clicking on the ‘Module’ icon (top right of the JAMOVI homepage) then click on the 'jamovi library' option.



1. Installation of the module

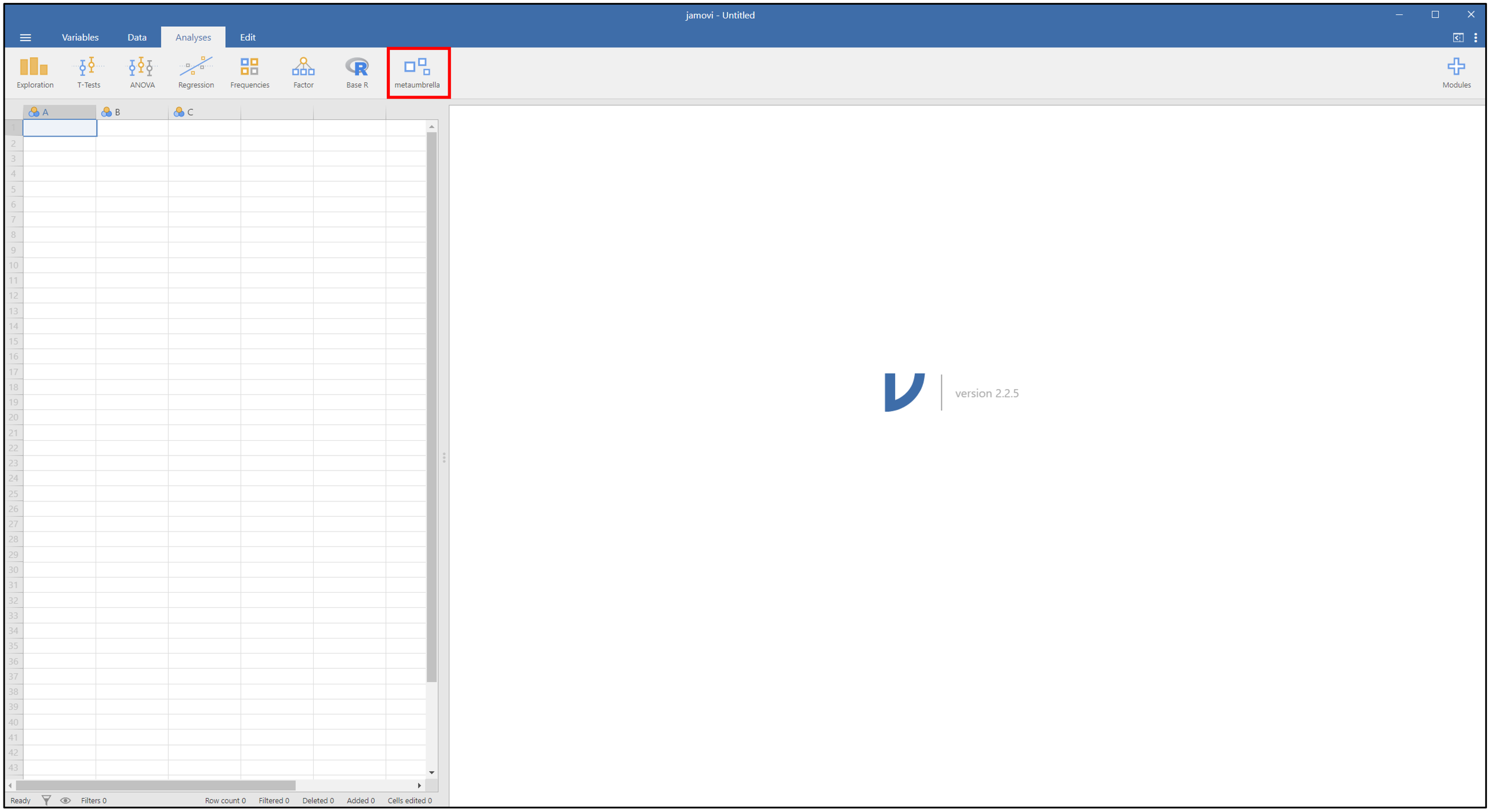
Use the navigation bar to identify our 'metaumbrella' module and click on the ‘INSTALL’ button



1. Installation of the module

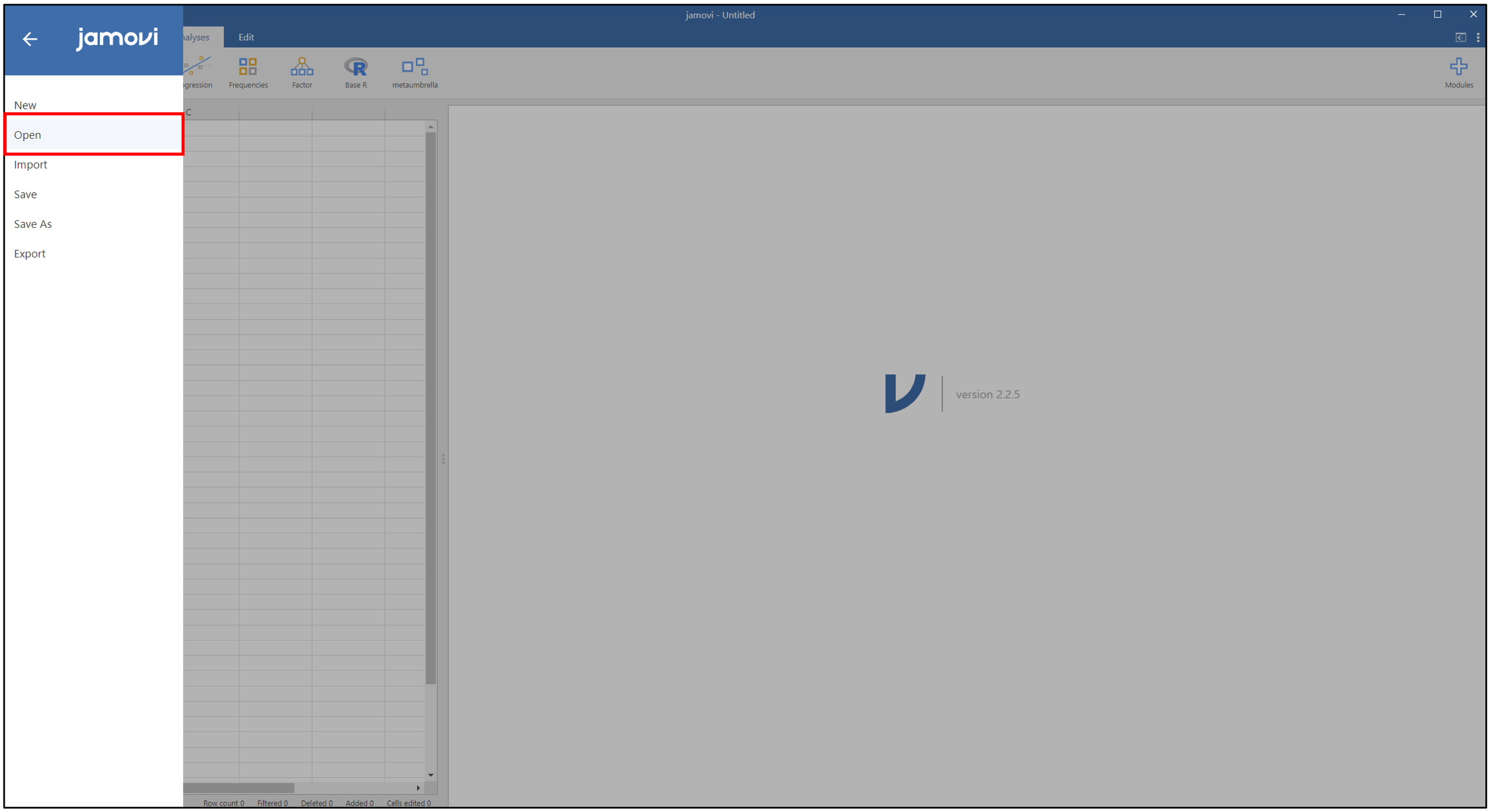
Once the module has been installed, you can retrieve it from the home page of JAMOVI.

At this stage, the module is ready to be used!



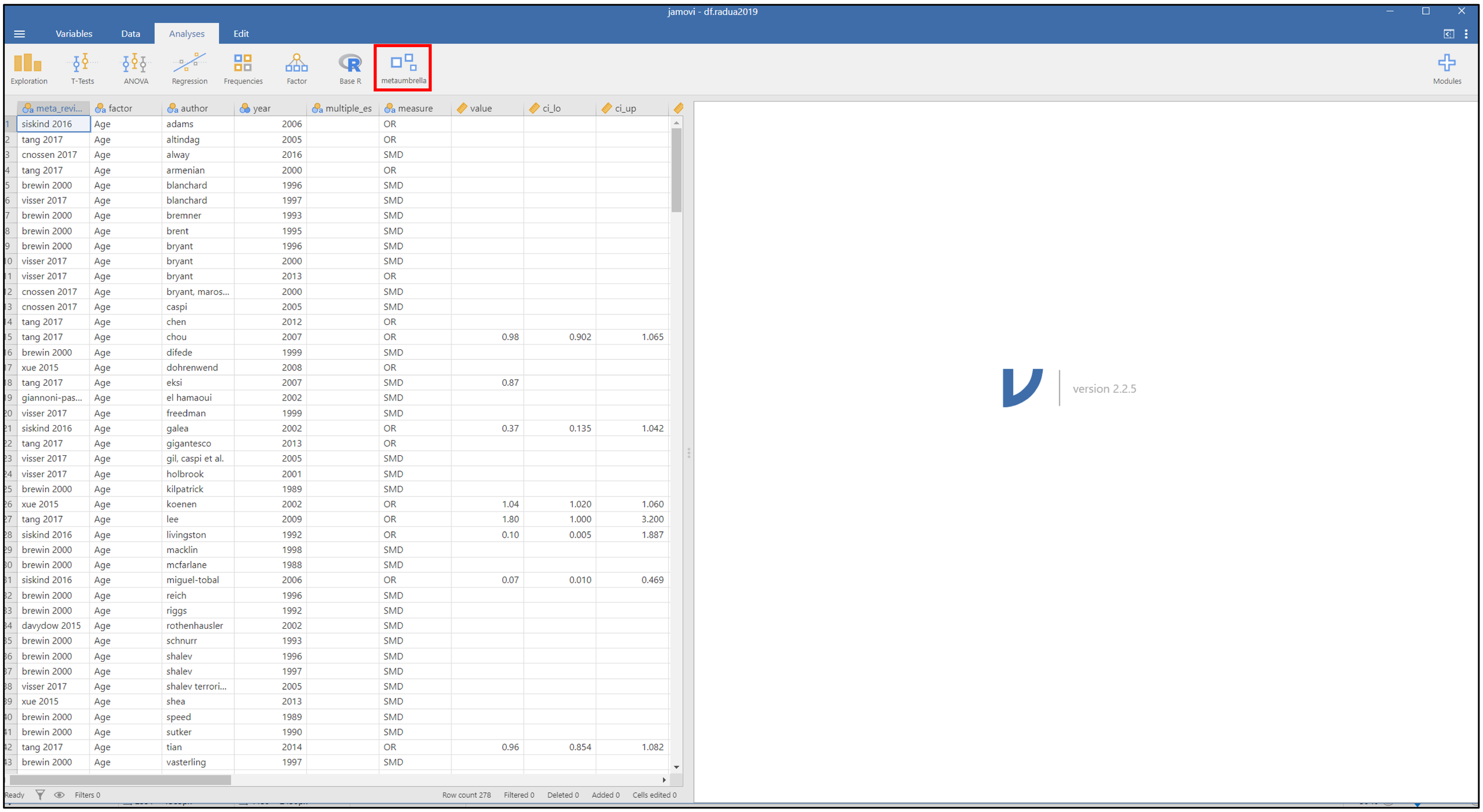
2. Loading of the dataset

Before trying the different features of the ‘metaumbrella’ module, start by loading your well-formatted dataset.



3. The metaumbrella module

Once your dataset is loaded, you can run the metaumbrella module. Open it by simply clicking on it.

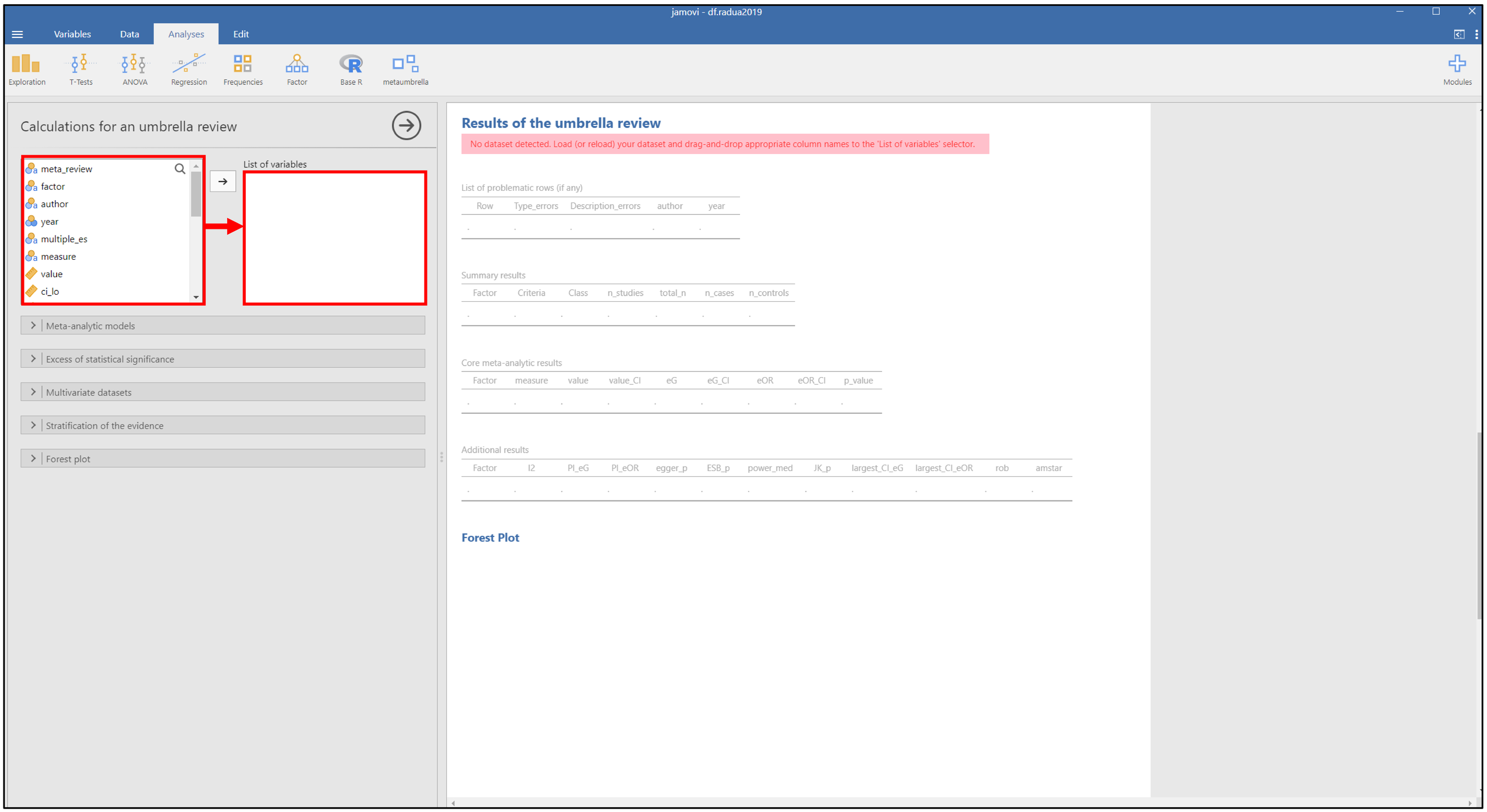


	meta_revi...	factor	author	year	multiple_es	measure	value	ci_lo	ci_up
1	siskind 2016	Age	adams	2006		OR			
2	tang 2017	Age	altindag	2005		OR			
3	cnossen 2017	Age	alway	2016		SMD			
4	tang 2017	Age	armenian	2000		OR			
5	brewin 2000	Age	blanchard	1996		SMD			
6	visser 2017	Age	blanchard	1997		SMD			
7	brewin 2000	Age	bremner	1993		SMD			
8	brewin 2000	Age	brent	1995		SMD			
9	brewin 2000	Age	bryant	1996		SMD			
10	visser 2017	Age	bryant	2000		SMD			
11	visser 2017	Age	bryant	2013		OR			
12	cnossen 2017	Age	bryant, maros...	2000		SMD			
13	cnossen 2017	Age	caspi	2005		SMD			
14	tang 2017	Age	chen	2012		OR			
15	tang 2017	Age	chou	2007		OR	0.98	0.902	1.065
16	brewin 2000	Age	difede	1999		SMD			
17	xue 2015	Age	dohrenwend	2008		OR			
18	tang 2017	Age	eksi	2007		SMD	0.87		
19	giannoni-pas...	Age	el hamaoui	2002		SMD			
20	visser 2017	Age	freedman	1999		SMD			
21	siskind 2016	Age	galea	2002		OR	0.37	0.135	1.042
22	tang 2017	Age	gigantesco	2013		OR			
23	visser 2017	Age	gil, caspi et al.	2005		SMD			
24	visser 2017	Age	holbrook	2001		SMD			
25	brewin 2000	Age	kilpatrick	1989		SMD			
26	xue 2015	Age	koenen	2002		OR	1.04	1.020	1.060
27	tang 2017	Age	lee	2009		OR	1.80	1.000	3.200
28	siskind 2016	Age	livingston	1992		OR	0.10	0.005	1.887
29	brewin 2000	Age	macklin	1998		SMD			
30	brewin 2000	Age	mcfarlane	1988		SMD			
31	siskind 2016	Age	miguel-tobal	2006		OR	0.07	0.010	0.469
32	brewin 2000	Age	reich	1996		SMD			
33	brewin 2000	Age	riggs	1992		SMD			
34	davydow 2015	Age	rothenhausler	2002		SMD			
35	brewin 2000	Age	schnurr	1993		SMD			
36	brewin 2000	Age	shalev	1996		SMD			
37	brewin 2000	Age	shalev	1997		SMD			
38	visser 2017	Age	shalev terrori...	2005		SMD			
39	xue 2015	Age	shea	2013		SMD			
40	brewin 2000	Age	speed	1989		SMD			
41	brewin 2000	Age	sutker	1990		SMD			
42	tang 2017	Age	tian	2014		OR	0.96	0.854	1.082
43	brewin 2000	Age	vasterling	1997		SMD			

3.1. Passing your dataset

When you load the ‘metaumbrella’ module, several functions are automatically run. A red warning message automatically indicates that you need to load a dataset.

To make your dataset available to ‘metaumbrella’, simply select all needed columns in the dataset and then drag them in the ‘List of variables’ box



3.2. Structure of your dataset

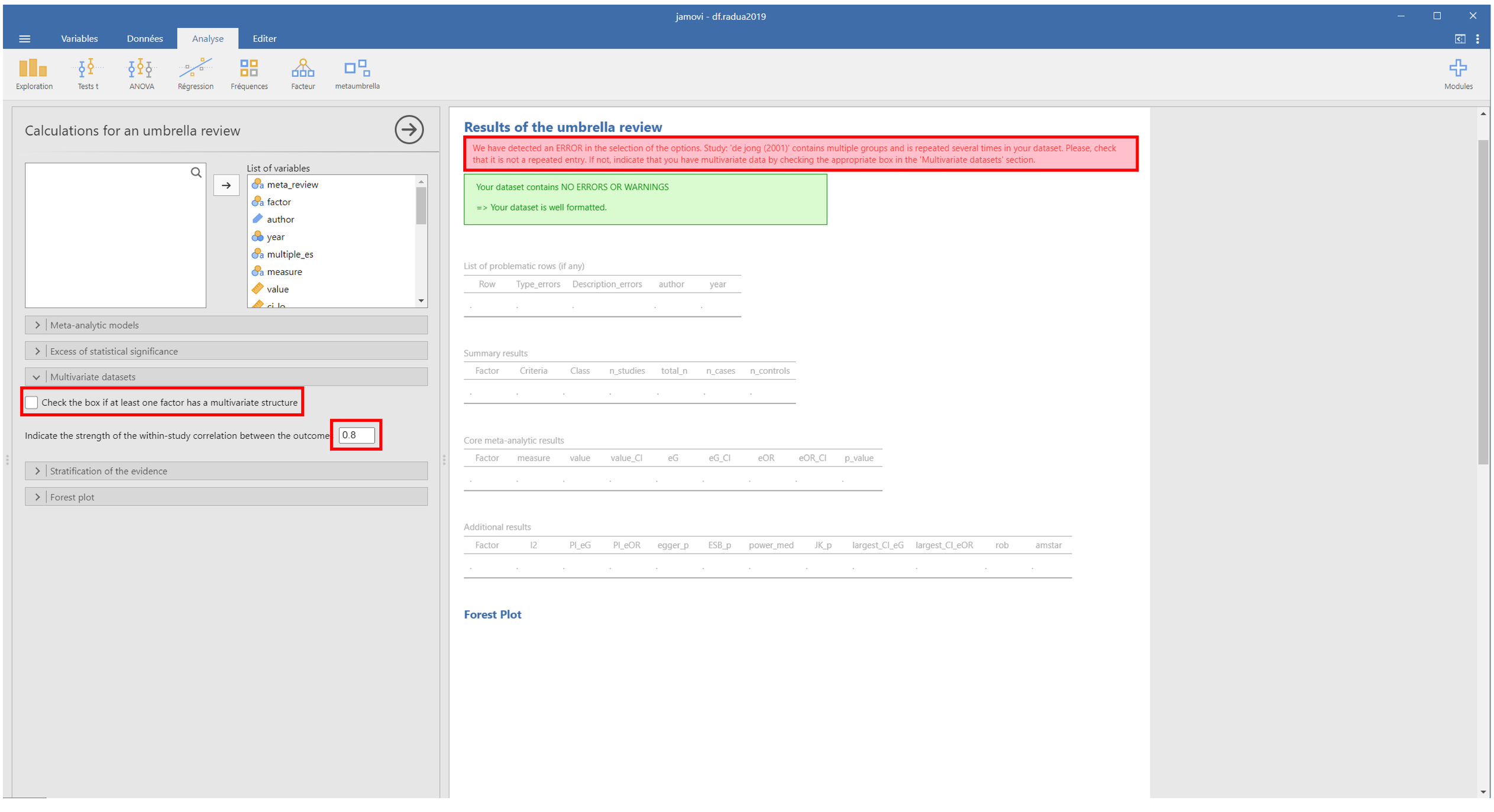
If your dataset contains only factors with one effect size per study, results will automatically appear.

However, if your dataset includes at least one factor with a study that produced two or more dependent effect sizes (such as in the example below), the ‘metaumbrella’ module requires you to confirm that you are aware of this multivariate structure (this is made to ensure that there is no erroneous repeated entries).

To confirm that your dataset has a multivariate structure, simply check the box in the ‘Multivariate datasets’ section.

You can also indicate the strength of the correlation between the effect sizes coming from the same studies (only for the effect sizes coming from the same participants, i.e., those with a “outcomes” value in the ‘multiple_es’ column.

Note that you can indicate this correlation directly from the dataset using the ‘r’ column.

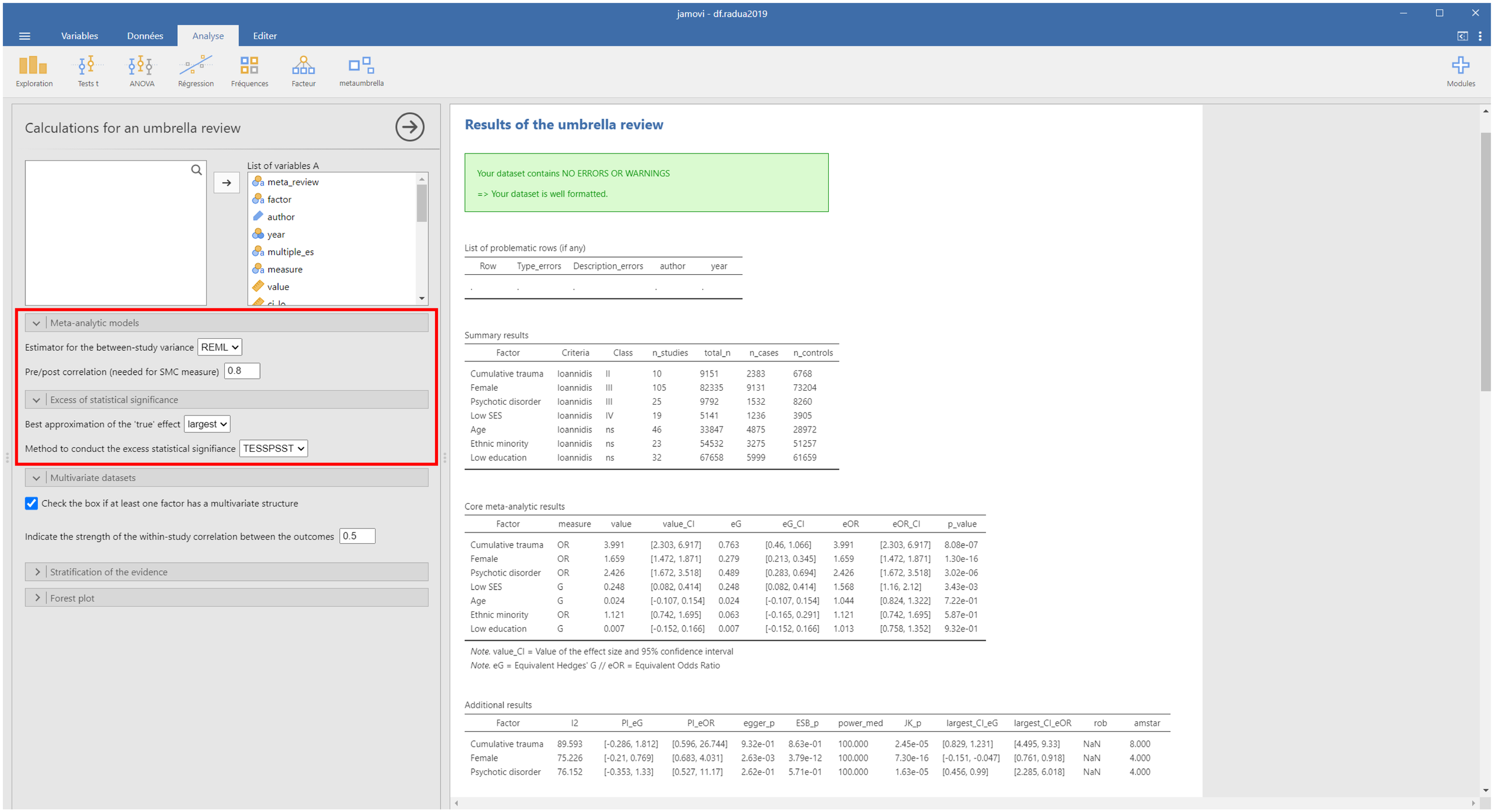


3.3. Customizations (meta-analyses and ESB test)

As soon as the appropriate structure of the dataset is declared, the results of the umbrella review automatically appear!

You have multiple customizations possible (such as the estimator used in the meta-analysis and the test for excess of significance bias; ESB).

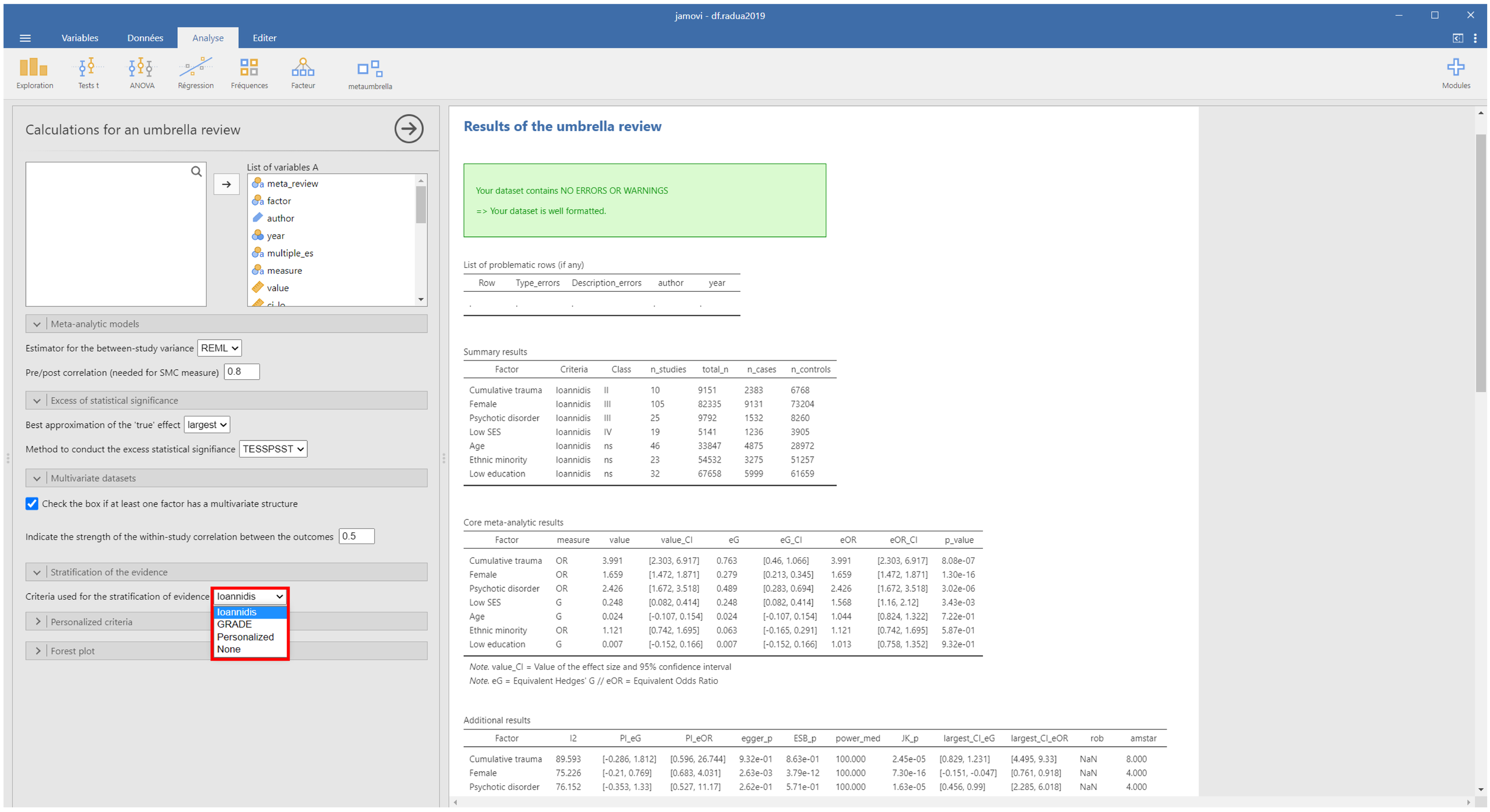
- The description of calculations implied by each customization can be retrieved in: https://cran.r-project.org/web/packages/metaumbrella/metaumbrella.pdf



3.4. Customizations (stratification of the evidence)

You can also choose the criteria used to stratify the evidence.

If you choose some personalized criteria, all the 13 criteria available in the R package are available in the JAMOVI module!

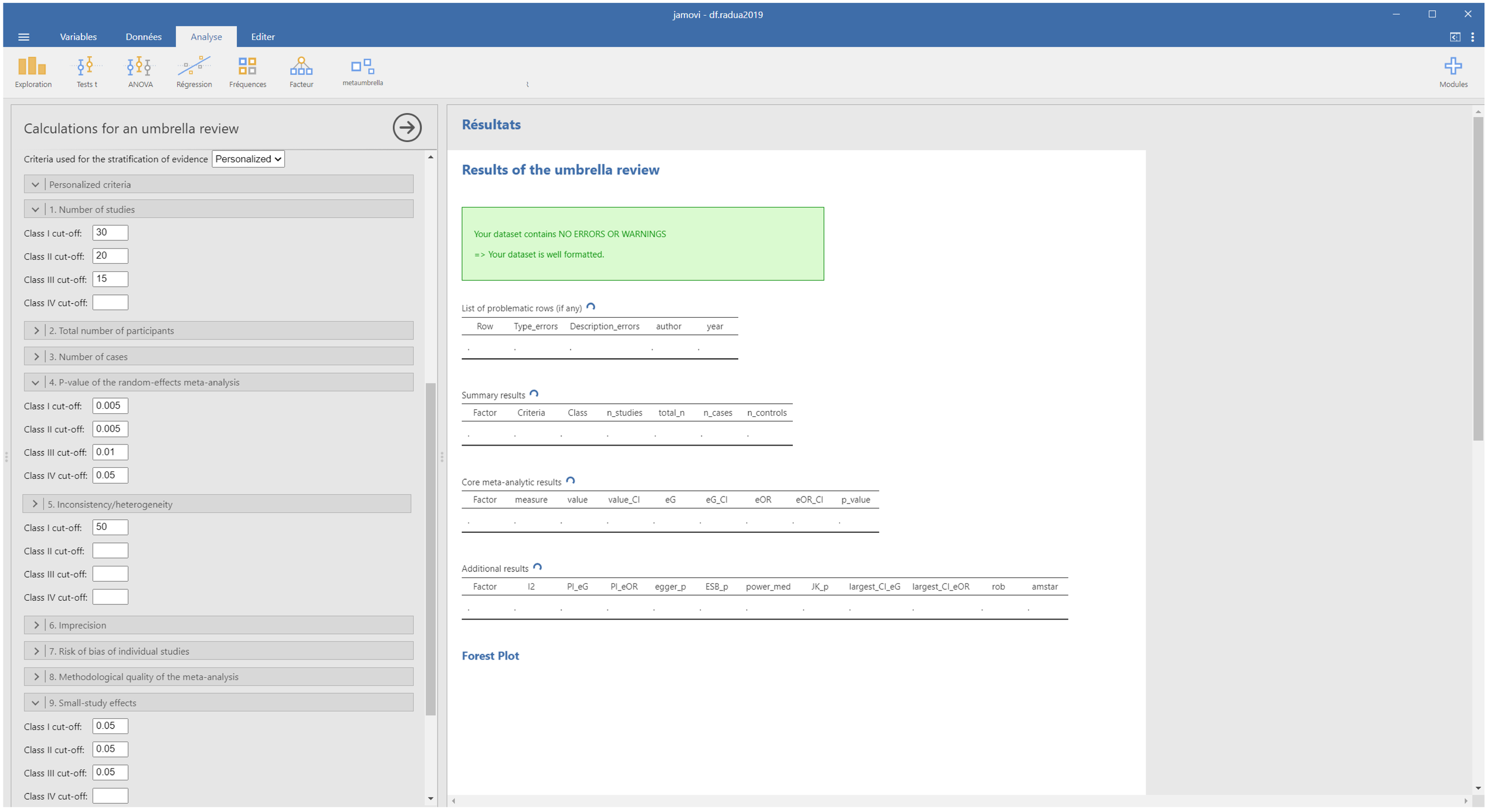


3.4. Customizations (stratification of the evidence)

To use one of the personalized criteria, you simply have to indicate cut-off values for at least one class

We use the same criteria and the same cut-off values as in the manuscript.

Calculations can last up to a minute when your dataset includes many studies / factors



3.5. Interpreting the output

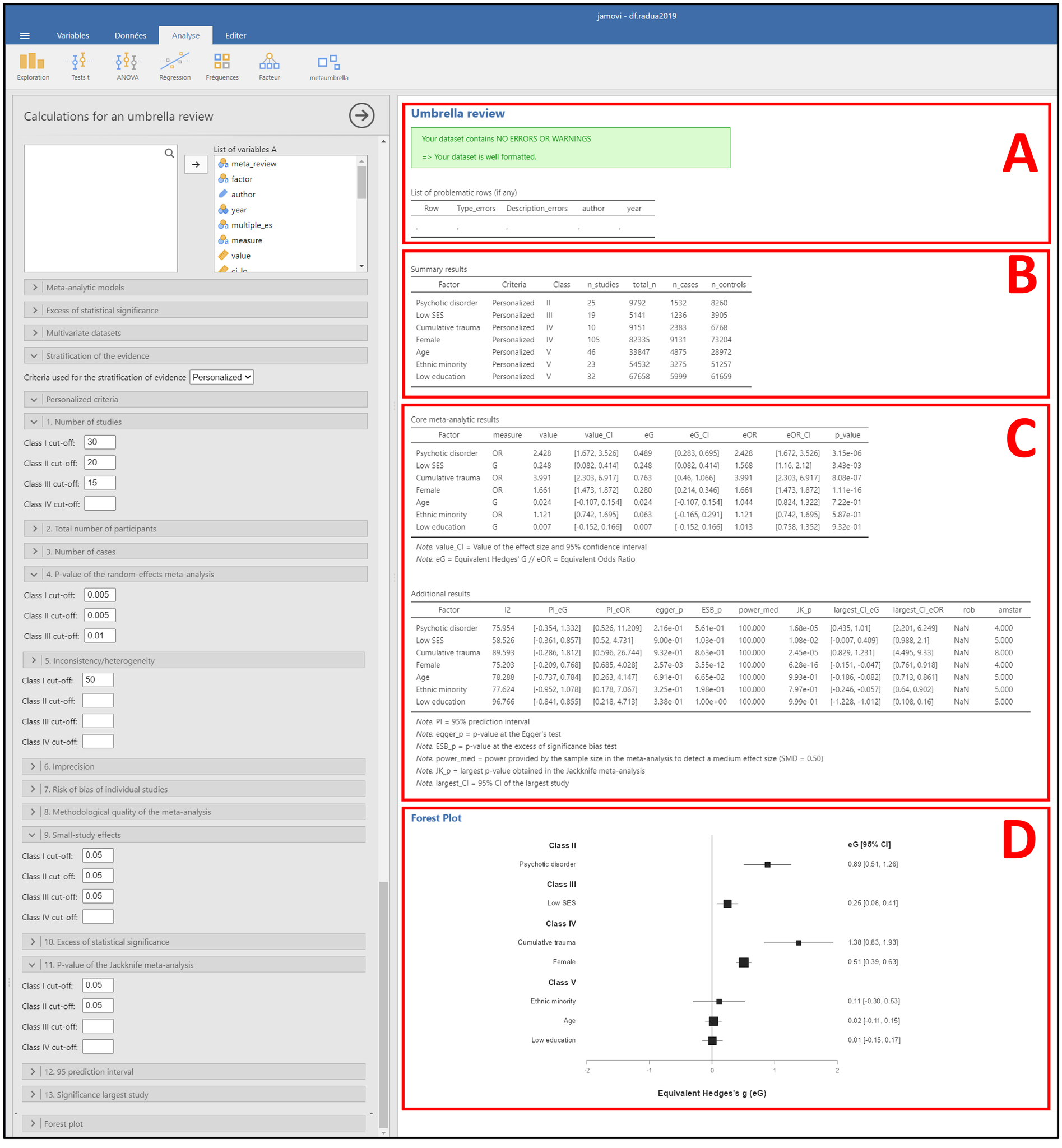
The output is composed of 4 important panels

(A) Results of the dataset checks (any errors will be identified and described)

(B) Results of the stratification of the evidence and general information on meta-analyses

(C) Core meta-analytic results

(D) Forest plot



3.5. Interpreting the output

Results can be exported by right-clicking directly on the tables

jamovi - df.radua2019

Variables | Données | Analyse | Editer

Exploration | Tests t | ANOVA | Régression | Fréquences | Facteur | esci | MAJOR | metaumbrella | TOSTER

Calculations for an umbrella review

List of variables A

- meta_review
- factor
- author
- year
- multiple_es
- measure
- value
- ci_lo

Meta-analytic models

Excess of statistical significance

Multivariate datasets

Stratification of the evidence

Criteria used for the stratification of evidence: Personalized

Personalized criteria

1. Number of studies
2. Total number of participants
3. Number of cases
4. P-value of the random-effects meta-analysis
5. Inconsistency/heterogeneity
6. Imprecision
7. Risk of bias of individual studies
8. Methodological quality of the meta-analysis
9. Small-study effects
10. Excess of statistical significance
11. P-value of the Jackknife meta-analysis
12. 95 prediction interval
13. Significance largest study

Umbrella review

Your dataset contains NO ERRORS OR WARNINGS

=> Your dataset is well formatted.

List of problematic rows (if any)

Row	Type_errors	Description_errors	author	year
.	.	.	.	.

Summary results

Factor	Criteria	Class	n_studies	total_n	n_cases	n_controls
Psychotic disorder	Personalized	II	25	9792	1532	8260
Low SES	Personalized	III	19	5141	1236	3905
Cumulative trauma	Personalized	IV	10	9151	2383	6768
Female	Personalized	IV	105	82335	9131	73204
Age	Personalized	V	46	33847	4875	28972
Ethnic minority	Personalized	V	23	54532	3275	51257
Low education	Personalized	V	32	67658	5999	61659

Core meta-analytic results

Tous | Analyses | Tableau → Copier | Exporter... | Ajouter une note

Factor	measure	v	CI	eG	eG_CI	eOR	eOR_CI	p_value
Psychotic disorder	OR	2.4			283, 0.695]	2.428	[1.672, 3.526]	3.15e-06
Low SES	G	0.248	[0.082, 0.4		082, 0.414]	1.568	[1.16, 2.12]	3.43e-03
Cumulative trauma	OR	3.991	[2.303, 6.9		46, 1.066]	3.991	[2.303, 6.917]	8.08e-07
Female	OR	1.661	[1.473, 1.8		214, 0.346]	1.661	[1.473, 1.872]	1.11e-16
Age	G	0.024	[-0.107, 0.154]	0.024	[-0.107, 0.154]	1.044	[0.824, 1.322]	7.22e-01
Ethnic minority	OR	1.121	[0.742, 1.695]	0.063	[-0.165, 0.291]	1.121	[0.742, 1.695]	5.87e-01
Low education	G	0.007	[-0.152, 0.166]	0.007	[-0.152, 0.166]	1.013	[0.758, 1.352]	9.32e-01

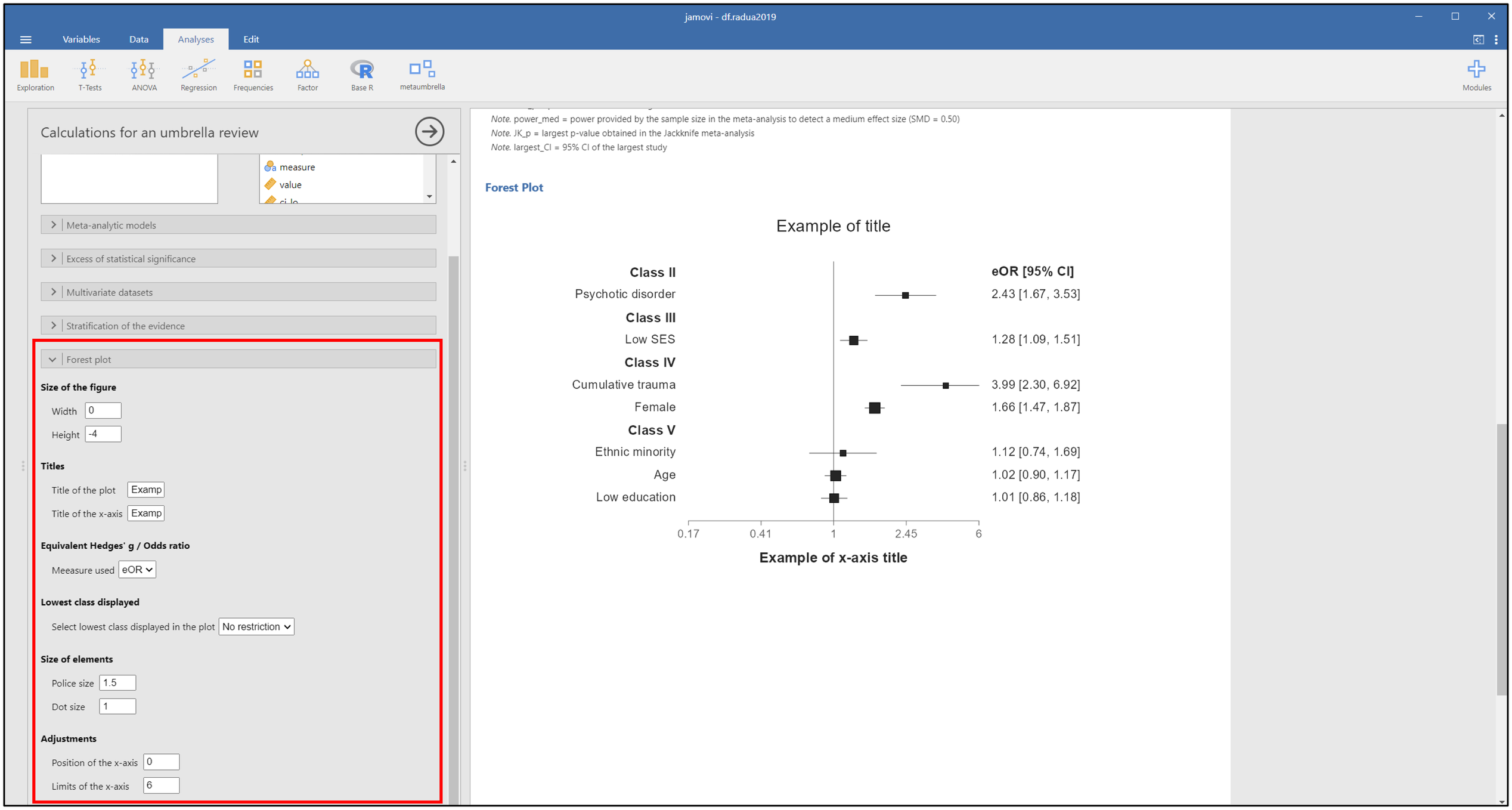
Note. value_CI = Value of the effect size and 95% confidence interval
Note. eG = Equivalent Hedges' G // eOR = Equivalent Odds Ratio

Additional results

Factor	I2	PI_eG	PI_eOR	egger_p	ESB_p	power_med	JK_p	largest_CI_eG	largest_CI_eOR	rob	amstar
Psychotic disorder	75.954	[-0.354, 1.332]	[0.526, 11.209]	2.16e-01	5.61e-01	100.000	1.68e-05	[0.435, 1.01]	[2.201, 6.249]	NaN	4.000
Low SES	58.526	[-0.361, 0.857]	[0.52, 4.731]	9.00e-01	1.03e-01	100.000	1.08e-02	[-0.007, 0.409]	[0.988, 2.1]	NaN	5.000
Cumulative trauma	89.593	[-0.286, 1.812]	[0.596, 26.744]	9.32e-01	8.63e-01	100.000	2.45e-05	[0.829, 1.231]	[4.495, 9.33]	NaN	8.000

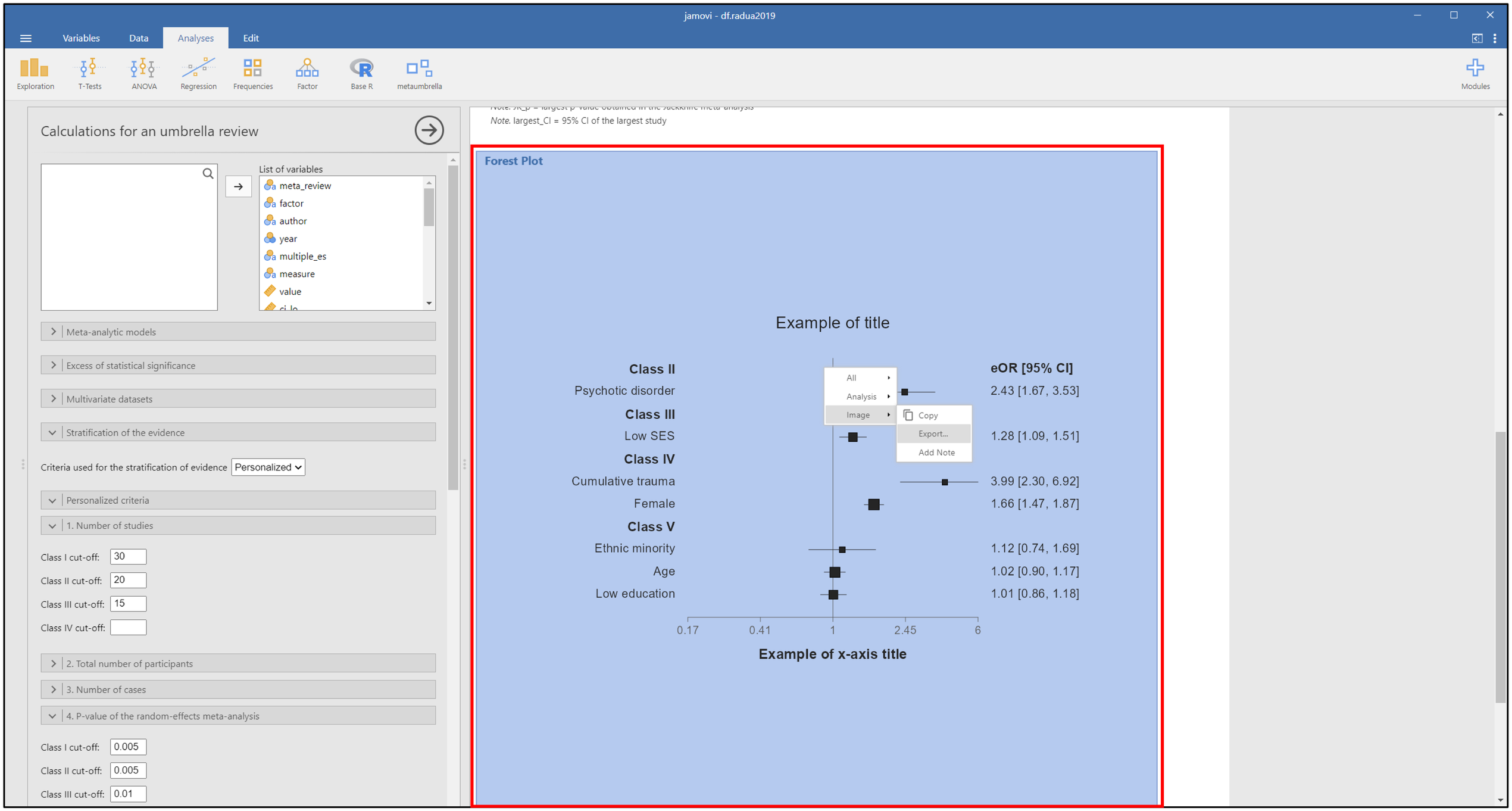
3.6. Customizations (forest plot)

Note that many customizations are also possible for the forest plot!



3.6. Customizations (forest plot)

As for the tables, the forest plot can be exported by right-clicking directly on the plot.



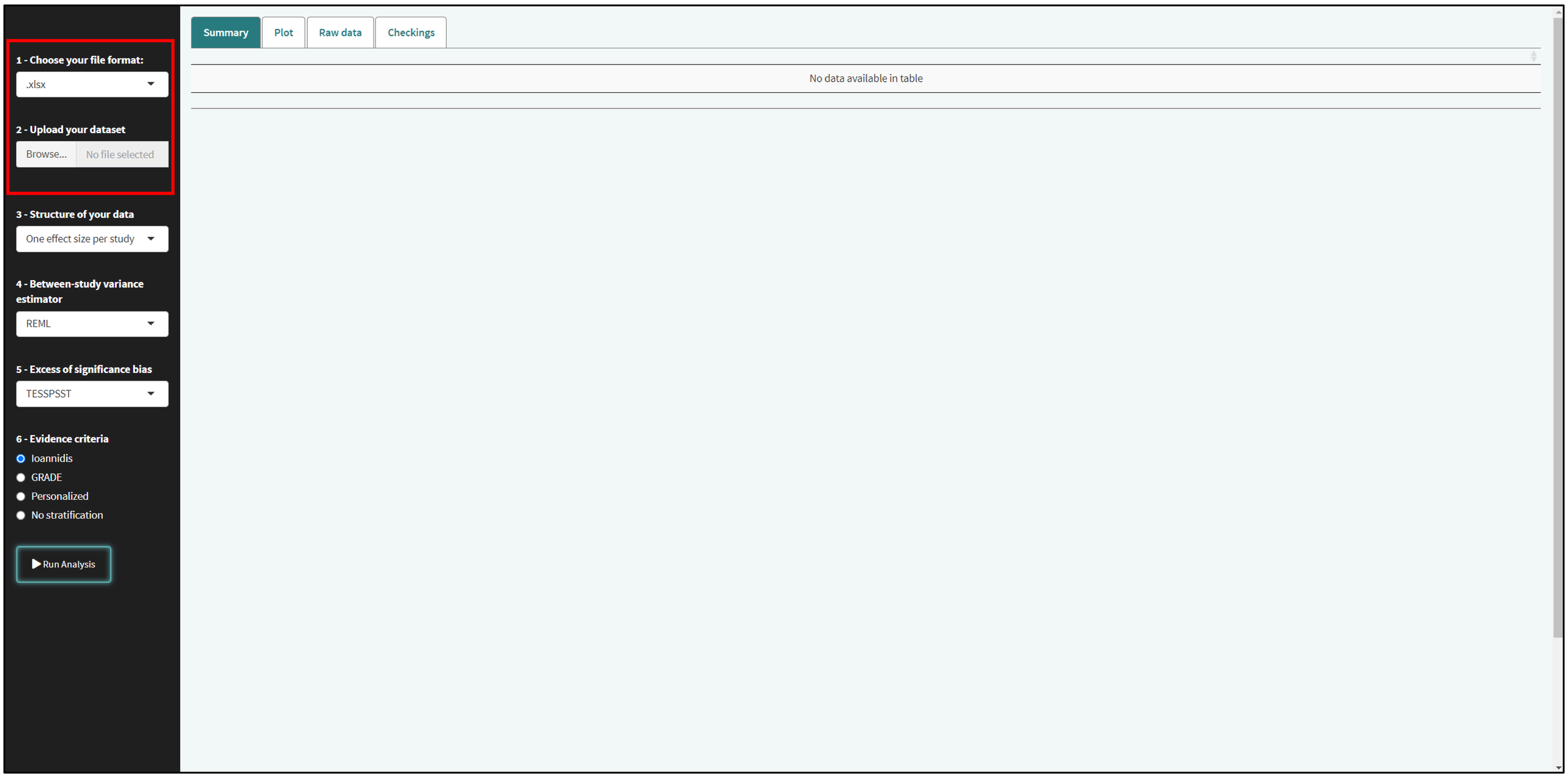
Supplement 2.

Tutorial of the metaumbrella browser-based app

1. Loading of the dataset

Before trying the different features of the ‘metaumbrella’ app, you must load a well-formatted dataset.

The type of the file storing your dataset has to be indicated (.xlsx, .txt and .csv) .

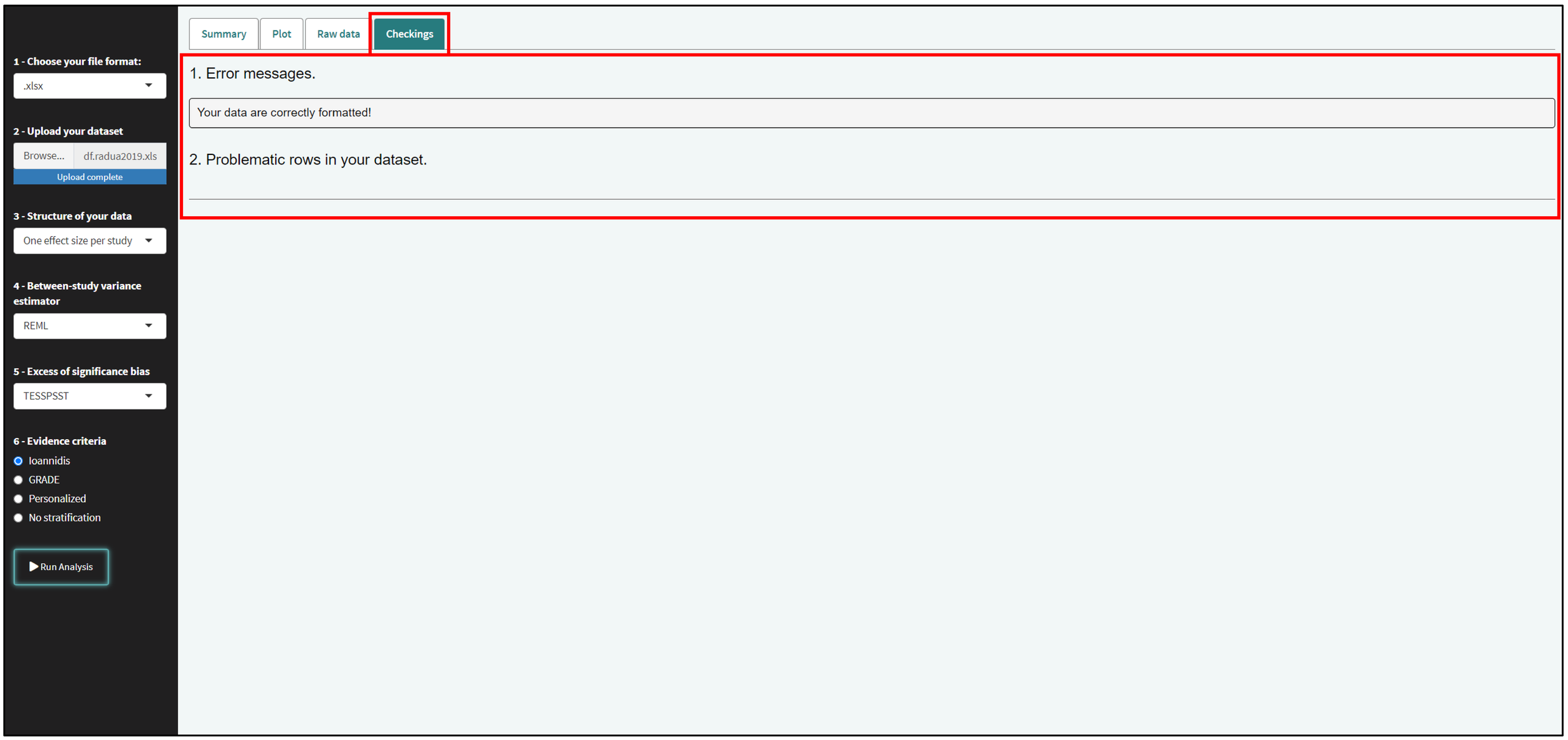


2. Checking the dataset

Because the ‘metaumbrella’ app requires heavy formatting of the dataset, it is a good practice to check that no errors have been identified.

All the errors and the rows with formatting issues are available in the ‘Checkings’ tab.

In this case, there are no errors so we can move forward.

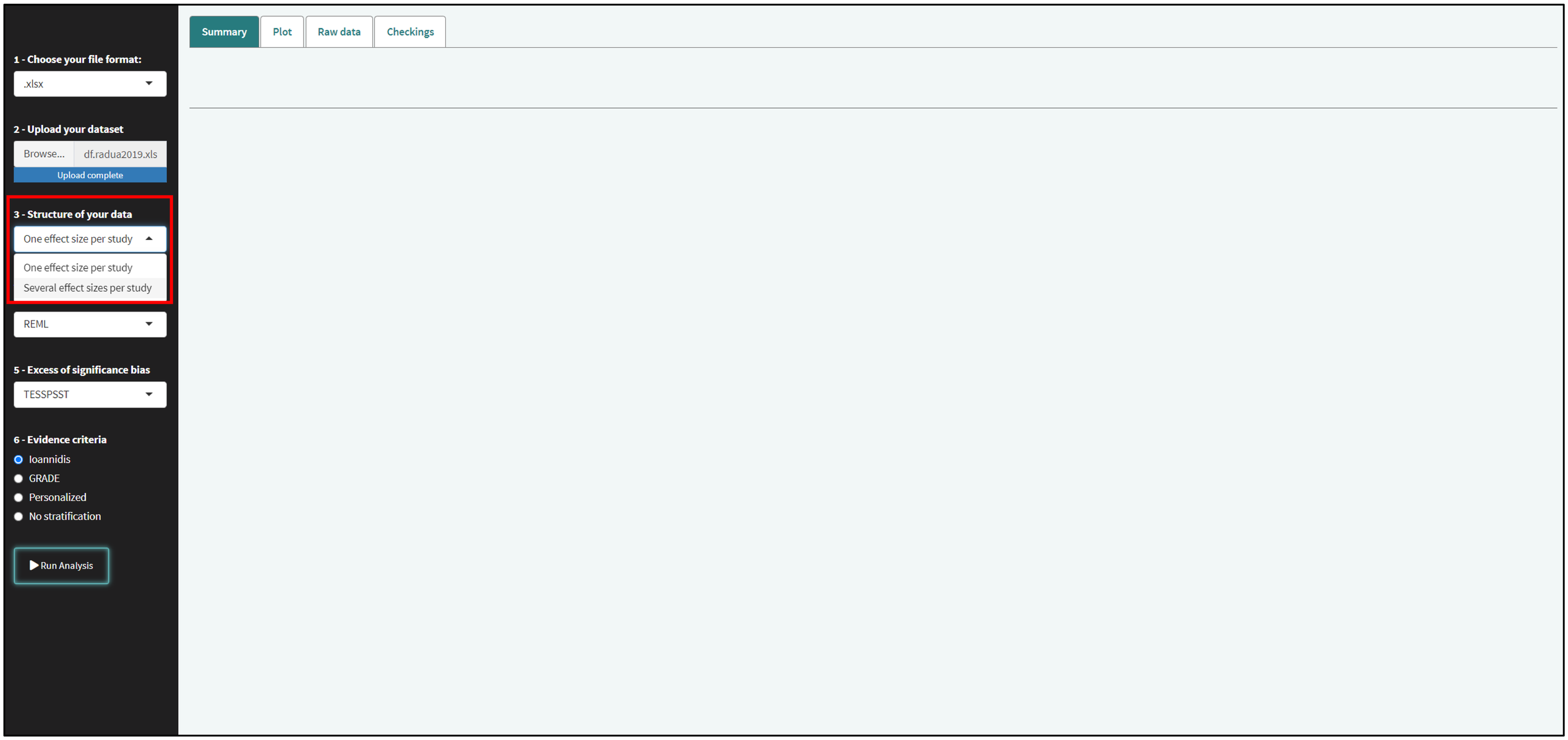


3. Structure of the dataset

After loading your dataset and checking the formatting, indicate the structure of your dataset:

- '**One effect size per study**': this option should be selected if your factors include only studies with independent effect sizes.
- '**Several effect sizes per study**': this option should be selected if at least one factor includes a study with more than one effect size.

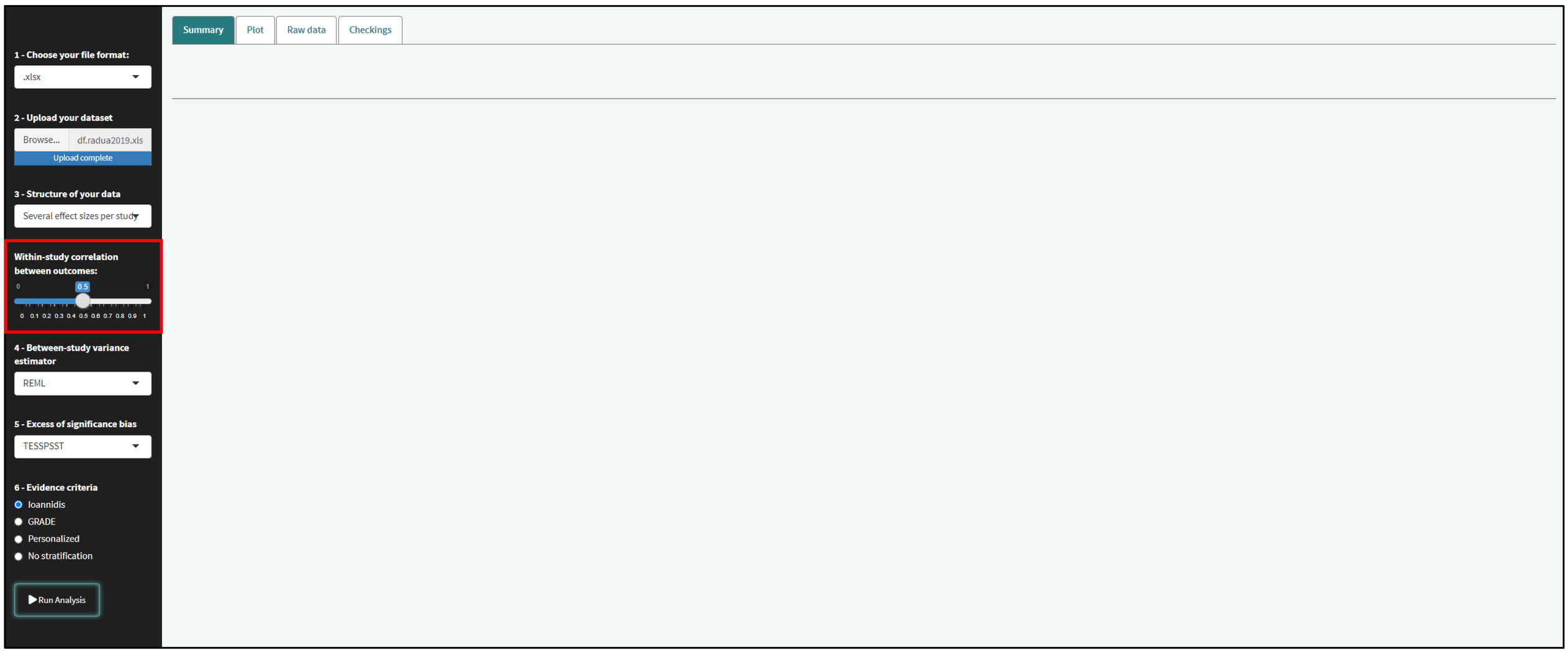
In the present example we have several factors that include studies with multiple dependent effect sizes. We thus have to select the '**Several effect sizes per study**' option.



3. Structure of the dataset

When you select the '**Several effect sizes per study**', a slider automatically appears to indicate the strength of the correlation between the effect sizes coming from the same studies (only for the effect sizes coming from the same participants, i.e., those with a "outcomes" value in the 'multiple_es' column.

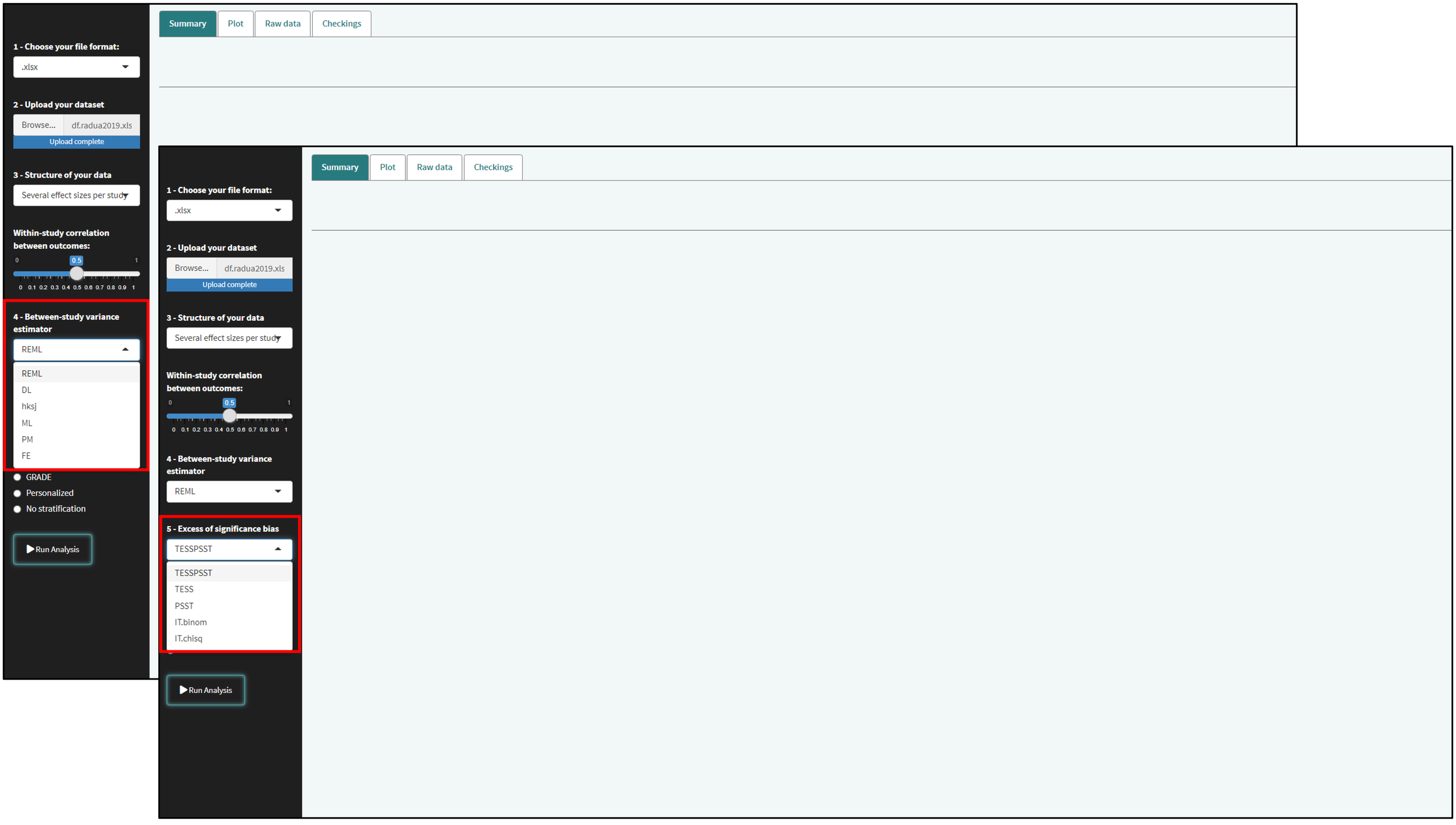
Note that you can indicate this correlation directly from the dataset using the 'r' column.



4.1. Customizations (meta-analyses and ESB test)

Several customizations are possible regarding the meta-analytic models and the tests for excess of significance bias (ESB).

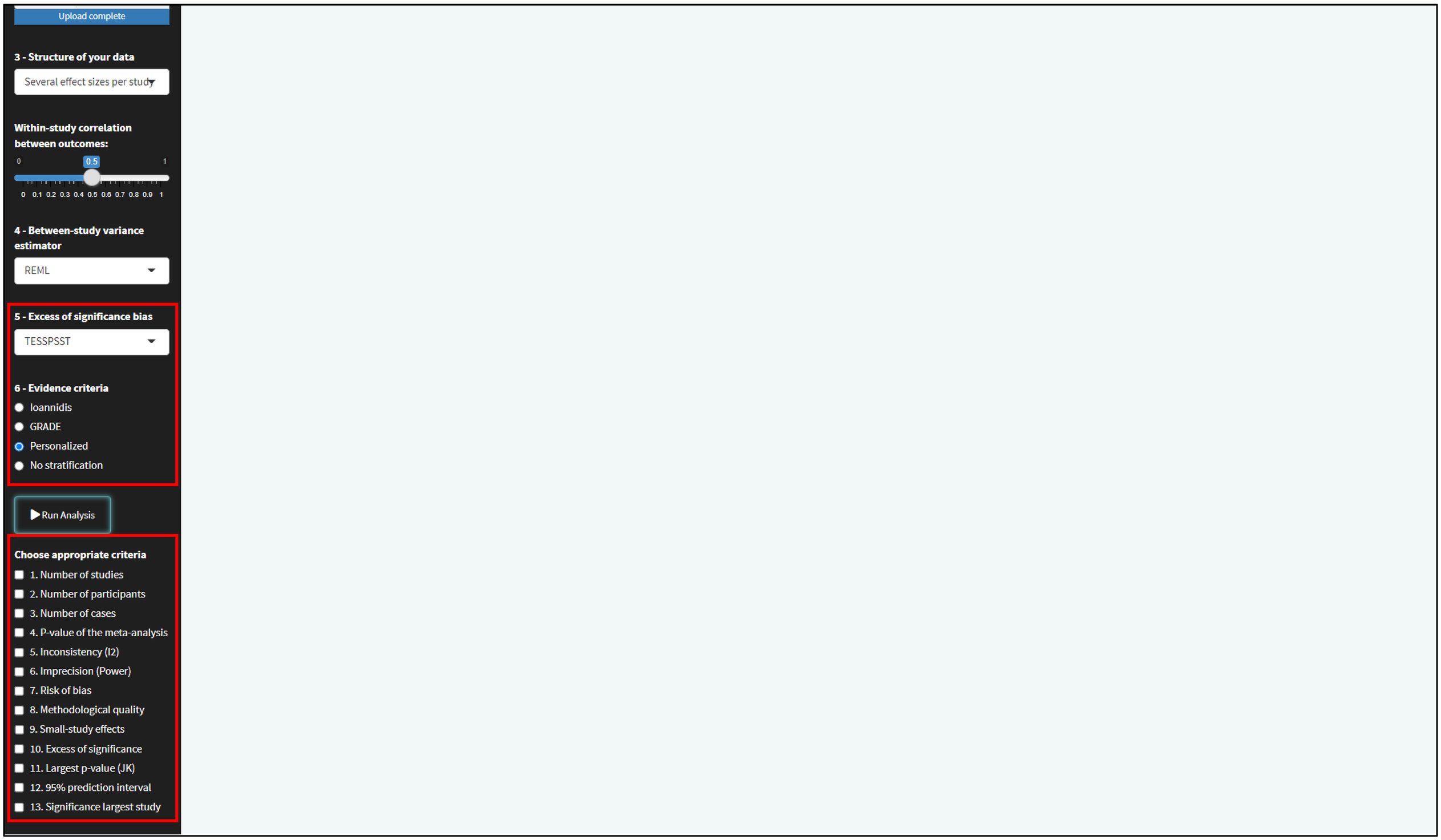
- The description of calculations implied by each customization can be retrieved in: https://cran.r-project.org/web/packages/metaumbrella/metaumbrella.pdf



4.2. Customizations (stratification of the evidence)

You can also choose the criteria used to stratify the evidence.

If you choose to use the personalized criteria, the 13 criteria available in the R package are also available in the browser-based app!

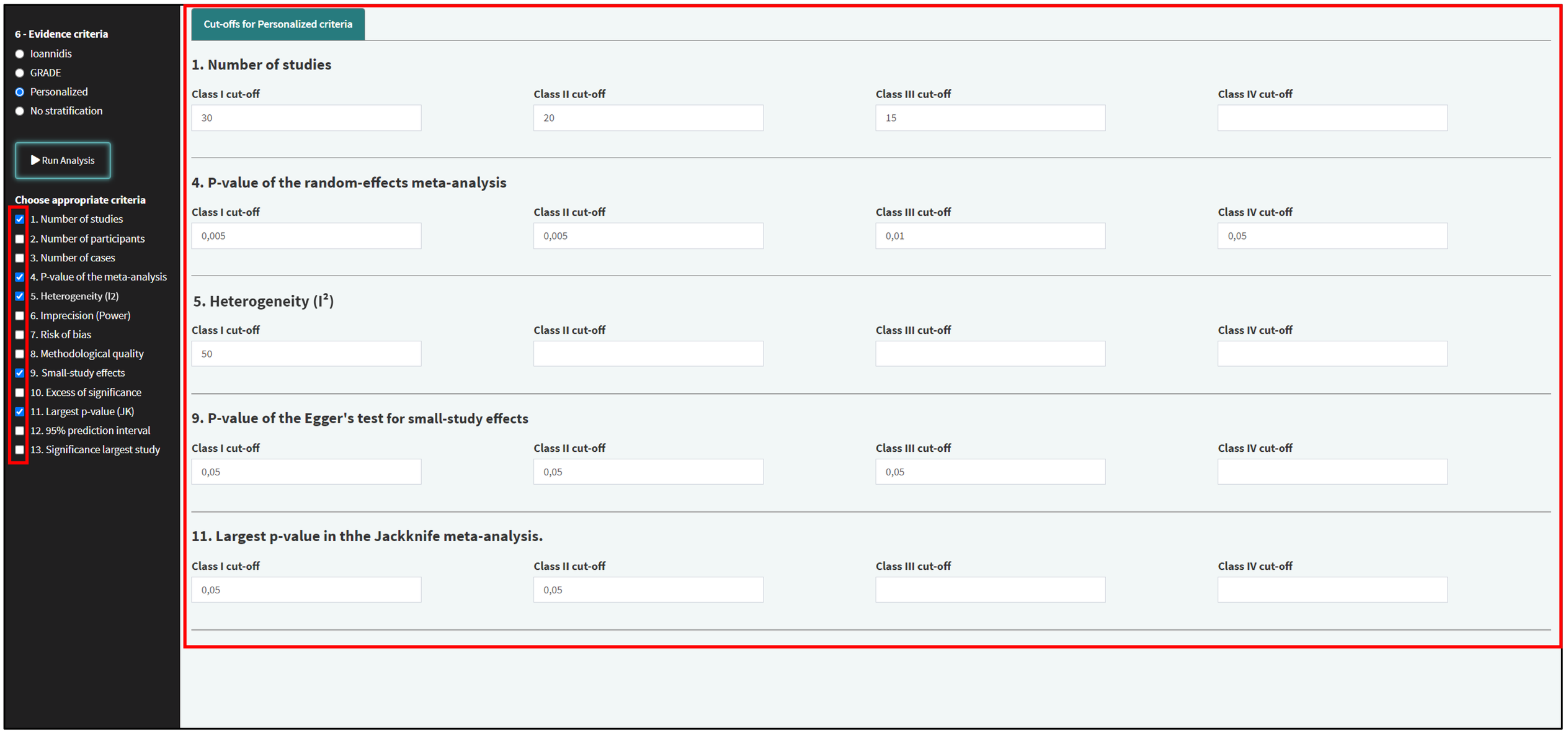


4.2. Customizations (stratification of the evidence)

To use one of the personalized criteria, you have to check the box of the criteria.

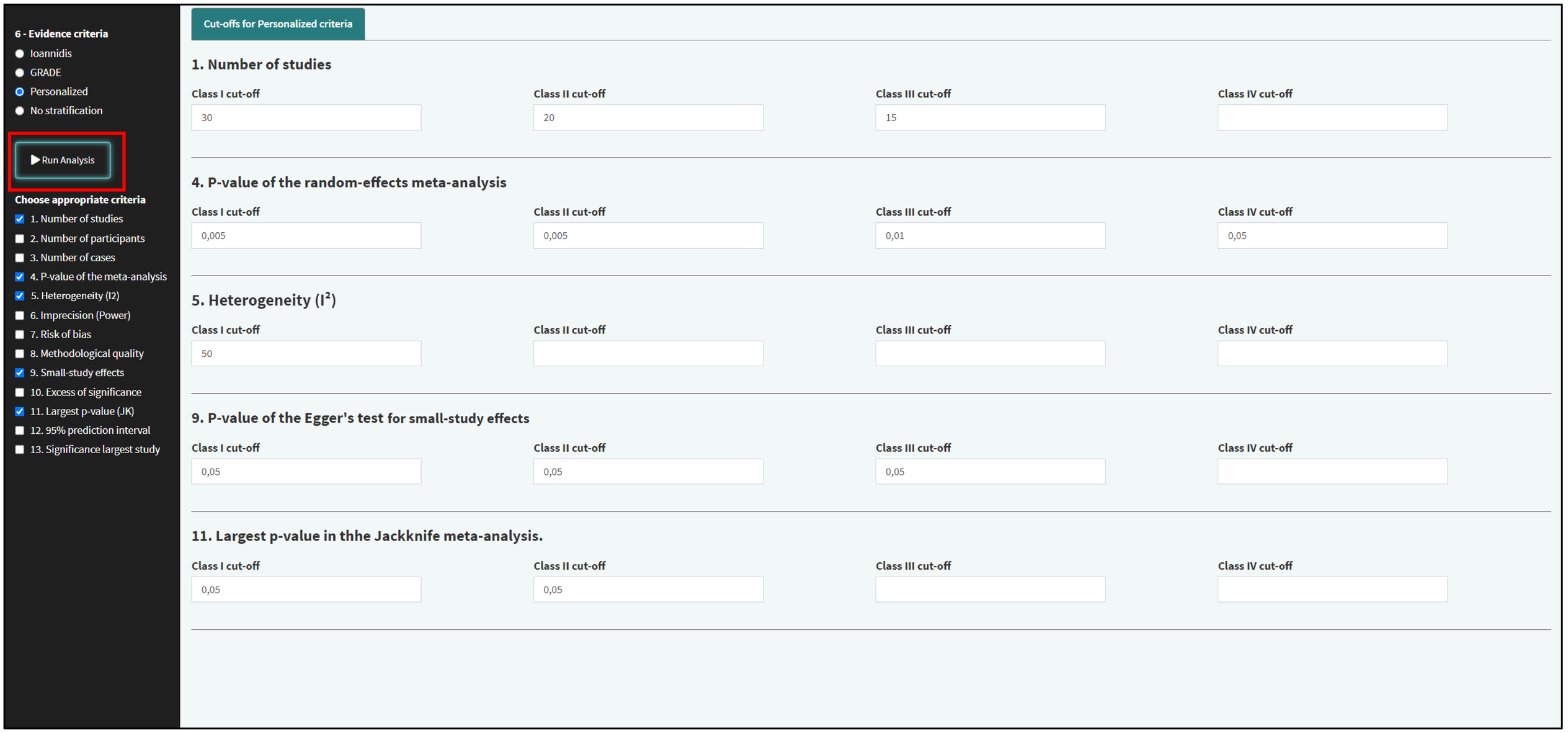
Clicking on the box automatically opens a new tab where the cut-off values for each class can be indicated.

We use the same criteria and the same cut-off values as in the manuscript.



4.2. Customizations (stratification of the evidence)

Once all customization have been set, you can run the analyses by clicking on the ‘Run analysis’ button.



5. Results

Core results will appear on the main page. You can easily export the results using the appropriate buttons.

1 - Choose your file format:

.xlsx

2 - Upload your dataset

Browse... df.radua2019.xls

Upload complete

3 - Structure of your data

Several effect sizes per study

Within-study correlation between outcomes:

0 0.5 1

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

4 - Between-study variance estimator

REML

5 - Excess of significance bias

TESSPSST

6 - Evidence criteria

- Ioannidis
- GRADE
- Personalized
- No stratification

Run Analysis

Choose appropriate criteria

- 1. Number of studies

Summary | Plot | Raw data | Checkings

Search:

Factor	Criteria	Class	measure	value	value_CI	eG	eG_CI	eOR	eOR_CI	p_value	n_studies	total_n
Psychotic disorder	Personalized	II	OR	2.426	[1.672, 3.518]	0.489	[0.283, 0.694]	2.426	[1.672, 3.518]	3.02e-06	25	9792
Low SES	Personalized	III	G	0.248	[0.082, 0.414]	0.248	[0.082, 0.414]	1.568	[1.16, 2.12]	3.43e-03	19	5141
Cumulative trauma	Personalized	IV	OR	3.991	[2.303, 6.917]	0.763	[0.46, 1.066]	3.991	[2.303, 6.917]	8.08e-07	10	9151
Female	Personalized	IV	OR	1.659	[1.472, 1.871]	0.279	[0.213, 0.345]	1.659	[1.472, 1.871]	1.30e-16	105	82335
Ethnic minority	Personalized	V	OR	1.121	[0.742, 1.695]	0.063	[-0.165, 0.291]	1.121	[0.742, 1.695]	5.87e-01	23	54532
Age	Personalized	V	G	0.024	[-0.107, 0.154]	0.024	[-0.107, 0.154]	1.044	[0.824, 1.322]	7.22e-01	46	33847
Low education	Personalized	V	G	0.007	[-0.152, 0.166]	0.007	[-0.152, 0.166]	1.013	[0.758, 1.352]	9.32e-01	32	67658

Copy CSV Excel PDF

Cut-offs for Personalized criteria

1. Number of studies

Class I cut-off 30

Class II cut-off 20

Class III cut-off 15

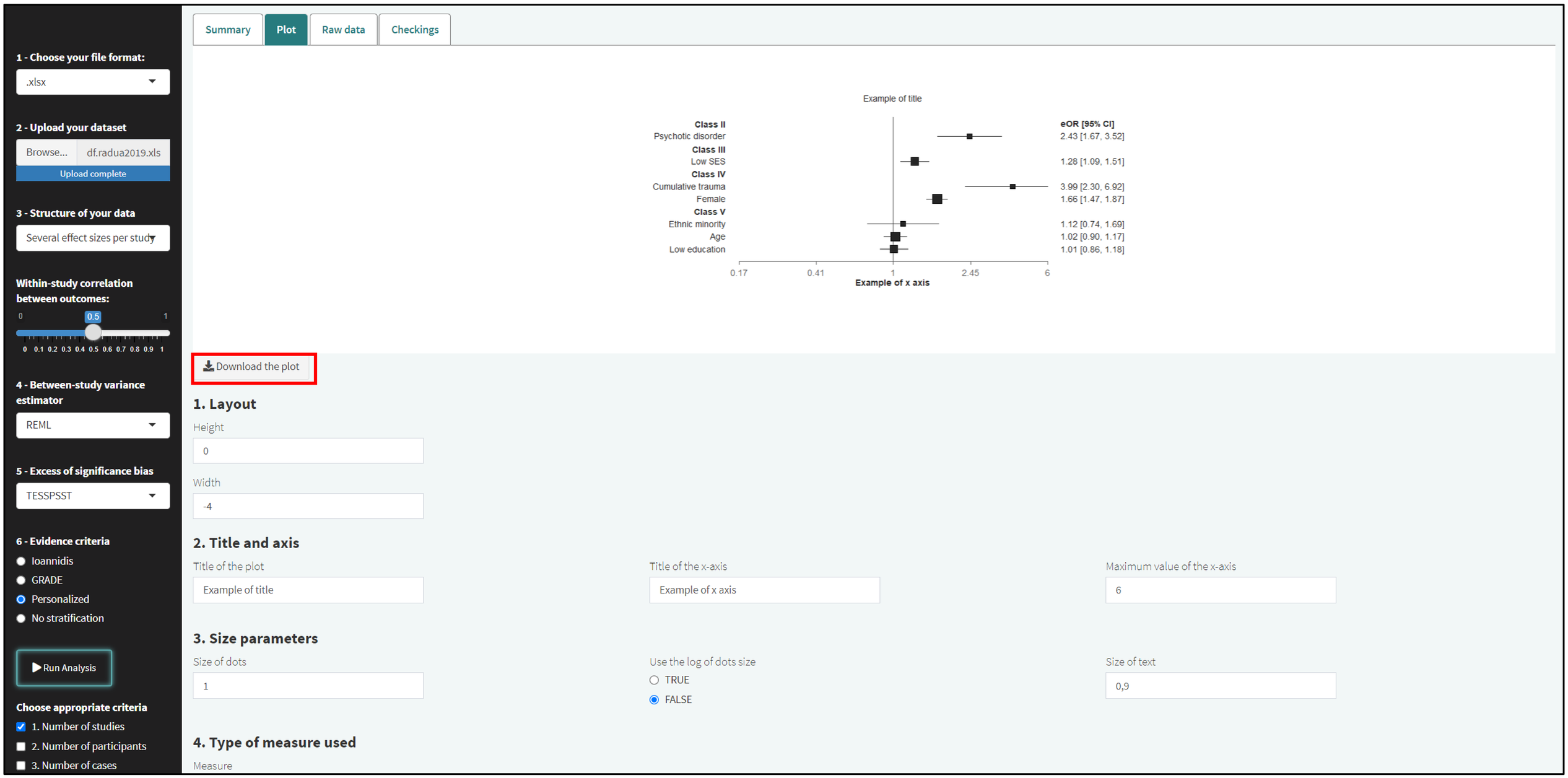
Class IV cut-off

6. Forest plot

You can obtain a graphical presentation of the results in the ‘Plot’ tab.

Many customizations are also possible!

You can download a .svg file which contains the plot that you generated and that can be edited further.



Supplement 3.

Creation of a well-formatted dataset

1. Introduction to well-formatted datasets

One of the specificities of the ’metaumbrella’ package is that all the functions of this package do not have an argument to specify the name of the variables contained in the dataset of the users. Therefore, it is necessary that the datasets that are passed to the different functions of the package respect a very precise formatting (which we will refer to as well-formatted dataset). We present here the rules that must be respected when creating a well-formatted dataset.

The datasets passed to the functions of the metaumbrella package should contain information on each individual study pooled in the different meta-analyses included in the umbrella review. The information about each individual study must allow for replication of the meta-analyses. It is therefore necessary that the information contained in a well-formatted dataset allows for estimating the effect size and variance of all individual studies. Ten types of effect size measures are accepted:

- "**SMD**" standardized mean difference (i.e., Cohen's d)
- "**G**": Hedges' g
- "**MD**": mean difference
- "**SMC**": standardized mean change
- "**R**": Pearson's r
- "**Z**": Fisher's z
- "**OR**" or "logOR": odds ratio or its logarithm
- "**RR**" or "logRR": risk ratio or its logarithm
- "**HR**" or "logHR": hazard ratio or its logarithm
- "**IRR**" or "logIRR": incidence rate ratio or its logarithm

You can retrieve more information on the formatting of the datasets in the following links:

- https://cran.r-project.org/web/packages/metaumbrella/metaumbrella.pdf
- https://metaumbrella.org/tutorials/tutorial-01-format-data

2. Mandatory columns

The following variables must be included in the dataset regardless of the effect size measure used. The name of these variables (in bold) cannot be changed.

- **meta_review:** a character variable that contains an identifier for the sources of the meta-analyses included in an umbrella review. Typically, this variable contains the name of the first-author of the included meta-analyses.

- **factor:** a character variable that contains an identifier for the risk factors or the interventions whose effect are studied. Importantly, all rows in the dataset with the same factor value will be pooled together in a meta-analysis.

- **author** and **year:** character variables identifying the name and the year of publication of each individual study that is included in a meta-analysis. For a given factor, all rows with the same author and year values will be identified as having some type of dependence (see below).

- **measure:** a character variable describing the type of effect size measure used to quantify the effect of the factor and it must be either "SMD", "MD", "G", "SMD", "R", "Z", "OR", "logOR", "RR", "logRR", "HR", "logHR", "IRR" or "logIRR". Note here that if a study reports the numbers of cases and controls in exposed and non-exposed groups but does not report an effect size value (i.e., the value of an OR or RR), we recommend specifying "OR" for case-control studies while "RR" for cohort studies.

To estimate the effect size and the variance of each individual study, the ’metaumbrella’ package allows for flexible inputs. We detail in the next pages the variables that are mandatory and must be indicated in a well-formatted dataset, the variables that vary depending on the effect size measure and the variables that are optional but that can be indicated to benefit from certain features of the package.

3. Information dependent on effect size measure

Depending on the effect size measure used, different information must be provided to replicate the meta-analyses. To allow users adapting to the data available in the original articles, several combinations of information can be provided for a given effect size measure. We detail the information that can provided in the dataset to replicate the meta-analyses and we provide several summary tables displaying the various combinations of minimum information required to replicate the meta-analyses

- **value**: Value of the effect size for each individual study.
- **ci_lo**: Lower bound of the 95% confidence interval around the effect size for each individual study.
- **ci_up**: Upper bound of the 95% confidence interval around the effect size for each individual study.
- **n_sample**: Total number of participants in each study.
- **n_cases**: Number of cases in each individual study.
- **n_controls**: Number of controls in each individual study.
- **n_exp**: Number of exposed participants in each individual study.
- **n_nexp**: Number of non-exposed participants in each individual study.
- **n_cases_exp**: Number of cases in the exposed group in each individual study.
- **n_controls_exp**: Number of controls in the exposed group in each individual study.
- **n_cases_nexp**: Number of cases in the non-exposed group in each individual study.
- **n_controls_nexp**: Number of controls in the non-exposed group in each individual study.
- **mean_cases**: Mean of the cases for each individual study (at follow-up).
- **mean_controls**: Mean of the controls for each individual study (at follow-up).
- **sd_cases**: Standard deviation of the cases for each individual study (at follow-up).
- **sd_controls**: Standard deviation of the controls for each individual study (at follow-up).
- **mean_pre_cases**: Mean of the cases for each individual study at baseline.
- **mean_pre_controls**: Mean of the controls for each individual study at baseline.
- **sd_pre_cases**: Standard deviation of the cases for each individual study at baseline.
- **sd_pre_controls**: Standard deviation of the controls for each individual study at baseline.
- **mean_change_cases**: Mean change of the cases for each individual study (from baseline to follow up).
- **mean_change_controls**: Mean change of the controls for each individual study (from baseline to follow up).
- **sd_change_cases**: Standard deviation of the change of cases for each individual study (from baseline to follow up).
- **sd_change_controls**: Standard deviation of the change of controls for each individual study (from baseline to follow up).
- **pre_post_cor**: Correlation between the pre-post measure across groups.
- **time**: Sum of the person-time of disease-free observation in the exposed and non-exposed groups for each individual study.
- **time_exp**: Person-time of disease-free observation in the exposed group for each individual study.
- **time_nexp**: Person-time of disease-free observation in the non-exposed group for each individual study.

4. Minimum information needed

We now present the summary tables indicating the minimum combination of information that should be provided for each individual study to run the analyses. Here are some general indications to assist in understanding these tables.

- The header of the tables are the names of the columns in the dataset.
- The symbol **&** between two column names indicates that an information should be provided for the two columns of the dataset.
- The symbol **OR** between two column names indicates that an information should be provided for one of the two columns of the dataset.
- The symbol **X** indicates that an information should be provided.
- A blank cell indicates that the information can be missing.
- For each effect size measure, users must provide information on at least one row of the corresponding table. Otherwise, an error message will be printed and analyses will not be run.

After each summary table, an example dataset that respects the formatting is provided.

4. Minimum information needed (SMD)

Table containing all combinations of information to perform the calculations with SMD as effect measure
Each row of the table depicts a possible combination of information

mean_cases & mean_controls & sd_cases & sd_controls	n_cases & n_controls	value	se OR var	ci_lo & ci_up
X	X			
	X	X		
	X	X	X	
	X	X		X

Fictitious dataset respecting the formatting

measure	mean_cases	mean_controls	sd_cases	sd_controls	n_cases	n_controls	value	se	var	ci_lo	ci_up
SMD	100	98	9	13	24	31	*NA*	*NA*	*NA*	*NA*	*NA*
SMD	*NA*	*NA*	121	121	121	121	0.543	*NA*	*NA*	*NA*	*NA*
SMD	*NA*	*NA*	192	211	192	211	0.50	0.1	*NA*	*NA*	*NA*
SMD	*NA*	*NA*	29	64	29	64	-1.34	*NA*	0.84	*NA*	*NA*
SMD	*NA*	*NA*	12	9	12	9	0.45	*NA*	*NA*	-0.44	1.31

4. Minimum information needed (G)

Table containing all combinations of information to perform the calculations with G as effect measure
Each row of the table depicts a possible combination of information

n_cases & n_controls	value	se OR var	ci_lo & ci_up
X	X		
X	X	X	
X	X		X

Fictitious dataset respecting the formatting

measure	n_cases	n_controls	value	se	var	ci_lo	ci_up
G	**121**	**121**	**0.543**	*NA*	*NA*	*NA*	*NA*
G	**192**	**211**	**0.50**	**0.1**	*NA*	*NA*	*NA*
G	**29**	**64**	**-1.34**	*NA*	**0.84**	*NA*	*NA*
G	**12**	**9**	**0.45**	*NA*	*NA*	**-0.44**	**1.31**

4. Minimum information needed (MD)

Table containing all combinations of information to perform the calculations with MD as effect measure
Each row of the table depicts a possible combination of information

n_cases & n_controls	value	se OR var	ci_lo & ci_up
X	X	X	
X	X		X

Fictitious dataset respecting the formatting

measure	n_cases	n_controls	value	se	var	ci_lo	ci_up
MD	192	211	0.50	0.1	*NA*	*NA*	*NA*
MD	29	64	-1.34	*NA*	0.84	*NA*	*NA*
MD	12	9	0.45	*NA*	*NA*	-0.44	1.31

4. Minimum information needed (SMC)

Tables containing all combinations of information to perform the calculations with SMC as effect measure
Each row of the table depicts a possible combination of information

n_cases & n_controls	value	se OR var	ci_lo & ci_up
X	X	X	
X	X		X

n_cases & n_controls	mean_change_cases	mean_change_controls	sd_change_cases	sd_change_controls
X	X	X		

n_cases & n_controls	mean_pre_cases & mean_pre_controls	sd_pre_cases & sd_pre_controls	mean_cases & mean_controls	sd_cases & sd_controls
X	X	X	X	X

Fictitious datasets respecting the formatting

measure	n_cases	n_controls	value	se	var	ci_lo	ci_up
SMC	192	211	0.50	0.1	*NA*	*NA*	*NA*
SMC	29	64	-1.34	*NA*	0.84	*NA*	*NA*
SMC	12	9	0.45	*NA*	*NA*	-0.44	1.31

measure	n_cases	n_controls	mean_change_cases	mean_change_controls	sd_change_cases	sd_change_controls
SMC	41	42	0.50	0.1	0.24	0.38

measure	n_cases	n_controls	mean_pre_cases	mean_pre_controls	sd_pre_cases	sd_pre_controls	mean_cases	mean_controls	sd_cases	sd_controls
SMC	21	21	0.1	0.1	0.2	0.1	0.4	0.3	0.2	0.1

4. Minimum information needed (R)

Tables containing all combinations of information to perform the calculations with R as effect measure
Each row of the table depicts a possible combination of information

n_sample	value	se OR var	ci_lo & ci_up
X	X		
X	X	X	
X	X		X

Fictitious datasets respecting the formatting

measure	n_sample	value	se	var	ci_lo	ci_up
R	**44**	**0.65**	*NA*	*NA*	*NA*	*NA*
R	**322**	**0.2**	**0.1**	*NA*	*NA*	*NA*
R	**68**	**-0.24**	**0.01**	*NA*	*NA*	*NA*
R	**151**	**0.08**	*NA*	*NA*	**-0.08**	**0.24**

4. Minimum information needed (Z)

Tables containing all combinations of information to perform the calculations with Z as effect measure
Each row of the table depicts a possible combination of information

n_sample	value	se OR var	ci_lo & ci_up
X	X		
X	X	X	
X	X		X

Fictitious datasets respecting the formatting

measure	n_sample	value	se	var	ci_lo	ci_up
Z	**21**	**-0.1**	*NA*	*NA*	*NA*	*NA*
Z	**34**	**0.15**	**0.18**	*NA*	*NA*	*NA*
Z	**81**	**-0.16**	*NA*	**0.01**	*NA*	*NA*
Z	**54**	**0,7**	*NA*	*NA*	**0.5**	**0.8**

4. Minimum information needed (OR)

Table containing all combinations of information to perform the calculations with OR as effect measure
Each row of the table depicts a possible combination of information

n_cases_exp & n_cases_nexp & n_controls_exp & n_controls_nexp	n_exp & n_nexp	n_cases & n_controls	value	se OR var	ci_lo & ci_up
X					
		X	X		
		X	X	X	
		X	X		X
	X		X	X	
	X				X

Fictitious dataset respecting the formatting

measure	n_cases_exp	n_cases_exp	n_controls_exp	n_controls_nexp	n_exp	n_nexp	n_cases	n_controls	value	se*	var*	ci_lo	ci_up
OR	100	2011	501	11098	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
OR	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	148	132	1.16	0.38	*NA*	*NA*	*NA*
OR	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	58	95	4.28	*NA*	0.11	*NA*	*NA*
OR	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	73	130	3.23	*NA*	*NA*	1.71	6.19
OR	*NA*	*NA*	*NA*	*NA*	48	158	*NA*	*NA*	1.58	0.34	*NA*	*NA*	*NA*
OR	*NA*	*NA*	*NA*	*NA*	50	141	*NA*	*NA*	1.79	*NA*	0.11	0.92	3.47
OR	*NA*	*NA*	*NA*	*NA*	115	85	*NA*	*NA*	2.21	*NA*	*NA*	1.15	4.26

If you have information on the log OR, simply replace the measure of this table (OR) by (logOR)

* Here, the standard error (se) and variance (var) are for the log OR

4. Minimum information needed (RR)

Table containing all combinations of information to perform the calculations with RR as effect measure
Each row of the table depicts a possible combination of information

n_cases_exp & n_cases_nexp & n_controls_exp & n_controls_nexp	n_cases & n_controls	value	se OR var	ci_lo & ci_up
X				
	X	X	X	
	X	X		X

Fictitious dataset respecting the formatting

measure	n_cases_exp	n_cases_exp	n_controls_exp	n_controls_nexp	n_cases	n_controls	value	se*	var*	ci_lo	ci_up
RR	100	2011	501	11098	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
RR	*NA*	*NA*	*NA*	*NA*	148	132	1,16	0.38	*NA*	*NA*	*NA*
RR	*NA*	*NA*	*NA*	*NA*	58	95	4,28	*NA*	.11	*NA*	*NA*
RR	*NA*	*NA*	*NA*	*NA*	73	130	3,23	*NA*	*NA*	1,71	6,19
RR	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	1,58	.34	*NA*	*NA*	*NA*
RR	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	1,79	*NA*	.11	0,92	3,47
RR	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	2,21	*NA*	*NA*	1,15	4,26

If you have information on the log RR, simply replace the measure of this table (RR) by (logRR)

* Here, the standard error (se) and variance (var) are for the log RR

4. Minimum information needed (HR)

Table containing all combinations of information to perform the calculations with HR as effect measure
Each row of the table depicts a possible combination of information

n_cases & n_controls	value	se OR var	ci_lo & ci_up
X	X	X	
X	X		X

Fictitious dataset respecting the formatting

measure	n_cases	n_controls	value	se*	var*	ci_lo	ci_up
HR	**52**	**49**	**1.43**	**0.31**	*NA*	*NA*	*NA*
HR	**57**	**70**	**1.90**	*NA*	**0.05**	*NA*	*NA*
HR	**66**	**47**	**1.31**	*NA*	*NA*	**1.09**	**1.56**

If you have information on the log HR, simply replace the measure of this table (HR) by (logHR)

* Here, the standard error (se) and variance (var) are for the log HR

4. Minimum information needed (IRR)

Table containing all combinations of information to perform the calculations with IRR as effect measure
Each row of the table depicts a possible combination of information

n_cases_exp & n_cases_nexp & time_exp & time_nexp	n_cases	time	value	se OR var	ci_lo & ci_up
X					
	X	X	X	X	
	X	X	X		X

Fictitious dataset respecting the formatting

measure	n_cases_exp	n_cases_nexp	time_exp	time_nexp	n_cases	time	value	se*	var*	ci_lo	ci_up
IRR	**190**	**111**	**7**	**9.8**	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
IRR	*NA*	*NA*	*NA*	*NA*	**295**	**16.1**	**2.35**	**0.13**	*NA*	*NA*	*NA*
IRR	*NA*	*NA*	*NA*	*NA*	**102**	**15.5**	**3.71**	*NA*	**0.04**	*NA*	*NA*
IRR	*NA*	*NA*	*NA*	*NA*	**153**	**10.8**	**1.21**	*NA*	*NA*	**0.88**	**1.66**

If you have information on the log IRR, simply replace the measure of this table (IRR) by (logIRR)

* Here, the standard error (se) and variance (var) are for the log IRR

4. Optional information

The following variables do not have to be included in a well-formatted dataset but they can be added to benefit from certain features of the functions. The name of these variables (in bold) cannot be changed.

- **multiple_es**: Reason for the presence of several effect sizes for a unique study (i.e., a study with the same author and year values within the same factor). It must be either "groups" or "outcomes". An example of a well-formatted dataset with multiple outcomes/groups can be downloaded and an example of analysis of a dataset with dependent effect sizes is available in a vignette of the package.
  - "groups": When "groups" is indicated, it is assumed that the multiple effect sizes for a unique study come from independent subgroups. A unique effect size per study is calculated using the Borenstein's (2009) approach. For each study, the sample size is obtained by summing up all participants from the different groups.
  - "outcomes": When "outcomes" is indicated, it is assumed that the multiple effect sizes come from multiple outcomes (or time-points) measured within the same sample. Again, a unique effect size per study is calculated using the Borenstein's (2009) approach. Strength of the correlation between the outcomes (or time-points) can be indicated using either the "r" column in your dataset (see below) or the slider. Indicating the strength of the correlation between the outcomes of a study in the "r" column allows to use different values depending on the study. In contrast, using the slider allows to conveniently set a unique correlation for all studies that do not have any value in the "r" column. For each study, the sample size is obtained by taking the largest sample size for one outcome/time-point.

- **r**: The value of the correlation coefficient between the outcomes/time-points of a study. The r value should be (i) within the (-1, 1) range, (ii) constant within a study, and (iii) set as NA for studies which do not include multiple outcomes.

- **shared_nexp**: In some situations, several studies share participants from the same non-exposed group but compare this group to various exposed groups. When several studies in the same factor share a same non-exposed group, they should be identified as such by having the same "shared_nexp" value. Identifying studies sharing the same non-exposed group allows to adjust calculations (the size of the shared sample is divided by the number of studies sharing the sample). Studies not sharing their non-exposed group should have a NA (or a unique) value in theshared_nexp column.

- **shared_controls**: In some situations, several studies share participants from the same control group but compare this group to various experimental groups. When several studies in the same factor share a same control group, they should be identified as such by having the same shared_control value. Identifying studies sharing the same control group allows to adjust calculations (the size of the shared sample is divided by the number of studies sharing the sample). Studies not sharing their control group should have a NA (or a unique) value in the shared_controls column.

4. Optional information

The following variables do not have to be included in a well-formatted dataset but they can be added to benefit from certain features of the functions. The name of these variables (in bold) cannot be changed.

- **reverse_es**: Whether users want to reverse the effect size of a study. All rows with a "reverse" value in this column will have the direction of their effect size flipped (e.g., an OR of 0.5 will be expressed as 2). Note that the reverse_es column has an action on both the direction of the value of an effect size and on the information used to calculate an effect size (e.g., if the means and SDs of experimental and control groups are reported, the mean and SD of the experimental group are used as the mean and SD of the control group and vice-versa). This feature is particularly useful to facilitate the presentation of the results when several meta-analyses report the same effects in opposite direction.

- **rob**: The risk of bias of each individual study. Should be either "high", "low" or "unclear". These values are used to generate the "GRADE" classification and to stratify evidence according to the 'rob' criteria in the 'Personalized' classification. Studies with a missing rob are assumed to be at high risk of bias. The approach used to provide a categorical judgment ("low" vs. "unclear" vs. "high) on the risk of bias of a study is left to the user.

- **amstar**: The amstar score of the meta-analysis. Note that the amstar score should be constant for a given factor. These values are used only to stratify evidence according to the 'amstar' criteria in the 'Personalized' classification.

- **analysis**: Whether users want to conduct specific analyses. For now, only the "allelic" value can be specified, which multiplies by two the number of cases and controls.

- **discard**: Whether a particular row should be removed from the analyses (any row with a "yes" or TRUE value in the discard column will be removed).

Supplement 4.

Criteria for the pre-established classifications

Criteria for the pre-established classifications

Criteria for the Ioannidis classification.

Class I. number of cases > 1000, p-value of the meta-analysis < 10^{-6}, I^2 < 0.5, 95% prediction interval excluding the null, p-value of the Egger test > .05 and p-value of the test for excess of significance bias > .05.

Class II. number of cases > 1000, p-value of the meta-analysis < 10^{-6}, largest study with a statistically significant effect and class I criteria not met.

Class III. number of cases > 1000, p-value of the meta-analysis < 10^{-3} and class I-II criteria not met.

Class IV. p-value of the meta-analysis < 0.05 and class I-III criteria not met.

Class ns. p-value of the meta-analysis >= 0.05

Criteria for the algorithmic-GRADE classification

Imprecision. a total number of participants included in the meta-analysis giving a lower power than 80% to detect an SMD = 0.20 leads to a downgrading of 1 class. A number of participants giving a lower power than 80% to detect an SMD = 0.50 leads to a downgrading of 2 classes. Note that for IRR, the number of cases and controls to estimate the power is assumed to be equal to half the number of cases included in the meta-analysis. In the case of R and Z, the number of cases and controls for this calculation is equal to half the total sample size.

Limitations. a proportion of participants included in studies at low risk of bias < 75% leads to a downgrading of 1 class. A proportion < 50% leads to a downgrading of 2 classes.

Publication bias. a p-value at an Egger test < .10 leads to a downgrading of 1 class.

Inconsistency. an I^2 value >= 50% leads to a downgrading of 1 class.

Supplement 5.

R code allowing the results presented in Figure 2.

R code to replicate results presented in the manuscript

```
view.errors.umbrella(df.radua2019)

umb <- umbrella(df.radua2019, mult.level = TRUE)
umb

evid <- add.evidence(umb, criteria = "Personalized",
       class_I = c(n_studies = 30, p_value = .005, I2 = 50, egger_p = .05, JK_p = .05),
       class_II = c(n_studies = 20, p_value = .005, egger_p = .05, JK_p = .05),
       class_III = c(n_studies = 15, p_value = .01, egger_p = .05),
       class_IV = c(p_value = .05))
evid

sum.evid = summary(evid)

forest(evid, main_title = "Risk factors for PTSD",
       measure = "eG",
       add_columns = data.frame(sum.evid$n_cases, sum.evid$I2),
       main_add_columns = c("Cases", “I² (%)"),
       pos_text = "center",
       xlim_add_columns = c(-4.0, -2),
       xlim_factor = -6.5,
       xlim = c(-8, 5))
```