ProMeta

Version 2.0

Manual

www.internovi.com

Index

Part I
Introduction

ProMeta is a statistical software for conducting meta-analyses. Its main features are:

- User-friendliness: use of ProMeta is very intuitive and simple

- Completeness: ProMeta offers several tools for dealing effectively with complex meta-analytic data (e.g., multiple data entry formats, subgroups, comparisons, waves, and outcomes)

Thus, both the researcher who approaches meta-analysis for the first time and the expert meta-analyst will find in ProMeta an excellent instrument for performing their meta-analytic reviews.

Basic glossary of ProMeta

ProMeta is a software extremely intuitive. It does not present the usual spreadsheet but it is organized with an innovative graphic interface. To learn to use ProMeta you just need to familiarize with some keywords. First of all, you need to know what is a Topic:

Topic: it is the object of your meta-analysis (e.g., efficacy of a new drug, gender differences on well-being, association between leadership and job performance)

Let's now see the windows that are displayed on the left side of the screen:

Variables: subgroups, comparisons, waves, outcomes, moderators

These variables define your data structure. In complex meta-analyses you might have to manage multiple subgroups, comparisons, waves, and/or outcomes in each study. If so, you are going to use a specific combination of these variables to prepare your database. Most commonly, you define only one or more outcomes and you do not have to manage multiple subgroups, comparisons, and waves (in the second part of this Manual you will learn how to face each situation, moving from simple to complex data structures). The moderators are the

variables that might explain differences in your effect sizes. ProMeta creates two default moderators (i.e., publication type and publication year). You can add any further moderator that is important for your topic. There are three types of moderators: categorical, numerical decimal, and numerical integer moderators.

Studies: in this window you add the studies you have included in your meta-analysis

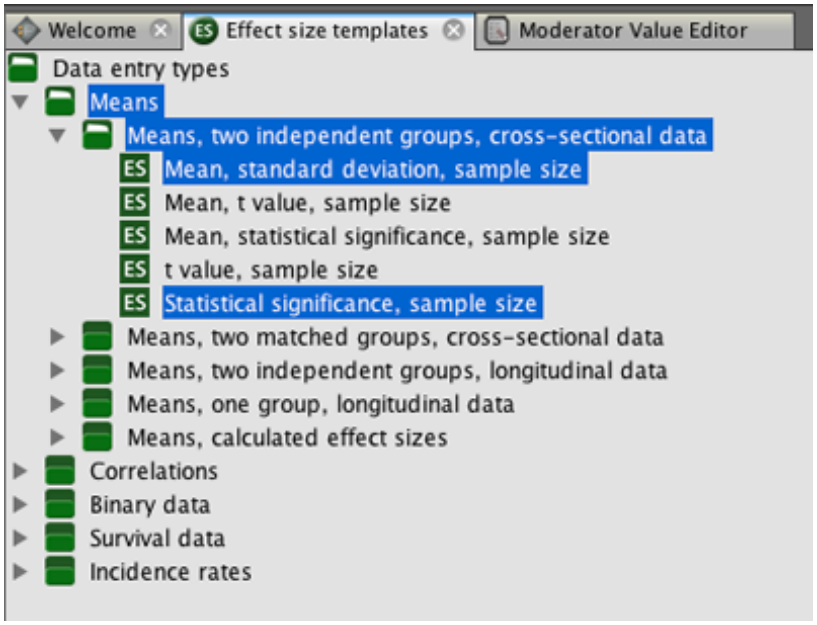
Projects: in this window you define your plan of analysis and visualize the results. The Pre-analyses are conducted when you manage complex data structures with multiple subgroups, comparisons, waves, and/or outcomes. Then, you can define as many projects as you want (e.g., if you have multiple outcomes you can define a project for each outcome)

Database tree: it summarizes all the other windows

Let's now see the windows that are displayed on the right side of the screen:

Welcome: this is a welcome page in which is always reported the version of ProMeta you are currently using

Effect size templates: in this window you have a large array of data entry types. You just have to look for the one that corresponds to the data format of your studies. Therefore, you have to see which data reported in your studies can be used for computing effect sizes. When in a study are reported multiple data that could be used for computing an effect size you have to decide which data to select. In this situation ProMeta helps you! In fact, *within each data entry type* (e.g., means > two independent groups, cross-sectional data) the order of the presentation of the data formats (from the top to the bottom) reflects precision of effect size computations: data entry types displayed in the top allows the best computation of the effect size, while data entry types displayed in the bottom allows an estimation of the effect size that is less precise (e.g., if in one paper you find a) mean, standard deviation, sample size and b) statistical significance, sample size you prefer the data entry type corresponding to mean, standard deviation, sample size):

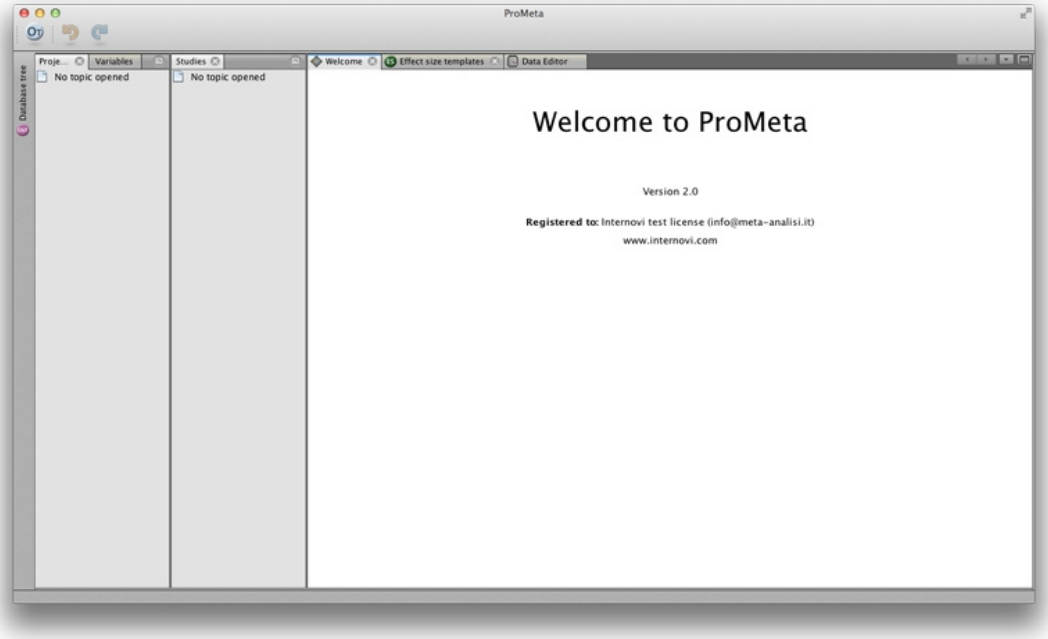


Editor: this window is automatically updated according to the action you are currently doing. Thus, you will use this window to include your studies, effect size data, projects, etc.

A new way of saving data

A true innovation of ProMeta is the system used for saving data and analyses. ProMeta has an integrated relational database so it does not work with files. This means that every time you work on a topic and you save (names, data, projects, etc.), the topic is automatically updated and available for your next use. If you are working on the same computer, every time you open ProMeta you will find all your updated topics in the database. On the other hand, if you are working on the same topic but using different computers/machines, you can export your topic to file (see Tools below).

The Welcome Page



In the Welcome Page is reported the current version of ProMeta and the data of the owner of the license.

Menu bar

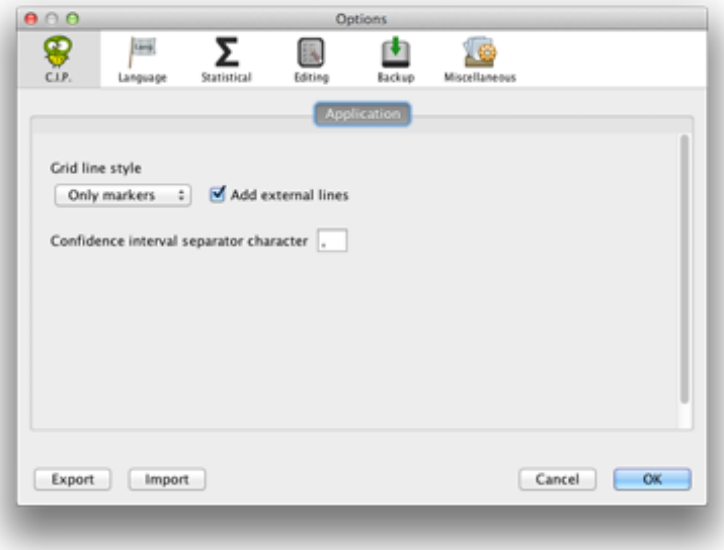
Options/preferences

For Mac OS-X users, Preferences are in the application menu (ProMeta); for Microsoft Windows and Linux users, Options are in the bar menu Tools.

Options/Preferences include the following possibilities:

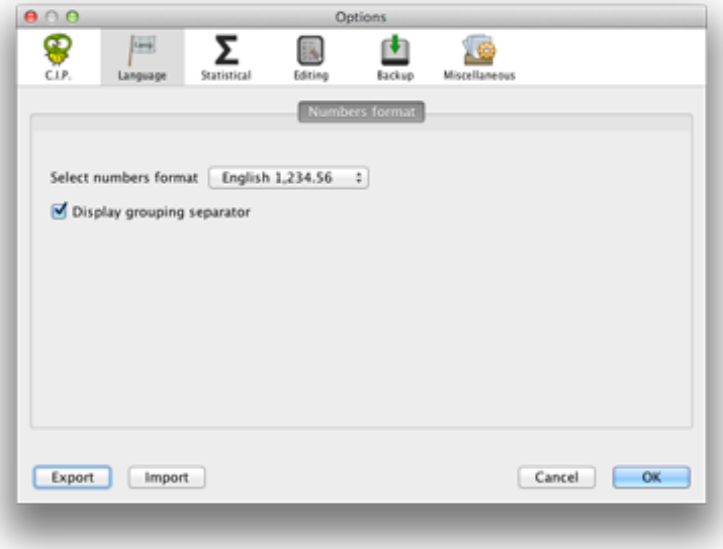
➔ C.I.P.: C.I.P. options offer tools to personalize forest plots. Specifically, you can choose the grid line style, if adding or not external lines, and which character to use as the confidence

interval separator (for further information you can consult C.I.P. Manual).

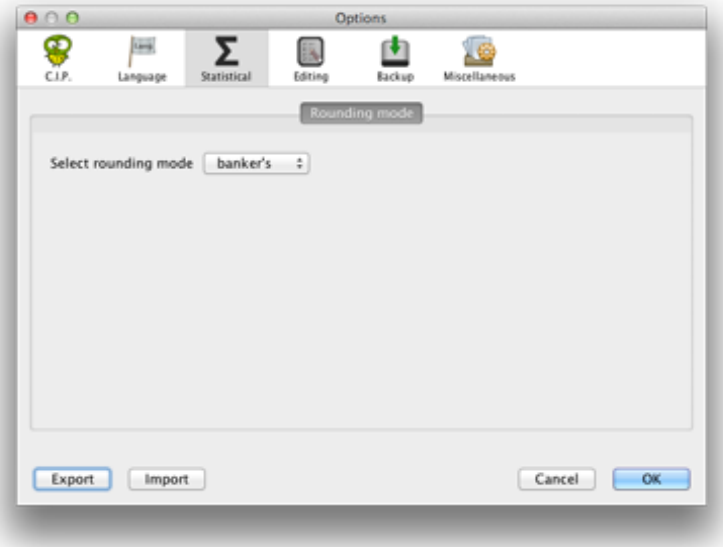


➔ Language:

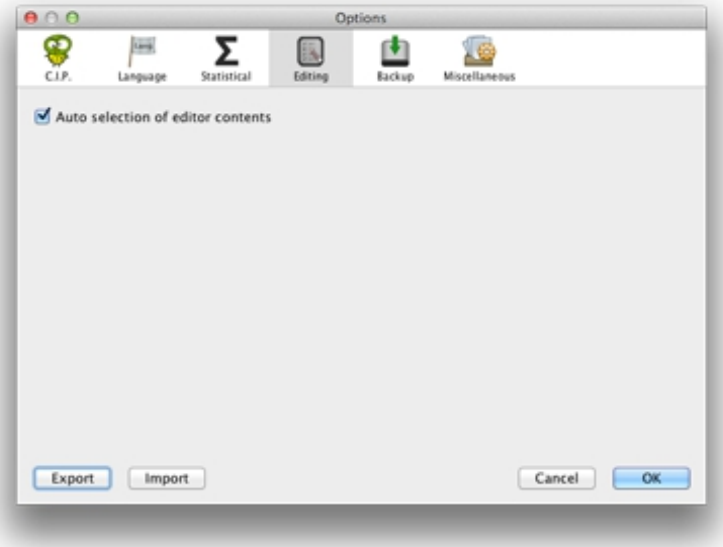
- ➔ you can select context help language
- ➔ you can select the format of numbers
- ➔ you can also choose if you prefer to display Grouping (thousands) separators



➔ Statistical: you can choose the statistical rounding mode

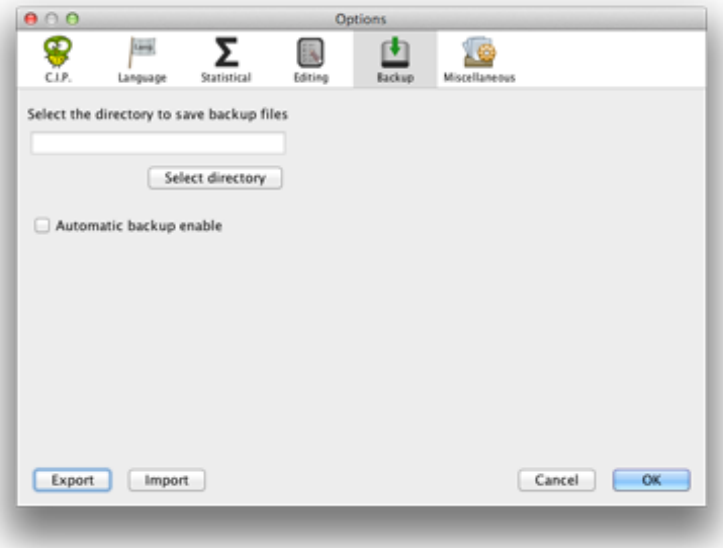


➔ Editing: you can select Auto selection of editor contents. This means that every time you stop in a data entry field, all the contents of it are selected and you can quickly overwrite them

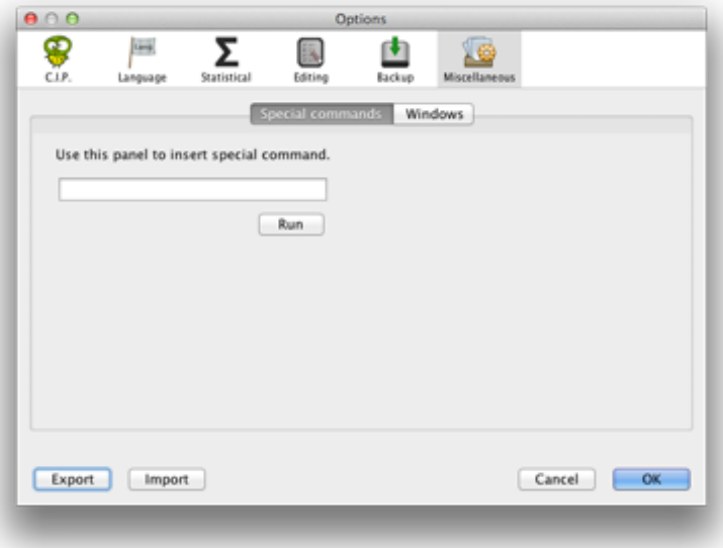


➔ Backup: you can select a directory for automatic backup and activate Automatic backup enable. When you choose this option every time you close a Topic or ProMeta, a backup copy

of your Topic will be saved in this directory as a file. It is recommended to activate this option, to have always available automatic backup copies of your work (just in case!)



➔ Miscellaneous: here you could eventually insert special commands or change windows display



When you have finished to select Options, you can click on Ok. You can also Export your Options selection if you want to set them in another computer/machine, or Import them from another

computer/machine.

Tools

In the Menu Bar you can select Tools:

- ➔ Import topic from file: use this function to import a topic that you have created on another computer/machine (or from backup copies)
- ➔ Export topic to file: use this function to export a topic since you plan to work on this on another computer/machine
- ➔ Clone topic: use this function to clone (duplicate) your current topic
- ➔ Remove topic: use this function to delete permanently your current topic (this action is irreversible)

Window

In the Menu Bar you can select Window. Here you have options about display of windows. When you click on one or more of these windows ProMeta displays them. You can use this menu when you want to re-open a window that you have closed. With the option Reset windows you reset the default mode of display. ProMeta saves your windows mode of display for your next use.

Help

In the Menu Bar you can select Help:

- ➔ help contents
- ➔ check for updates: if new updates are available you can install them by clicking on update. This service is free of charge and this is extremely useful: in this way you can always work with the most updated version of ProMeta
- ➔ about: you can display information on ProMeta and check the version of ProMeta you are currently using

Part II: Using ProMeta

In this manual you will learn how to use ProMeta navigating through some practical meta-analytic examples. You will follow a step-by-step approach: you will start with a simple example to understand the basic features of ProMeta; then you will move to further examples to learn how to deal with complex meta-analytic projects. These are the issues covered in each example:

	Example 1	*Example 2*	*Example 3*
Starting with ProMeta			
Creation of the topic and data entry	X	X	X
Moderators	X	X	X
Analyses	X	X	X
Managing complex projects			
Multiple comparisons		X	
Multiple subgroups			X
Multiple waves			X
Multiple outcomes			X
Multiple data entry formats			X

Example 1

Topic of this first meta-analysis: to examine the efficacy of a new drug for preventing panic attacks in patients with anxiety disorders.

We have selected eight studies. They are Randomized Controlled Trials (RCTs) that compared two groups:

- experimental group (i.e., participants received the new drug)
- control group (i.e., participants received a placebo)

We hypothesized the efficacy of the new drug, thus we expected a lower number of participants with

panic attacks in the experimental group. Consequently, our effect size is given by the difference in the number of participants having a panic attack in the experimental and control groups.

Additionally, we hypothesized that two factors could moderate the effect sizes: age of the participants (expressed as mean age) and type of publication (we have two types of studies: published in journal articles and conference presentations). Thus, we are going to test two moderators: the mean age of the participants is a numerical moderator and the type of publication is a categorical moderator.

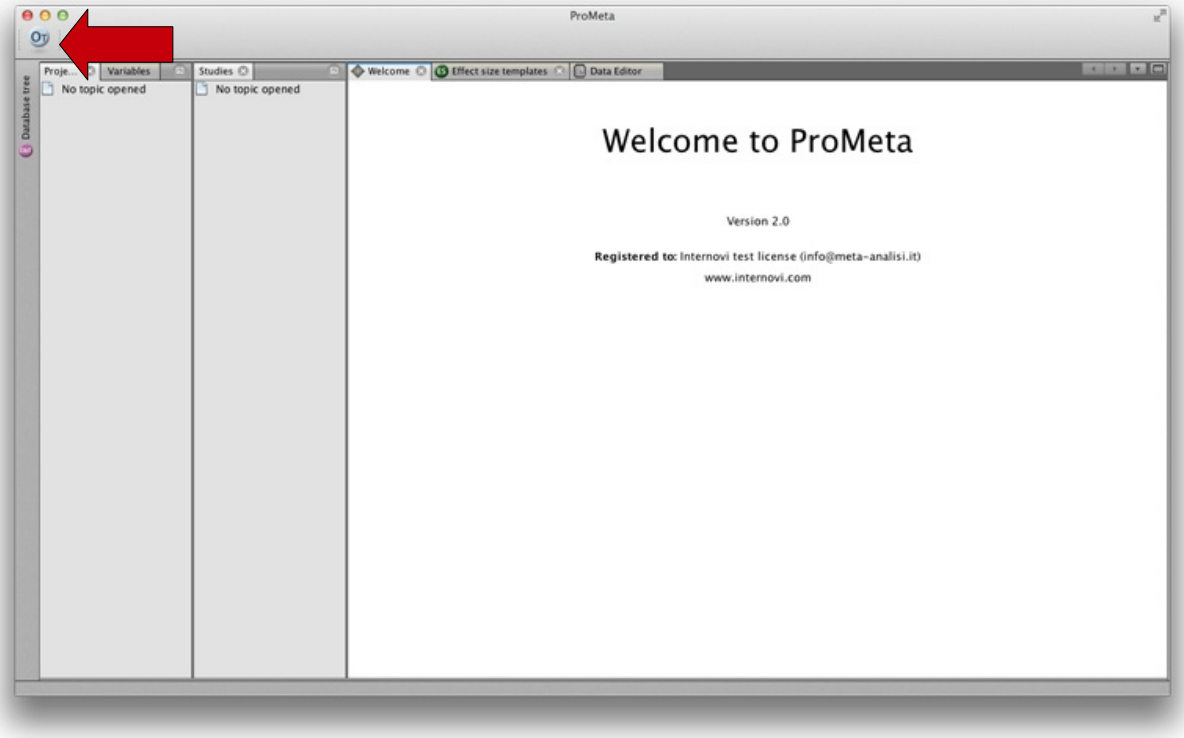
We have reported in Table 1 main characteristics of the studies included in this meta-analysis.

Table 1. *Study Characteristics of Example 1*

Study name	*Type of publication*	*Mean age of the sample*	*Events (experimental group)*	*Total sample size (experimental group)*	*Events (control group)*	*Total sample size (control group)*
Black et al. 2011	Journal article	19.36	10	110	40	110
Blue et al. 2010a	Journal article	35.97	25	220	65	220
Blue et al. 2010b	Journal article	25.69	12	150	62	150
Brown et al. 2012	Conference presentation	46.47	23	320	54	320
Green et al. 2006	Journal article	51.22	2	50	5	50
Orange et al. 2009	Conference presentation	24.52	8	80	8	80
Red et al. 2007	Conference presentation	21.26	15	500	20	500
White et al. 2008	Journal article	48.62	12	150	15	150

Step 1: Creating a new topic

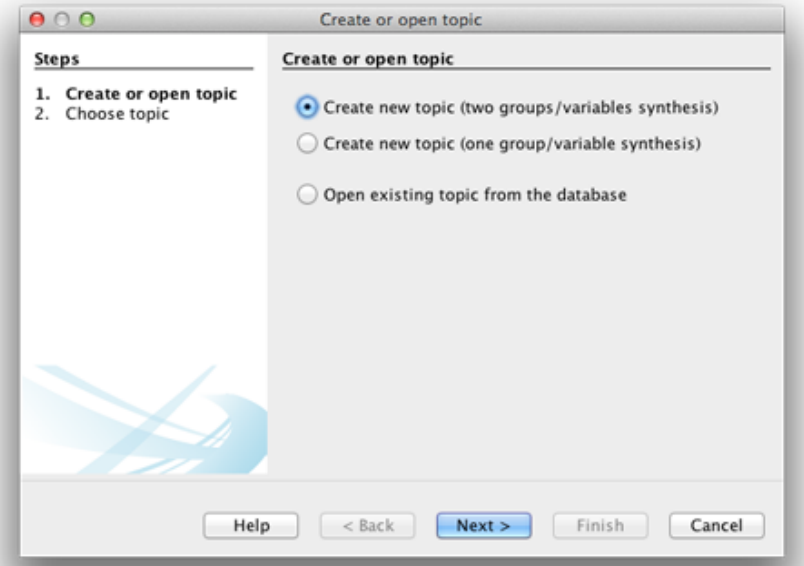
Click on OT for creating or opening a new topic:



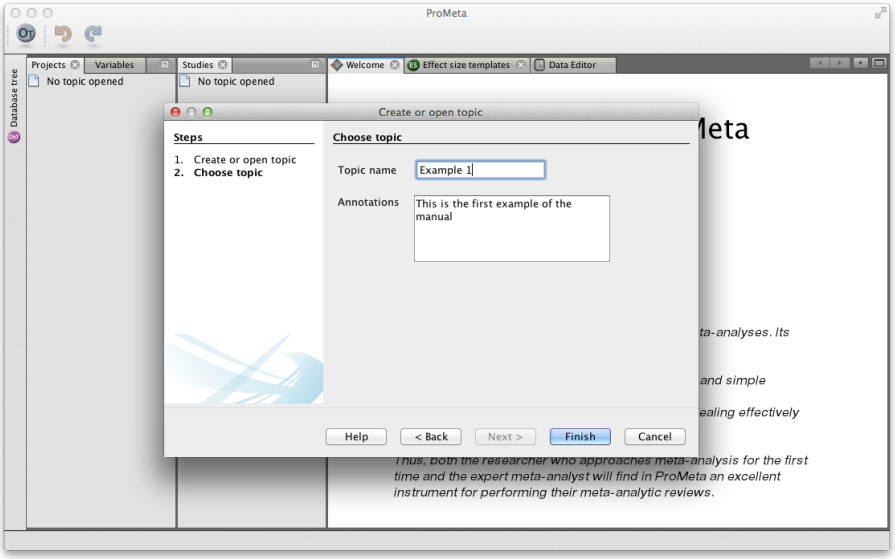
When you create a new topic you can choose between two formats:

- Two groups/variables synthesis: this is the standard meta-analysis in which your aim is to compare two groups (e.g., experimental versus control groups; women versus men) or to examine the associations between two variables (e.g., physical activity and physical health)
- One group/variable synthesis: this refers to a single-group summary. You use this option when your purpose is not to study an effect, but to synthesize values (e.g., means, frequencies) measured in the same way across studies (e.g., number of days of hospitalization for patients with a certain disease).

Create new topic (choose Two groups/variables synthesis):



Label the new topic Example 1. You can also include annotations:

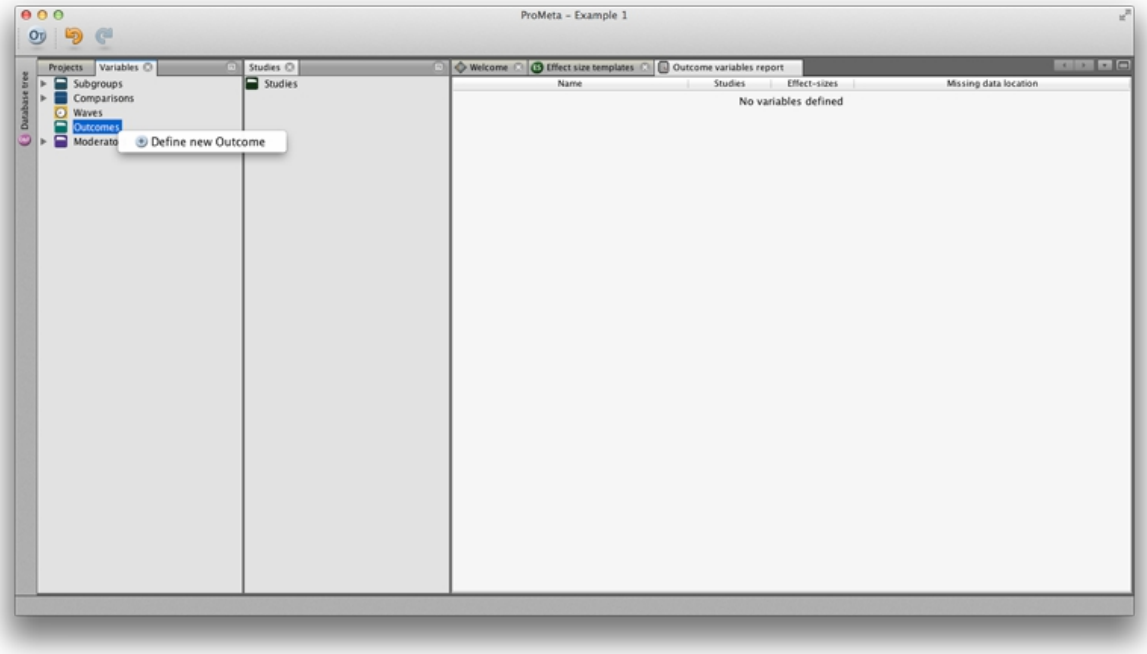


Step 2: Defining variables

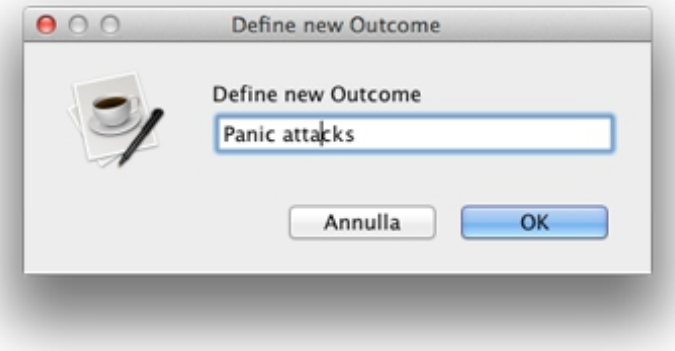
Select the window Variables (in this example we are not dealing with subgroups, comparisons, waves, we will see them in examples 2 and 3)

Outcomes

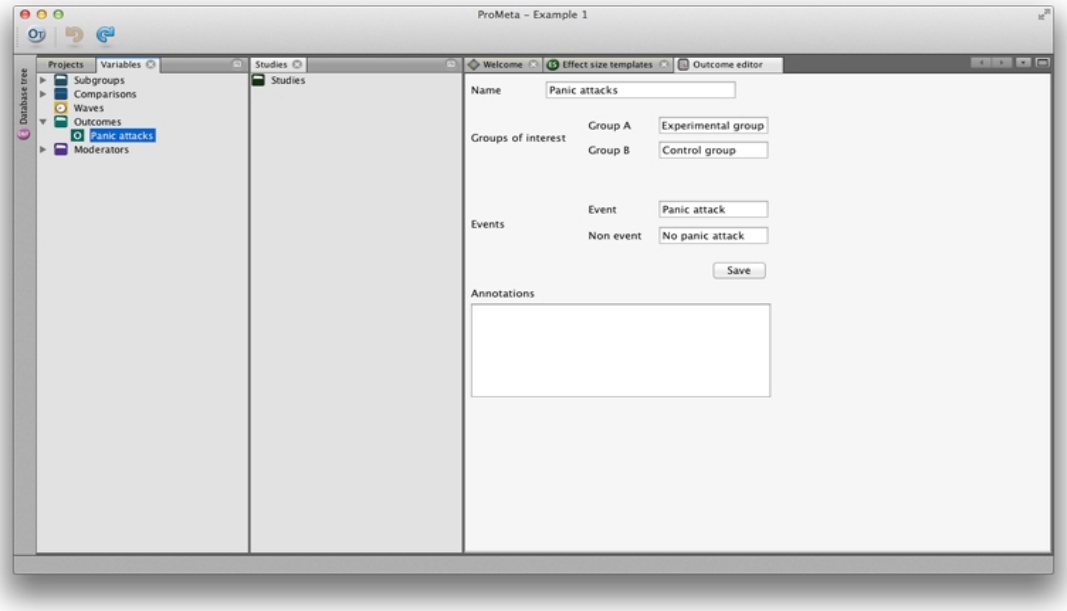
Define your outcome right-clicking on Outcomes:



Label the outcome Panic attacks:

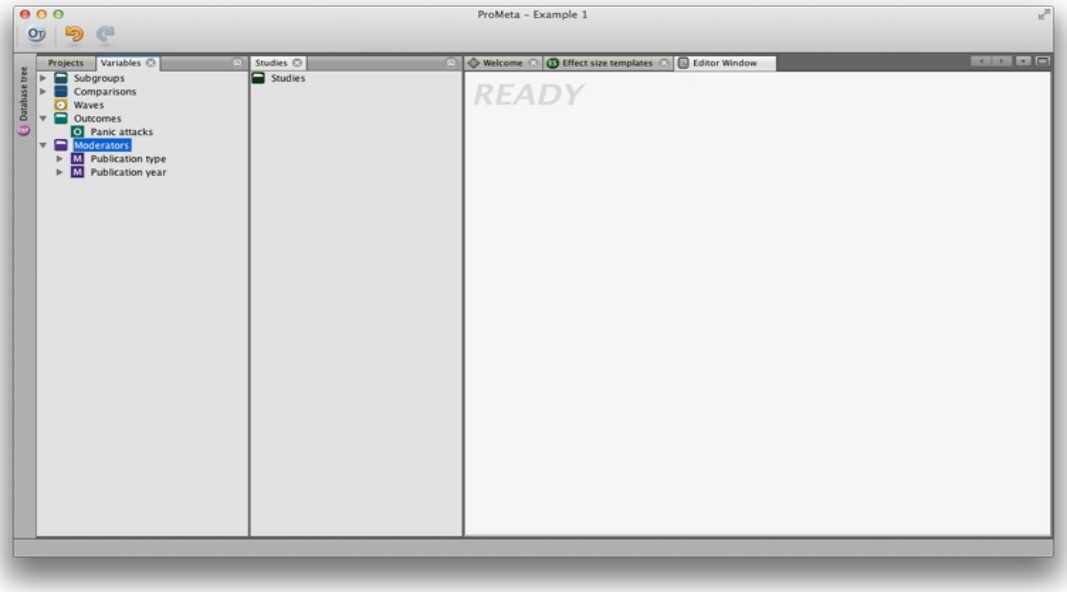


When you select the outcome you can further define your groups of interests and events:

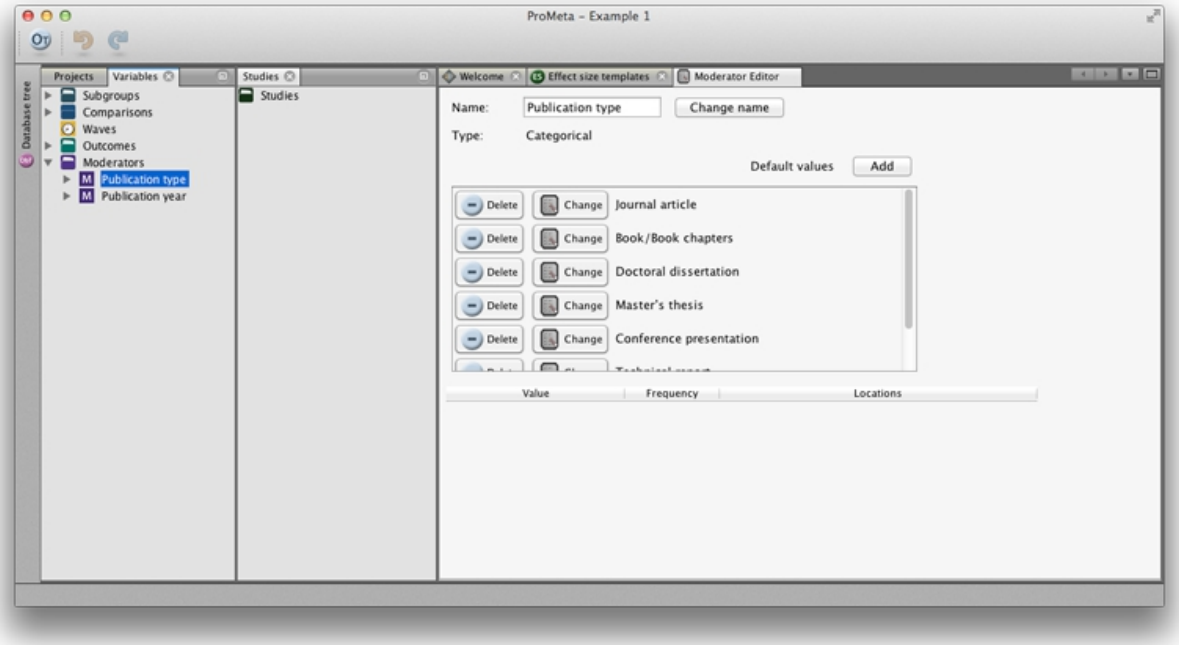


Moderators

You can define your moderators. ProMeta has already prepared two default moderators (i.e., publication type and publication year):

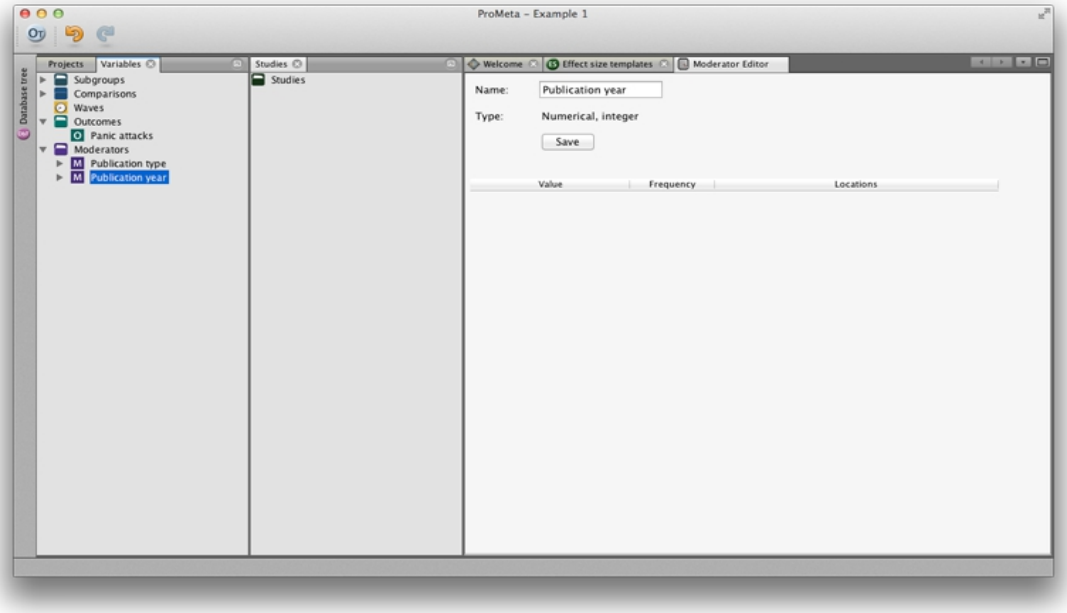


Publication type: the values Journal article and Conference presentation are already included among the default values, so you do not need to add them



Publication year: values will be automatically reported in this moderator every time you include a

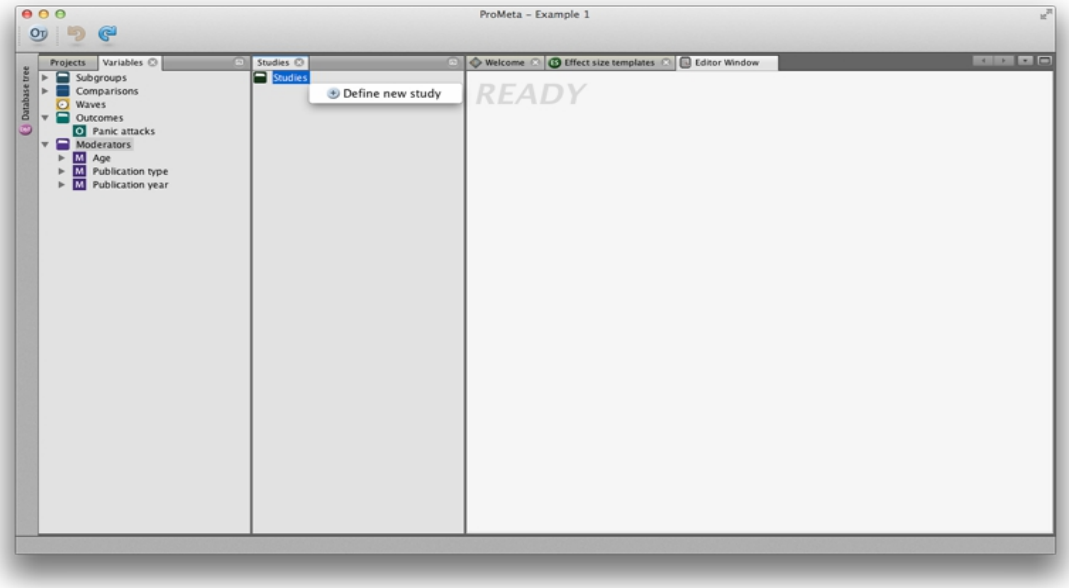
new study



Thus, you just have to add a third moderator: mean age of the sample. Right-clicking on Moderator you can define a new moderator. Since you are dealing with the mean age of the samples you define a new Numerical decimal moderator that you label Age:

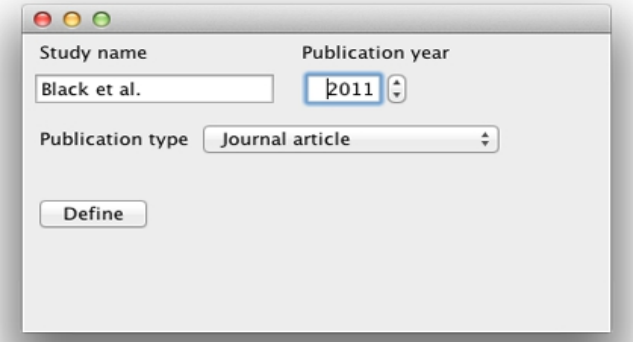
Step 3: Entering data

Now that you have prepared your topic, you can start to enter the studies. Include the first study by right-clicking on Studies:

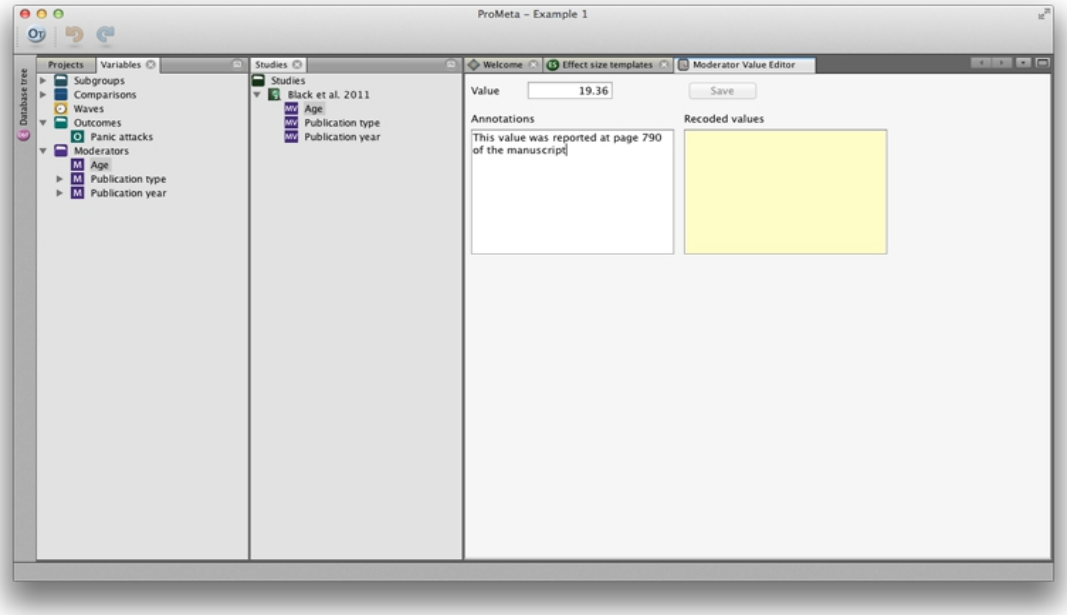


Indicate:

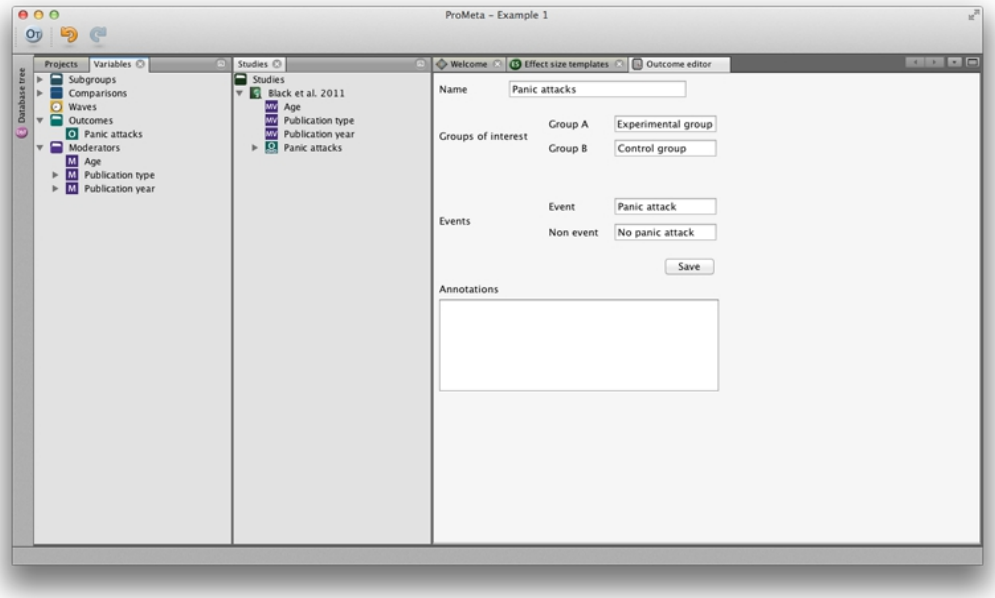
- authors (i.e., Black in case of a single author; Black & White in case of two authors; Black et al. in case of three or more authors) of the publication
- year of publication
- type of publication



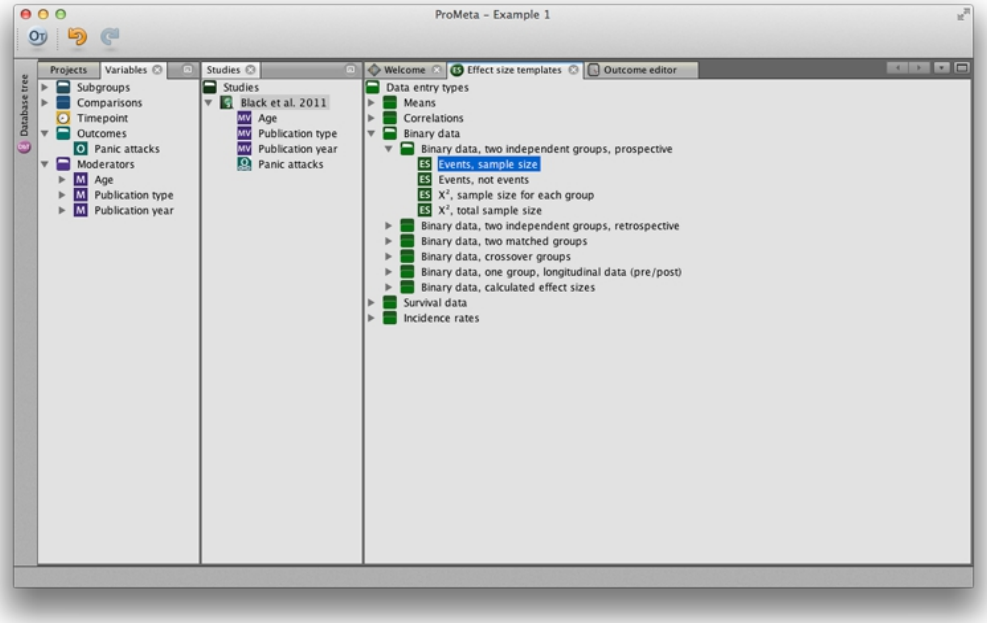
When you click on the Study you can eventually change the name of it. All the moderators are automatically assigned to the study:



When you click on each moderator you can enter its value. In Example 1 you only have to do this for the Moderator Age (you can also specify useful annotations):

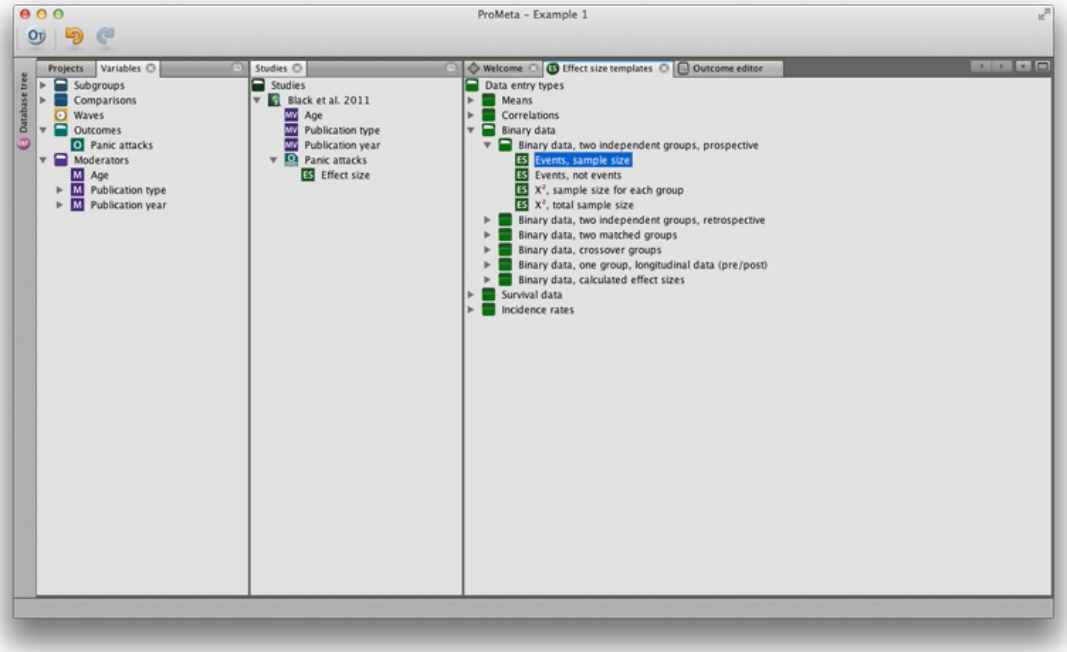


To assign the outcome Panic attacks to Black et al. simply drag and drop it from the Variables window to the current study. The outcome will appear after the moderators:



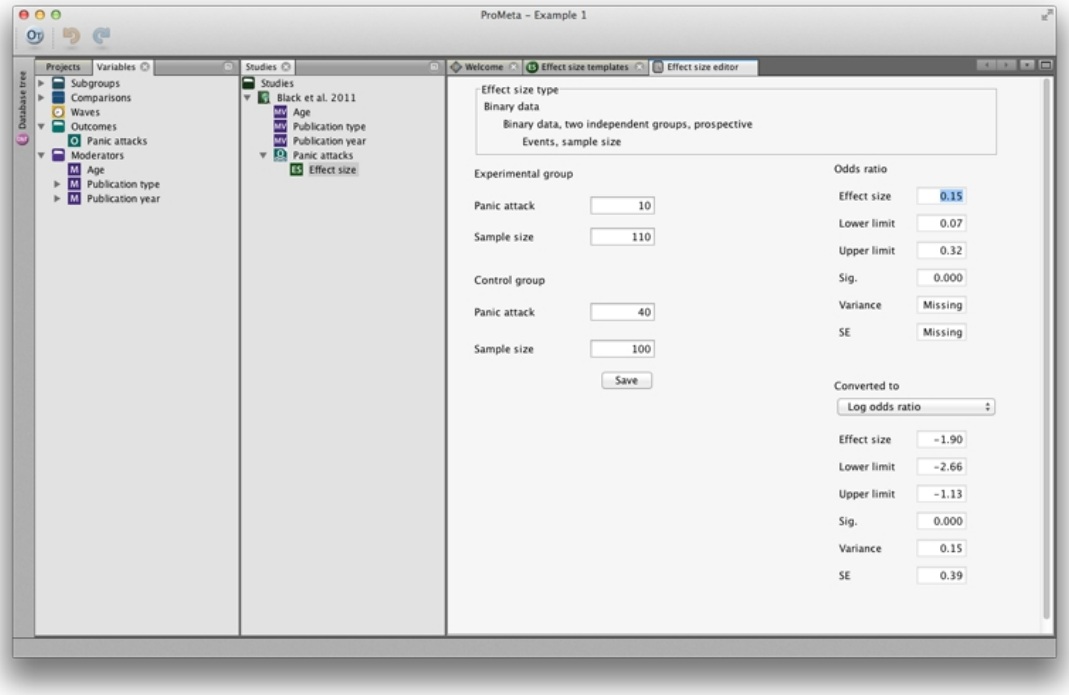
Now, select the Data entry type in order to include data necessary for computing an effect size. Select

the Effect size templates window. You are dealing with binary data from two independent groups (prospective) and for each study you know the number of events and total sample size for each group. Thus, select the corresponding Data entry type and drag and drop it to the outcome of the study:

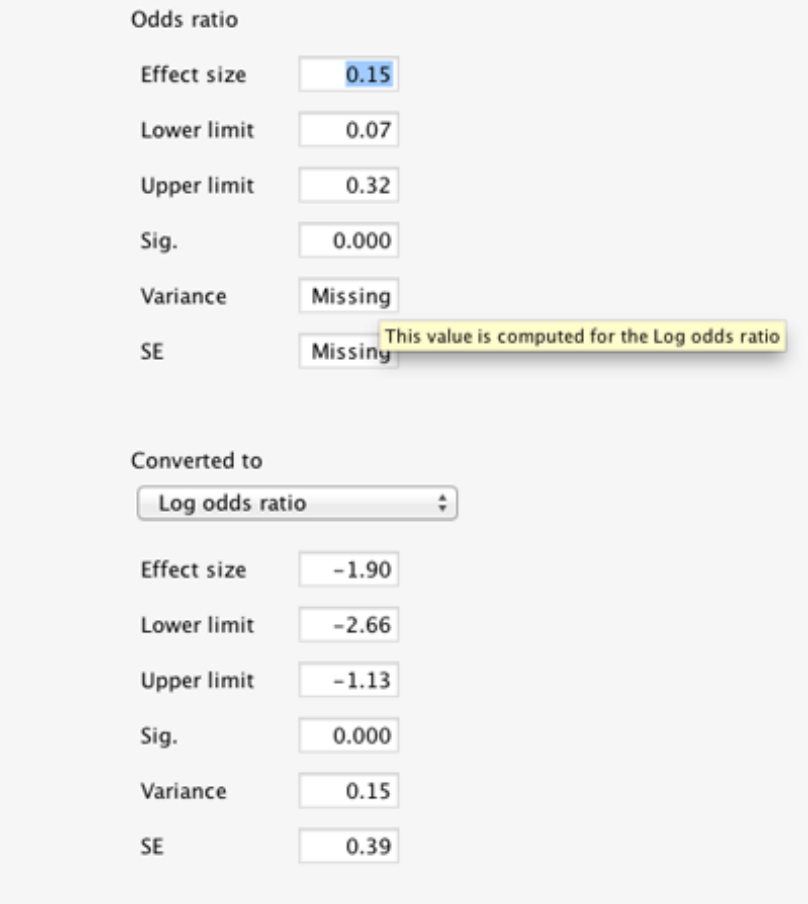


Useful tips (A): within each data entry type (e.g., binary data > two independent groups, prospective) the order of the presentation of the data formats (from the top to the bottom) reflects precision of effect size computations: data entry types displayed in the top allows the best computation of the effect size, while data entry types displayed in the bottom allows an estimation of the effect size that is less precise (e.g., if in one paper you find both events and sample size for each group and χ^2 and total sample size you choose events and sample size and you do not consider the χ^2 and total sample size). There are also cases in which two or more data entry types are statistically equivalent (e.g., binary data > two independent groups, prospective > events, sample size and events, non events are statistically equivalent, thus in this situation your choice does not affect the precision of the effect size).

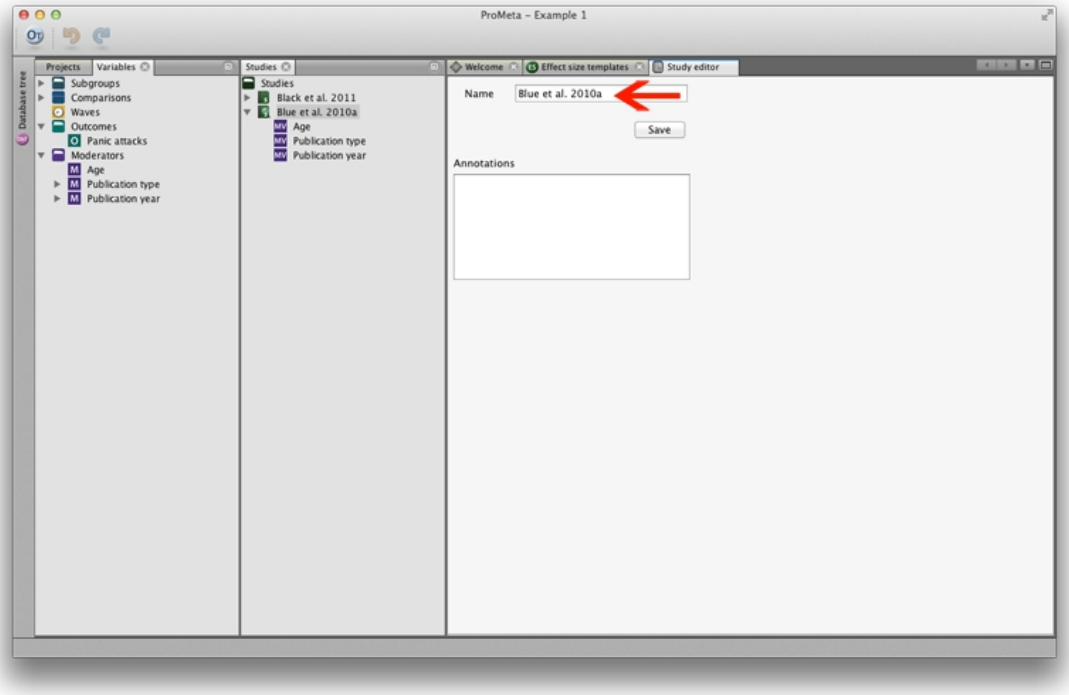
When you click the on the Effect size, ProMeta displays a new window that you can fill with your data and Save:



ProMeta computes and display on the right of the Data editor the effect size value (e.g., Odds Ratio) and offers the possibility to see it converted in other effect size formats (e.g., Log Odds Ratio). You can notice that some values (i.e., Variance and Standard Error) are reported as Missing. This is because these values cannot be computed for the Odds Ratio but are computed for the Log Odds Ratio. When you point the mouse cursor on Missing, ProMeta displays a message with this explanation:



You can now repeat the same procedure for the second study. In this case you have to remember to add the letter "a" to the study name to differentiate between the second study and the third study.

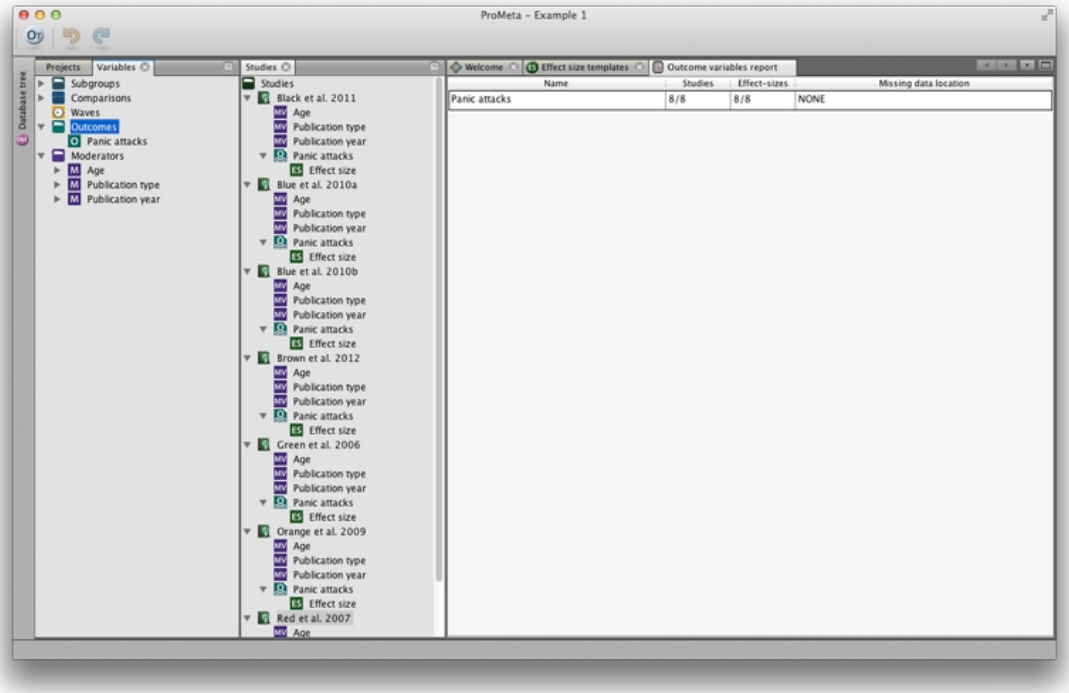


You can now complete this step entering all the studies, following the same procedure.

Useful tips (B): in Example 1 all the studies have the same structure (i.e., the same outcome and the same data entry type). Therefore, you can perform more quickly this phase following these simple steps:

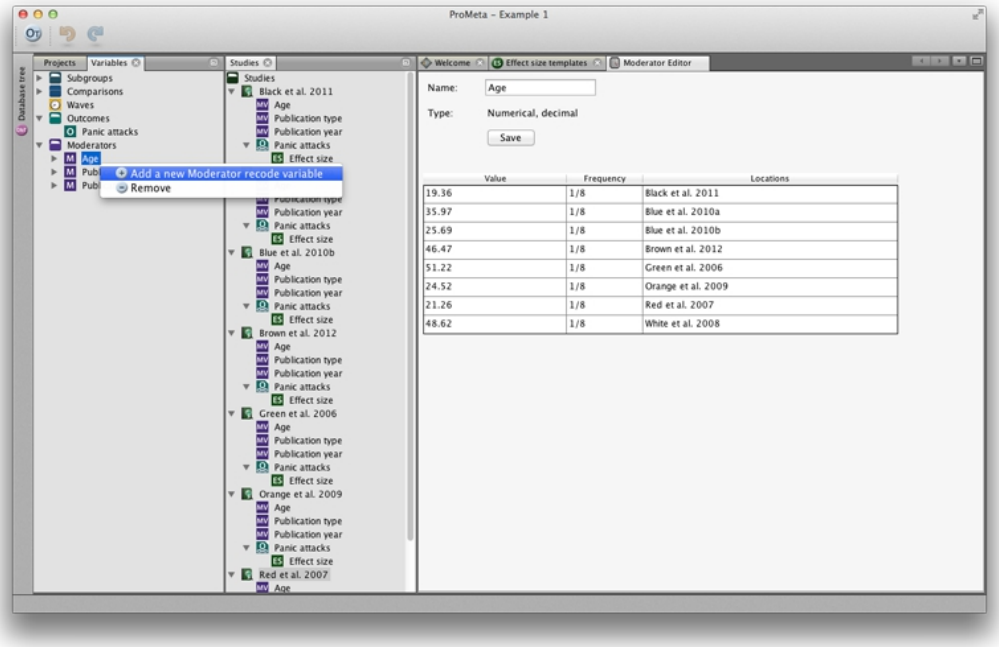
- define the name of the outcome
- define the names of your studies
- drag and drop the outcome directly to the Study folder: in this way the same outcome is assigned automatically to each study
- drag and drop the data entry type directly to the Study folder: in this way the same data entry type is assigned automatically to each study

Before moving to the next step, you might want to double check your data entry. ProMeta provides you with some useful tools. In the Variables window you can click on Outcome to see a summary of your data.

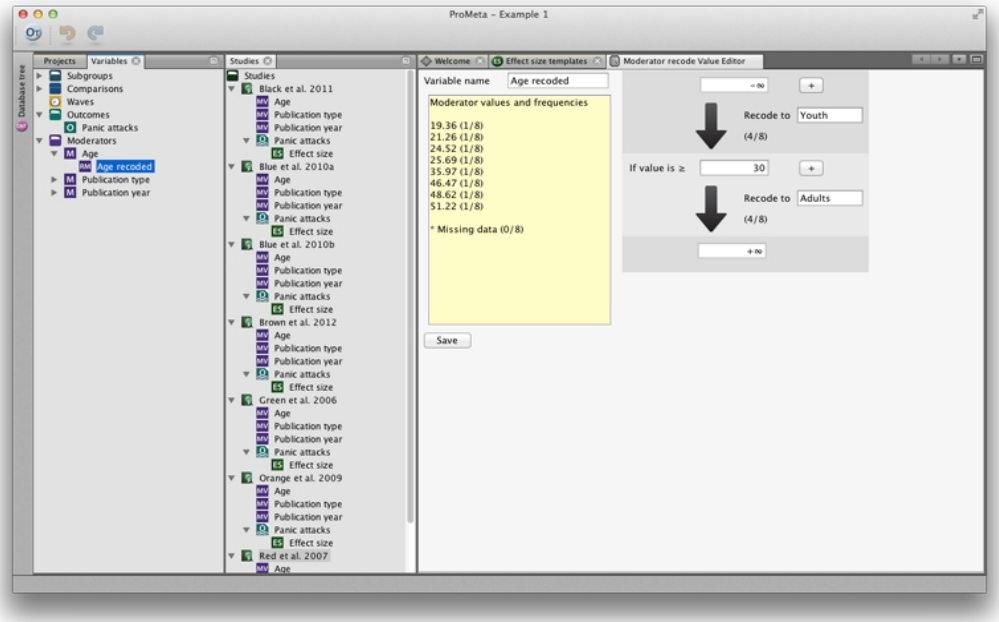


Step 4: Recoding moderators

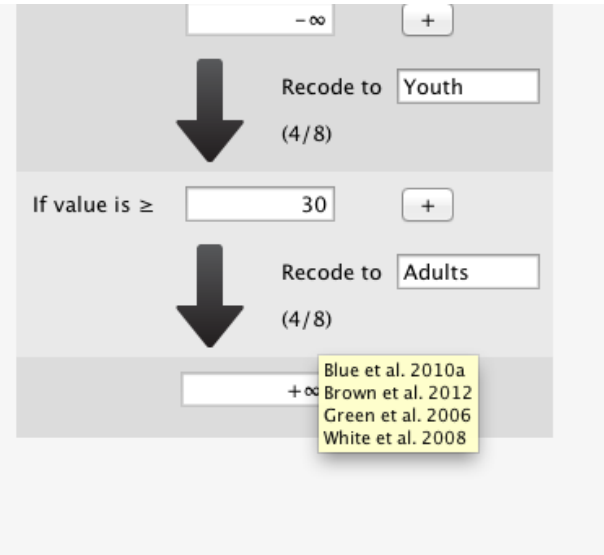
Clicking on each moderator you can visualize the distribution of your data. You can recode both categorical and numerical moderators. For instance, if you want to recode Age in two groups (i.e., youth and adults) right-click on Age and select Add a new moderator recode variable that you can label Age recoded:



Now, you can specify your intervals: you can say that all the values from - ∞ to 30 (excluded) are recoded into the category Youth, whereas all the values ≥ 30 are recoded into the category Adults:

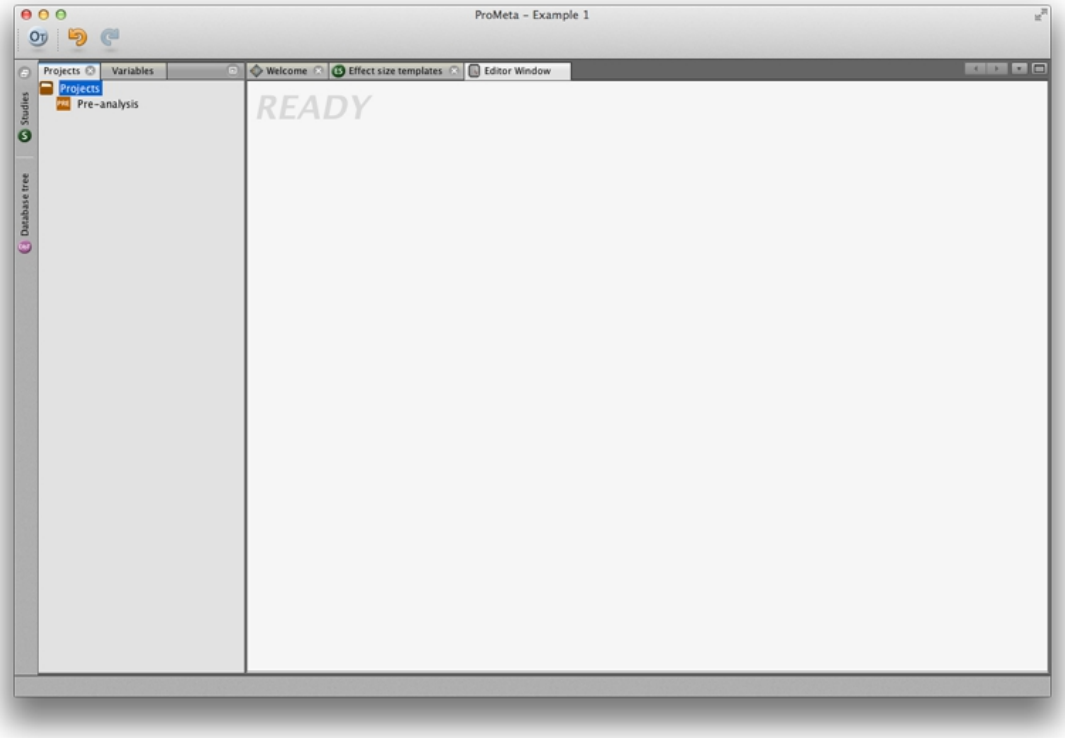


ProMeta automatically updates the frequency of each level of the recoded moderator variable and, when you point the mouse cursor on the summary of the frequency, ProMeta displays which studies belong to each level of the recoded moderator:



Step 5: Performing analyses

Now that you have finished with the data entry you can minimize, for reasons of visualization, the Studies window right-clicking on its right (you can see that it is now on the left border of your screen) and start to familiarize with the Projects window:

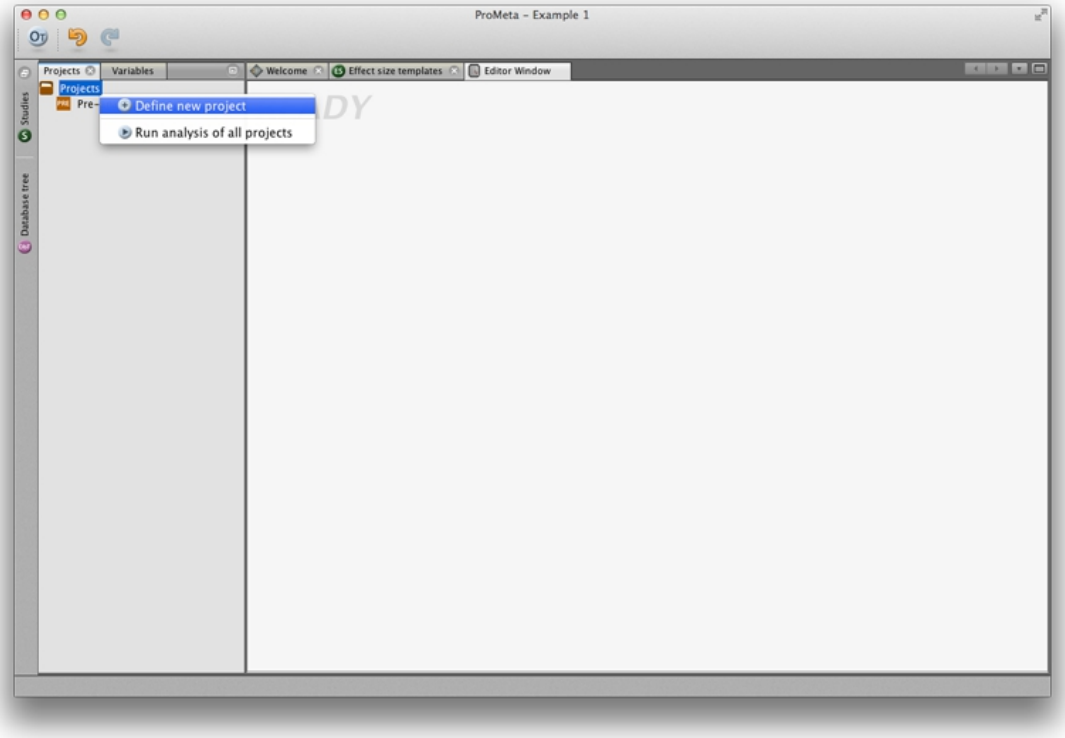


Pre-analysis

In the Pre-analysis you can test if there are significant differences between subgroups, comparisons, waves, and/or outcomes. In this example, you only have one outcome, so you do not need to look at the pre-analysis and you can move directly to the Projects (we will see the Pre-Analysis in Examples 2 and 3).

New project

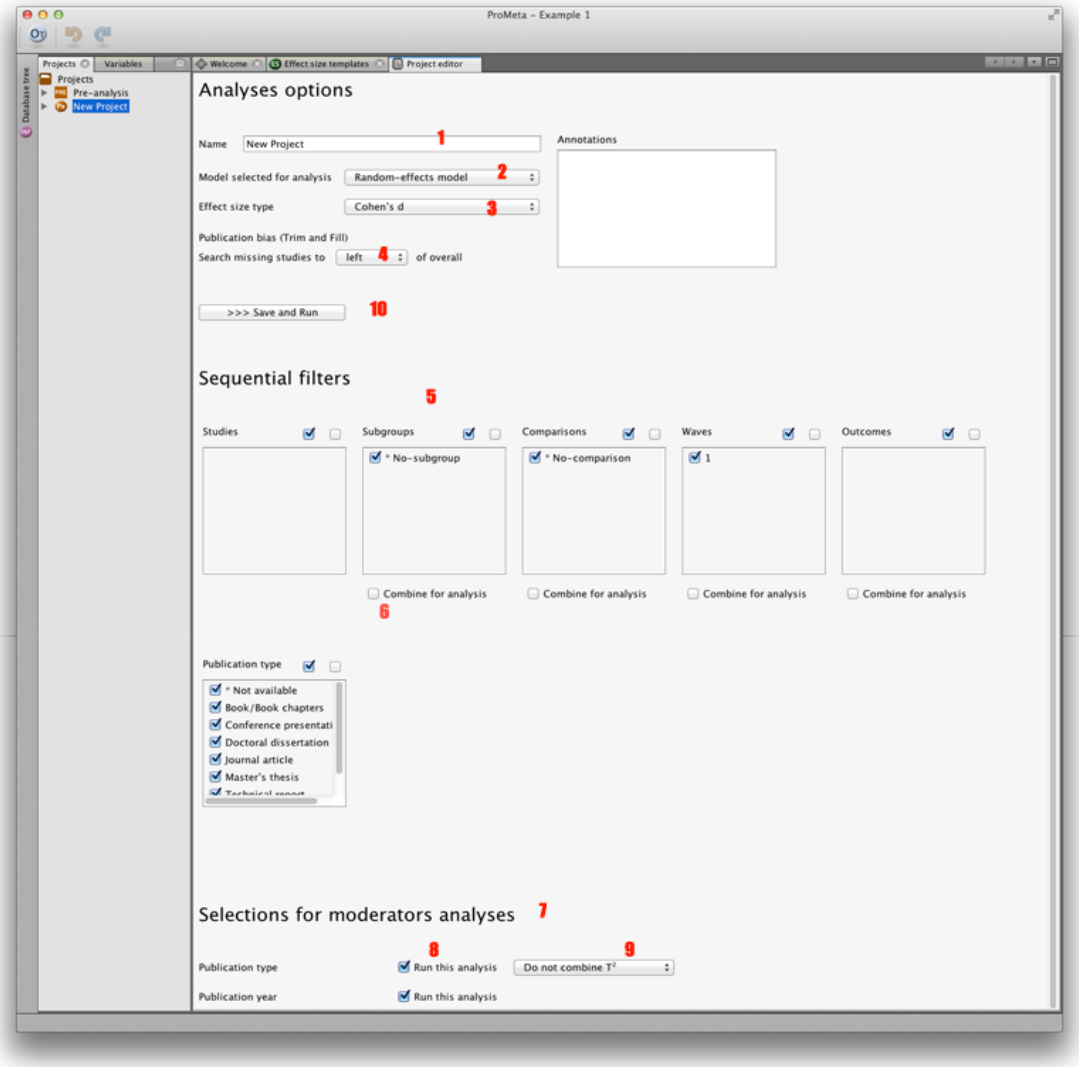
Define a new Project:



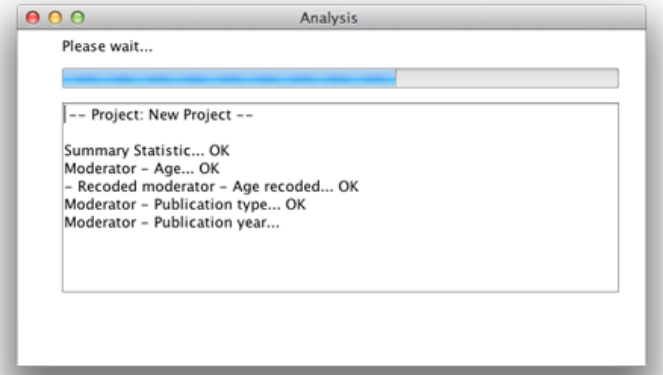
When you click on the new defined Project a new window appears and you can use it to specify your plan of analyses. Specifically, in the panel control:

1) define title (and eventually specify notes in the annotations window);
2) choose the model (i.e., fixed-effect model or random-effects model or both models) for analysis;
3) choose the effect size type: you can choose among seventeen effect size types (Cohen's d, Hedges's d, unstandardized means difference; Pearson's correlation, Fisher's Z; Odds ratio, Log odds ratio, Peto odds ratio, Log Peto odds ratio, Risk ratio, Log risk ratio, Risk difference; Rate ratio, Log rate ratio, Rate difference; Hazard ratio, Log hazard ratio) grouped on the basis of the data entry format (i.e., means, correlations, binary data, rate ratio, hazard ratio)
4) specify where to search for missing studies in the trim and fill analysis of publication bias (i.e., left or right of overall);
5) select studies to be include in the analyses, selecting/deselecting studies, subgroups, comparisons, waves, outcomes, and/or levels of categorical moderators. Filters are applied sequentially, one after the other, and exclude unselected studies/levels.

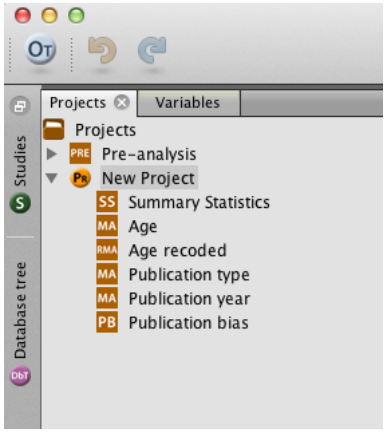
6) when you manage multiple subgroups, comparisons, waves, and/or outcomes, you specify if you want to combine them for the analyses (cf. Example 2 and 3);
7) specify your selections for the moderators analyses;
8) specify, for each moderator, if you want run its corresponding analysis;
9) specify, when you keep categorical moderators in the analyses, if the analysis of the corresponding moderator should be conducted do not combining or combining T^2 across levels of the moderator;
10) click on Save and Run for performing the analyses:



When you click on Save and Run, a window informing you about the progress of analyses appears:



After few seconds all the analyses are completed. Now, you can display the results:



Summary Statistics

When you select Summary Statistics you can see the main results:

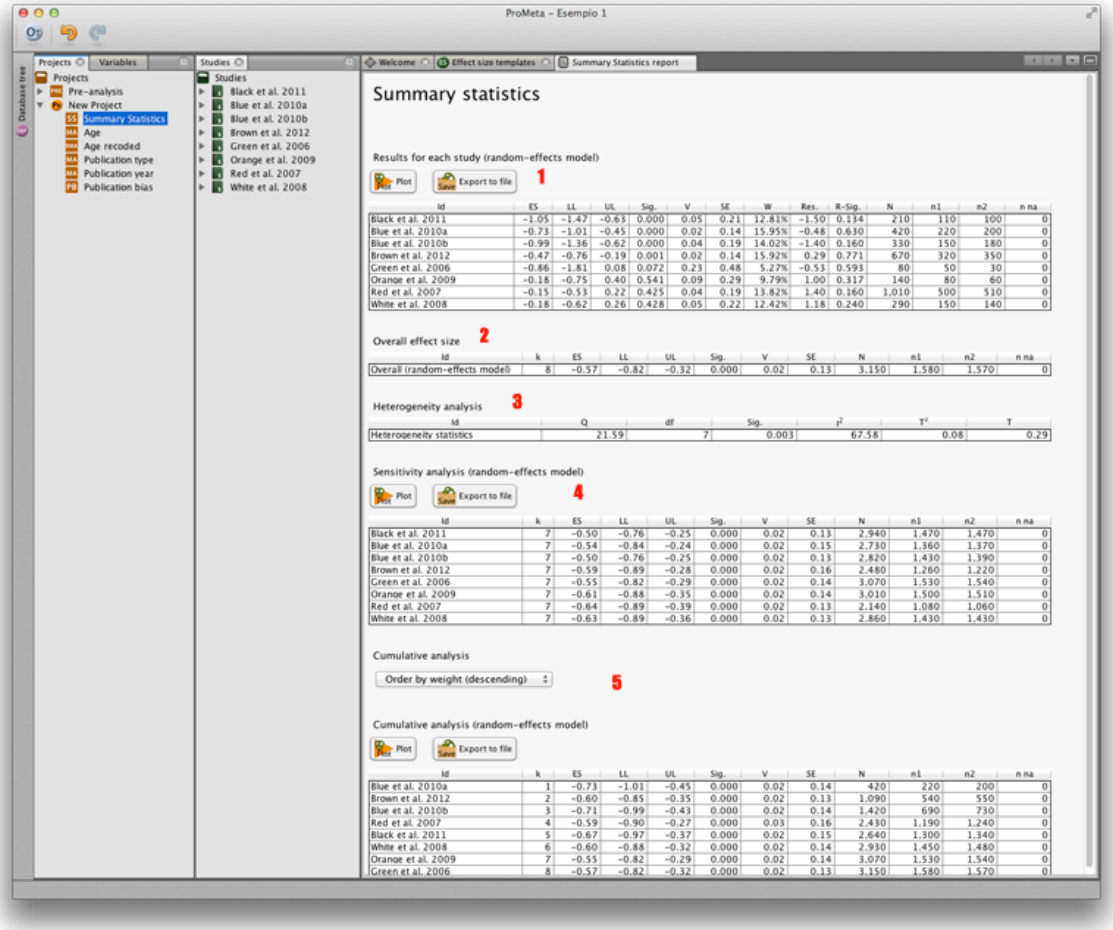
1) results for each study: Effect size (ES), 95% Confidence interval (Lower limit, LL; Upper limit, UL), Statistical significance of the effect size (Sig.), Variance (V), Standard error (SE), Weight (W), Standardized residual (Res.), Statistical significance of the standardized residual (R-Sig., it is used for detecting potential outliers), Total sample size (N), Sample size of the first group (n1), Sample size of the second group (n2), and Not assigned sample size (n na)
2) overall effect size: number of studies included in the analysis (k), Effect size (ES), 95% Confidence interval (Lower limit, LL, Upper limit, UL), Statistical significance of the overall

effect size (Sig.), Variance (V), Standard error (SE), Total sample size (N), Total sample size of the first group (n1), Total sample size of the second group (n2), and Total not assigned sample size (n na)

3) heterogeneity analysis: Q statistic (Q), degrees of freedom (df), statistical significance of Q (Sig.), I^2, Tau squared (T^2), Tau (T)

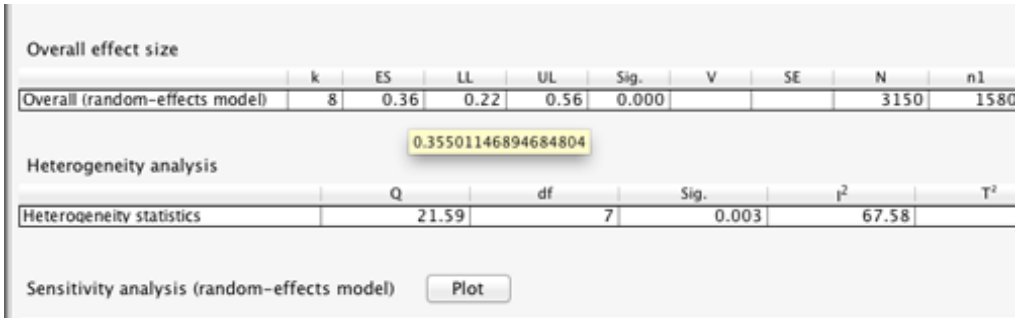
4) sensitivity analysis: this analysis indicates the influence of individual studies on the overall results. If k is number of studies included in the meta-analysis, it is conducted k times. Each time, the meta-analysis is conducted leaving out one study for testing which would be the final results without this specific study

5) cumulative analysis: select the order (e.g., order by variance ascending) that ProMeta will use for conducting this analysis. It is conducted adding at each step one study according to the order you have selected



General useful tips (C) for getting more information from tables:

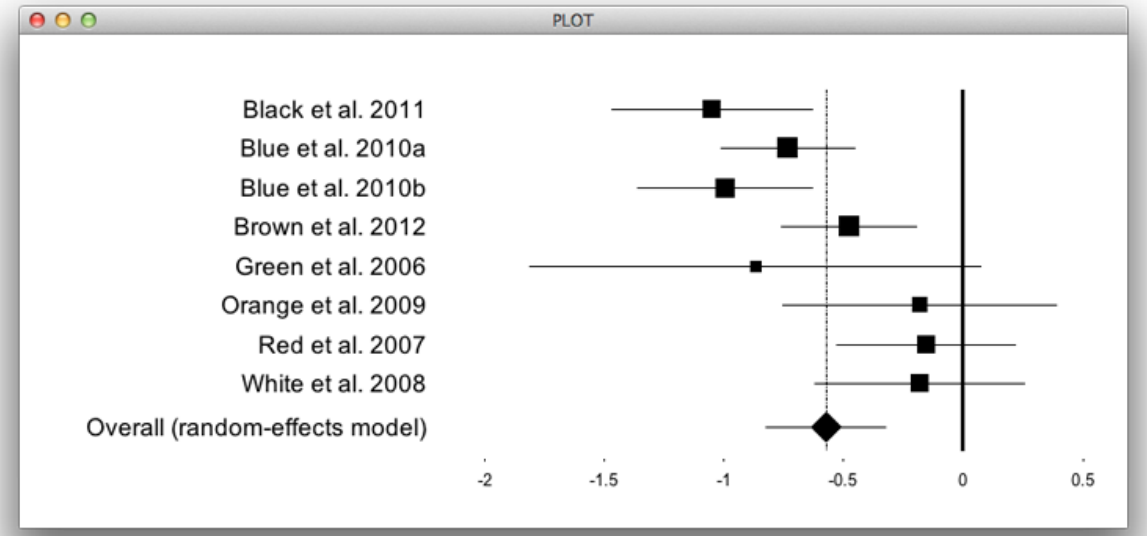
- when you point the mouse cursor on a label (e.g., ES), ProMeta displays its entire name (e.g, Effect size)
- when you point the mouse cursor on an empty cell of the Variance (V) and Standard Error (SE) columns, ProMeta displays a message saying that "This value is computed for the transformed effect size" (i.e., for the Odds ratio, Peto odds ratio, Risk ratio, Rate ratio, Hazard ratio is the Log version of the effect size)
- when you click on the top of a column, ProMeta re-orders the Table according to the data reported in that column
- when you point the mouse cursor on a number (e.g., 0.36), ProMeta displays more decimals



In the Summary statistics you can visualize three Plots. They are all Forest Plots reporting:

- ✔ Plot 1: results of each study and overall effect size
- ✔ Plot 2: results of sensitivity analysis
- ✔ Plot 3: results of cumulative analysis

As an example, see Plot 1:



In the Options (Menu bar) you can select which data (i.e., effect size, confidence interval, statistical significance, variance, standard error, weight, and sample size) and additional lines (i.e., grig and/or overall lines) you want to display.

You can order the forest plot using different criteria (e.g., order by name ascending or descending).

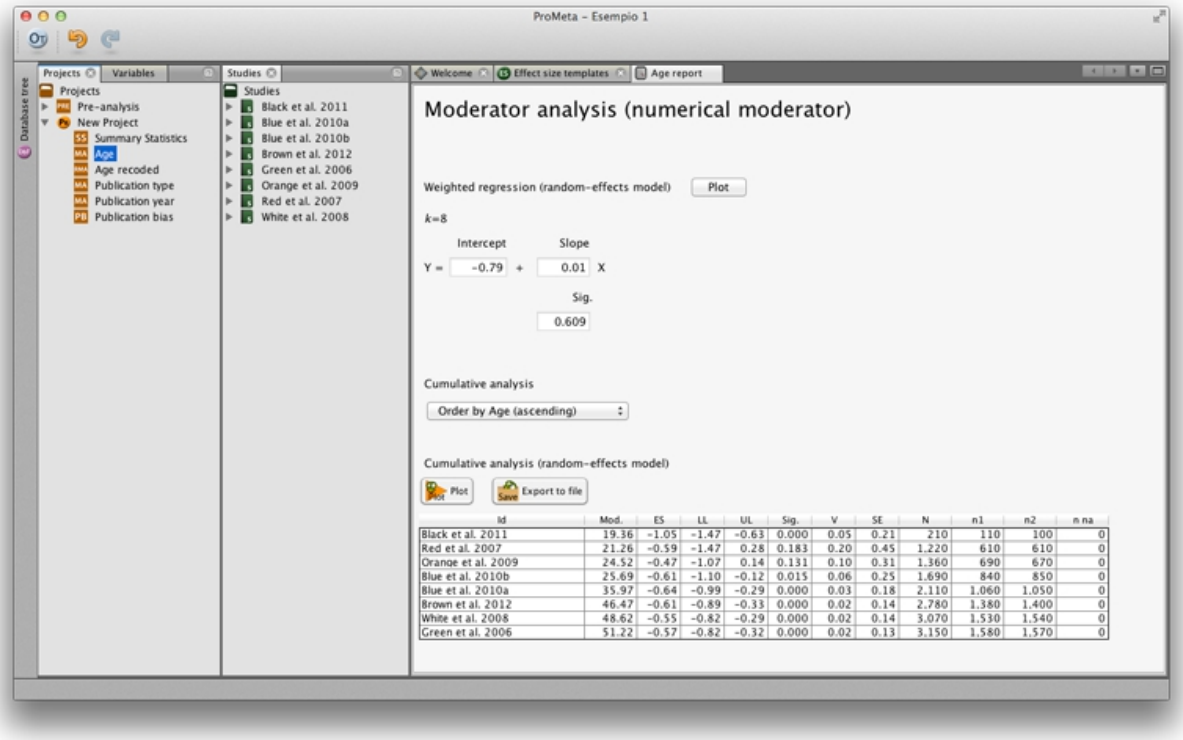
Finally, you can export the Forest plot as a high-quality PNG image for including it in your publication or conference presentation.

Useful tips (D): plots of ProMeta use the "Smart resizing" system, so you can easily model them in your screen. You can re-size the plot window to see how it works.

Moderator analysis (numerical moderator)

When you select Age, you visualize the results of the Moderator Analysis performed with a numerical moderator (the same type of analysis has been conducted also for Publication year):

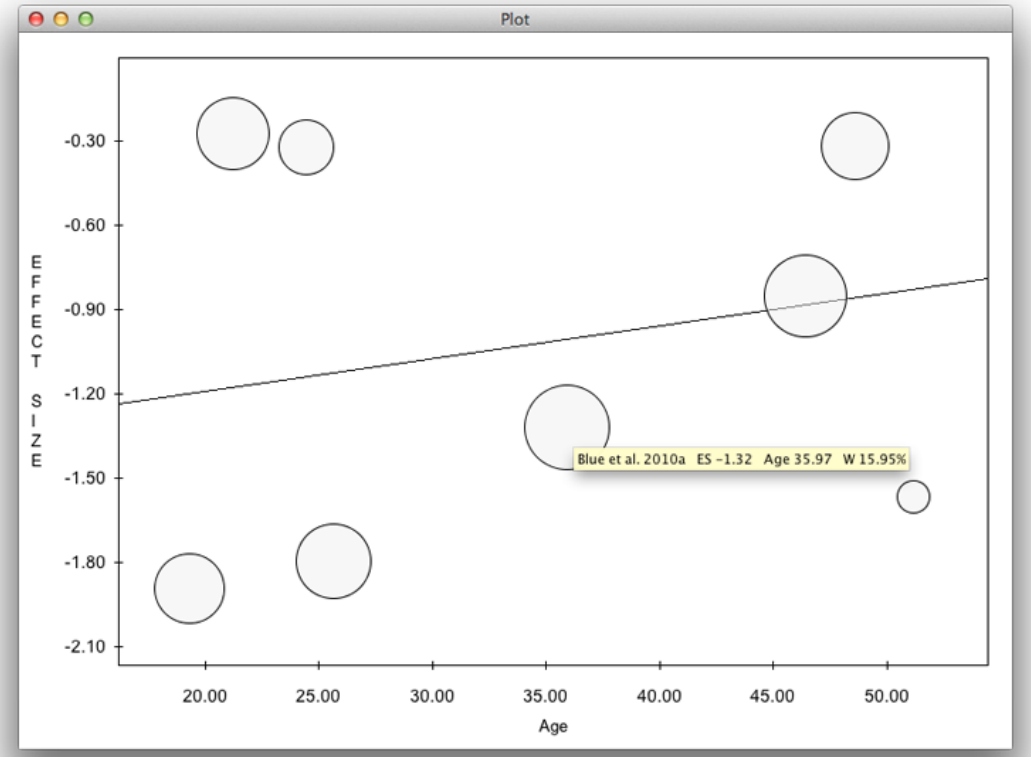
1) results of the weighted regression analysis (meta-regression): Intercept, Slope (i.e., unstandardized Beta), and Statistical significance of the slope (Sig.)
2) cumulative analysis: this is the same analysis you have seen in the Summary statistics, you can now conduct it according to the order (ascending or descending) of the moderator values



In the Moderator analysis (numerical moderator) you can visualize two Plots.

- ✔ Plot 1: scatterplot with the results of the meta-regression
- ✔ Plot 2: forest plot with the results of the cumulative analysis

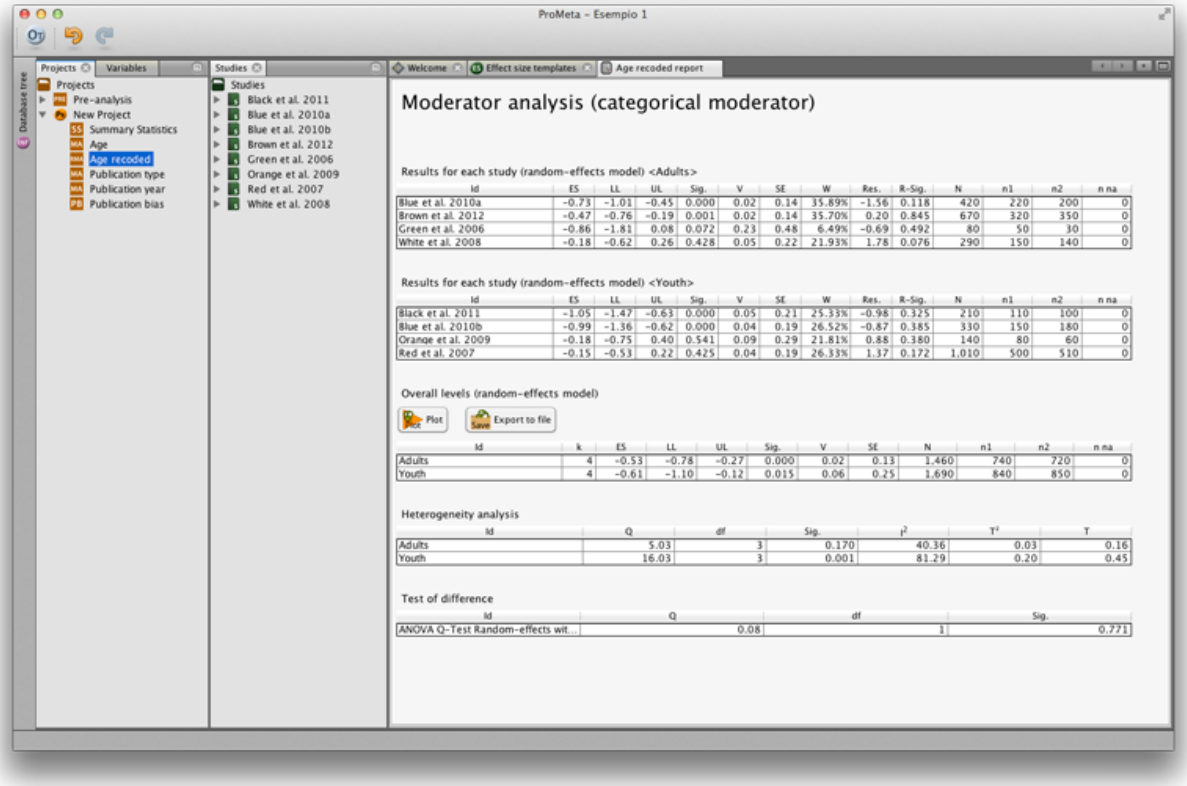
Since you have already seen features of the Forest plot, focus now on the Scatterplot. You can plot it and have the possibility to point the mouse cursor on each circle to see which study is represented. Also the scatterplot can be exported as a high-quality PNG image:



Moderator analysis (categorical moderator)

When you select Age recoded, you visualize the results of the Moderator Analysis performed with a categorical moderator (the same type of analysis has been conducted also for Publication type):

1) results for each study: these results are grouped for each level of the moderator. For instance in this example you have a categorical moderator (Age recoded) with two levels (Adults and Youth). Thus, ProMeta displays two tables: in the first table (1A) you see results for studies that belong to the first level of the moderator (i.e., Adults), in the second table (1B) you see results for studies that belong to the second level of the moderator (i.e., Youth)
2) overall levels: overall effect sizes are reported for each level of the moderator
3) heterogeneity analysis: results of heterogeneity are reported for each level of the moderator
4) test of difference: this test is conducted to ascertain whether the effect sizes for the levels of the moderator are significantly different



In the Moderator analysis (categorical moderator) you can visualize one Plot.

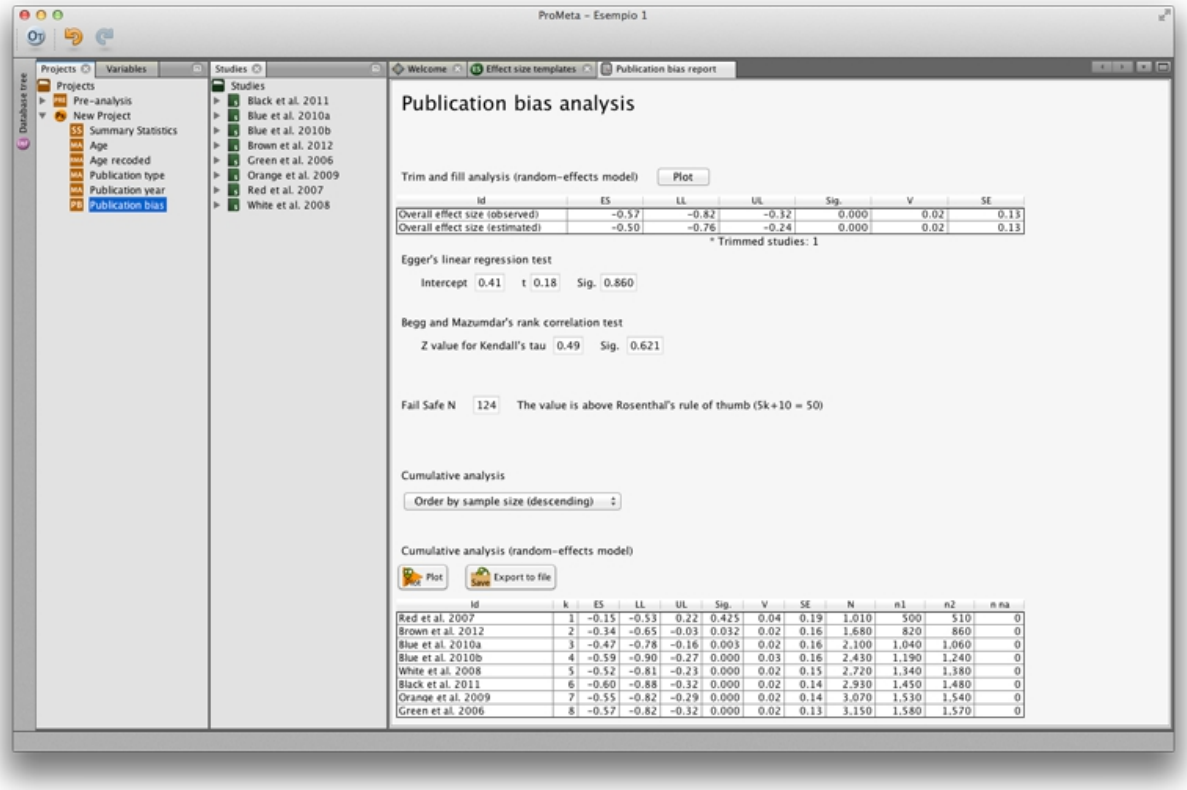
- ✔ Plot 1: Forest plot with the results of the categorical moderator. This plot presents all the features of the Forest plot that you have seen above.

Publication Bias

When you select Publication Bias, you visualize the results of the analyses conducted to evaluate the publication bias:

1) trim and fill analysis: it reports the number of trimmed studies and the overall results (i.e., both observed and estimated though the trim and fill analysis)
2) Egger's linear regression test: Intercept, t value (t), and statistical significance (Sig.)
3) Begg and Mazumdar's rank correlation test: Z value for Kendall's Tau and statistical significance (Sig.)
4) fail safe N: N and computation of safety number corresponding to Rosenthal's rule of thumb

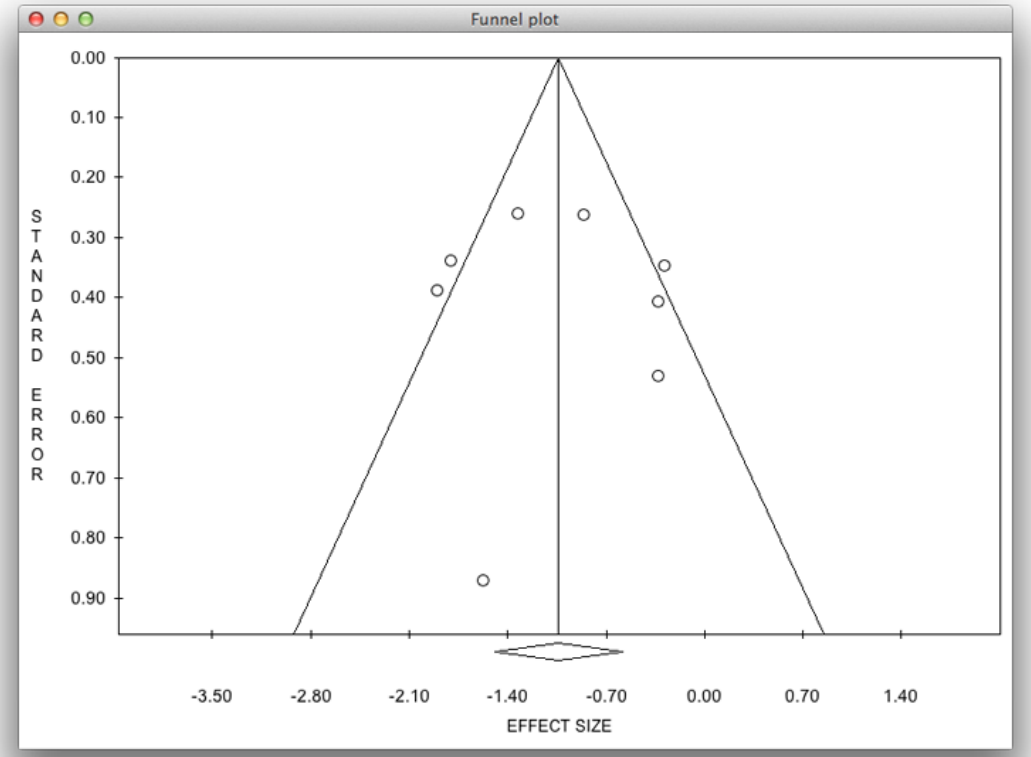
5) cumulative analysis: with the order (ascending or descending) defined by the sample size



In the Publication bias analysis you can visualize two Plots:

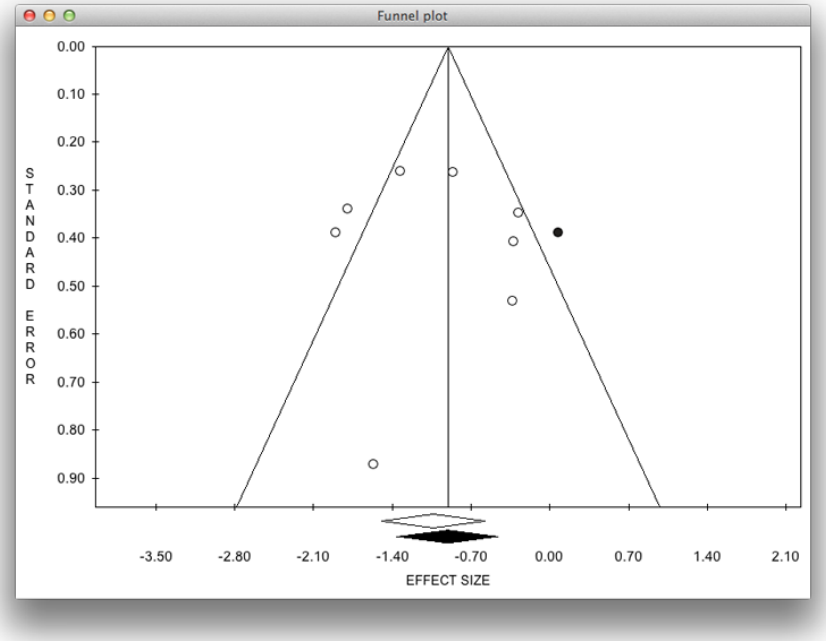
- ✔ Plot 1: Funnel plot with a representation of standard error (on the vertical axis) and effect size (on the horizontal axis) of each study
- ✔ Plot 2: Forest plot with the results of the cumulative analysis.

Take a look at the features of the funnel plot:

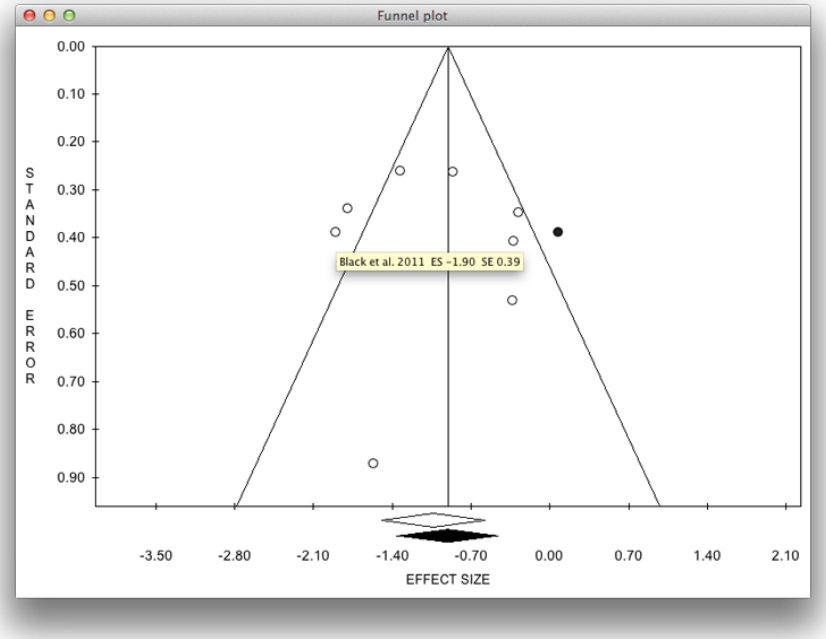


In the options of the Funnel plot you can choose between:

- displaying only the observed studies
- displaying both the observed and the estimated studies (on the basis of the results of the trim and fill analysis)



You can point the mouse cursor on each circle to see which study is represented. Also the funnel plot can be exported as a high-quality PNG image.



Example 2

In Example 1 we have seen basic features of ProMeta. Now we will start to familiarize with more complex meta-analytic projects. This second example represents an extension of Example 1 including multiple comparisons.

Topic of this second meta-analysis: to examine the efficacy of two new drugs (Z and W) for preventing panic attacks in patients with anxiety disorders.

We have selected five studies, all reported in journal articles. They are Randomized Controlled Trials (RCTs) that involved three groups:

- first experimental group (i.e., participants received the new drug Z)

- second experimental group (i.e., participants received the new drug W)

- control group (i.e., participants received a placebo).

In this example you have multiple comparisons under investigations: drug Z compared to placebo and drug W compared to placebo. So, the placebo group was used as the control group for both drugs.

We have reported in the Table 2 main characteristics of the studies included in this meta-analysis.

Table 2. *Study Characteristics of Example 2*

Study name	***Events (experimental group)***	***Total sample size (experimental group)***	***Events (control group)***	***Total sample size (control group)***
Black et al. 2011				
Comparison drug W/placebo	20	115	20	100
Comparison drug Z/placebo	10	110	20	100
Blue et al. 2010				
Comparison drug W/placebo	70	200	65	200
Comparison drug Z/placebo	25	220	65	200
Brown et al. 2012				
Comparison drug W/placebo	15	100	62	180

Comparison drug Z/placebo	12	150	62	180
Green et al. 2006				
Comparison drug W/placebo	40	300	54	350
Comparison drug Z/placebo	23	320	54	350
Orange et al. 2009				
Comparison drug W/placebo	9	70	8	60
Comparison drug Z/placebo	8	80	8	60

Now let's enter these data in ProMeta and perform statistical analyses.

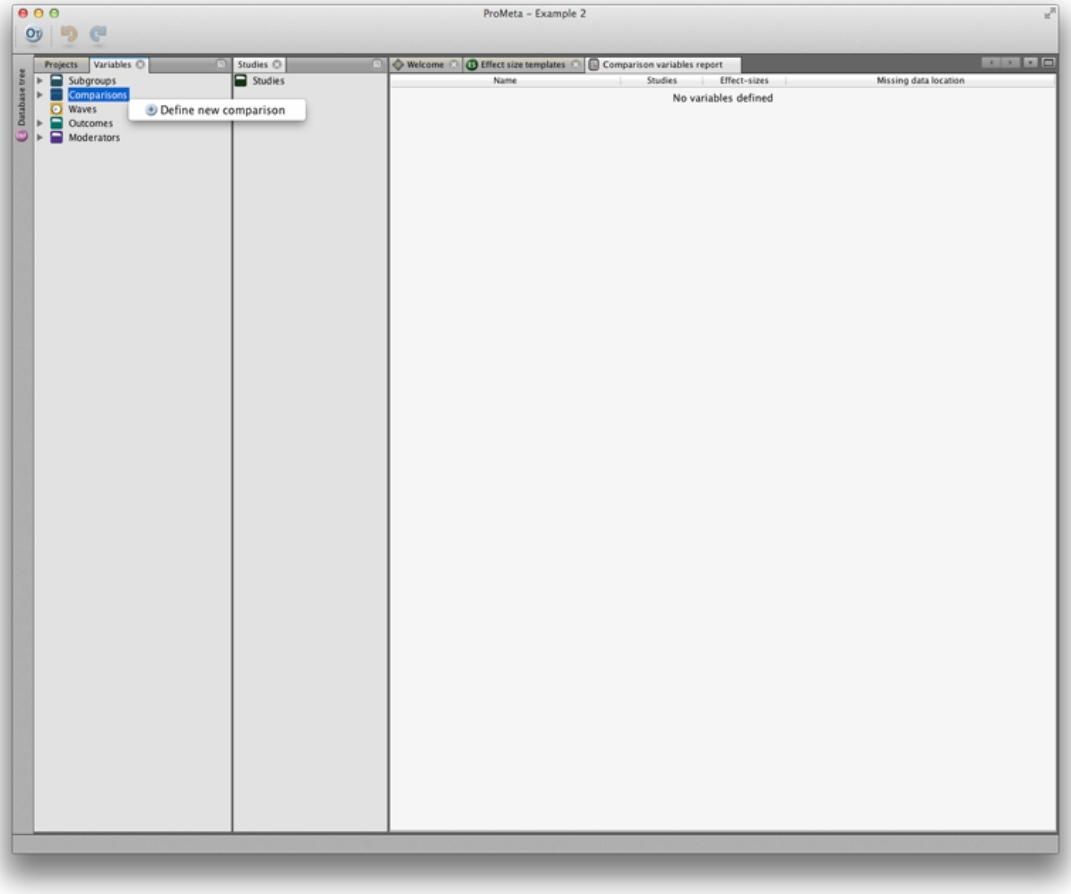
Step 1: Creating a new topic

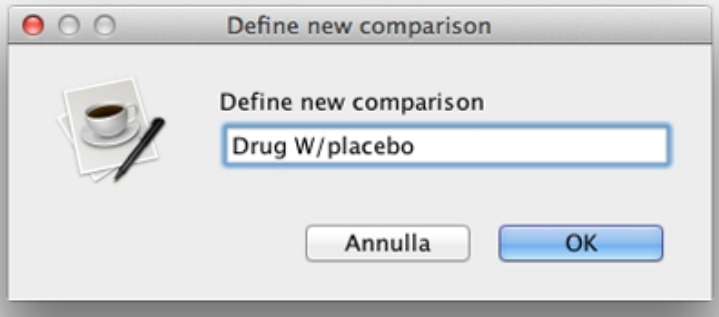
Click on OT for creating a new topic that you label Example 2.

Step 2: Defining variables

Comparisons

In this example you learn how to manage multiple comparisons. Right-clicking on Comparisons you define the first comparison (i.e., drug W/placebo):


ProMeta – Example 2
Projects
Variables
Studies
Welcome
Effect size templates
Comparison variables report
Database tree
Subgroups
Comparisons
Waves
Outcomes
Moderators
Define new comparison
Studies
Name
Studies
Effect-sizes
Missing data location
No variables defined


Define new comparison
Define new comparison
Drug W/placebo
Annulla
OK

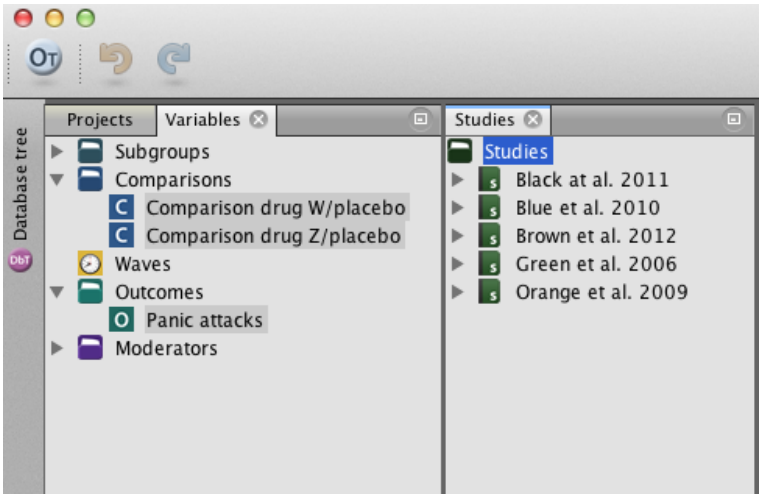
Repeat the same procedure for the second comparison (i.e., drug Z/placebo).

Outcomes

Select the window Variables and label your Outcome "Panic attacks". When you click on the Outcomes you can define the names of your groups (i.e., experimental and control groups) as you have done in the Example 1.

Step 3: Entering data

Now that you have prepared your topic, you can start to enter the studies you have selected. You can apply the Useful tip B you have seen in the Example 1. First, define all the new studies. Second, apply all the two comparisons to each study and for doing it drag the two comparisons and drop them directly to the Studies folder. Repeat the same procedure for the outcome and also for the data entry type (Binary data > Independent groups, prospective > Events, sample size):



Important note: you can follow this procedure only because all the studies have the same structure (i.e., same comparisons, same outcome, same data entry type). Otherwise, you had to insert one study after the other, assigning pertinent variables to each study.

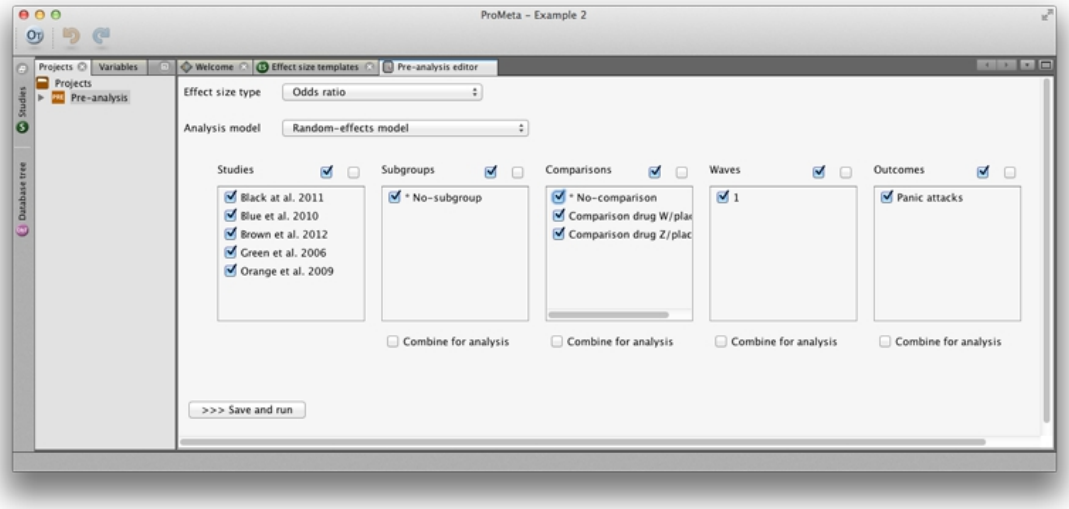
Step 4: Recoding moderators

In this example we are not interested in moderators.

Step 5: Performing analyses

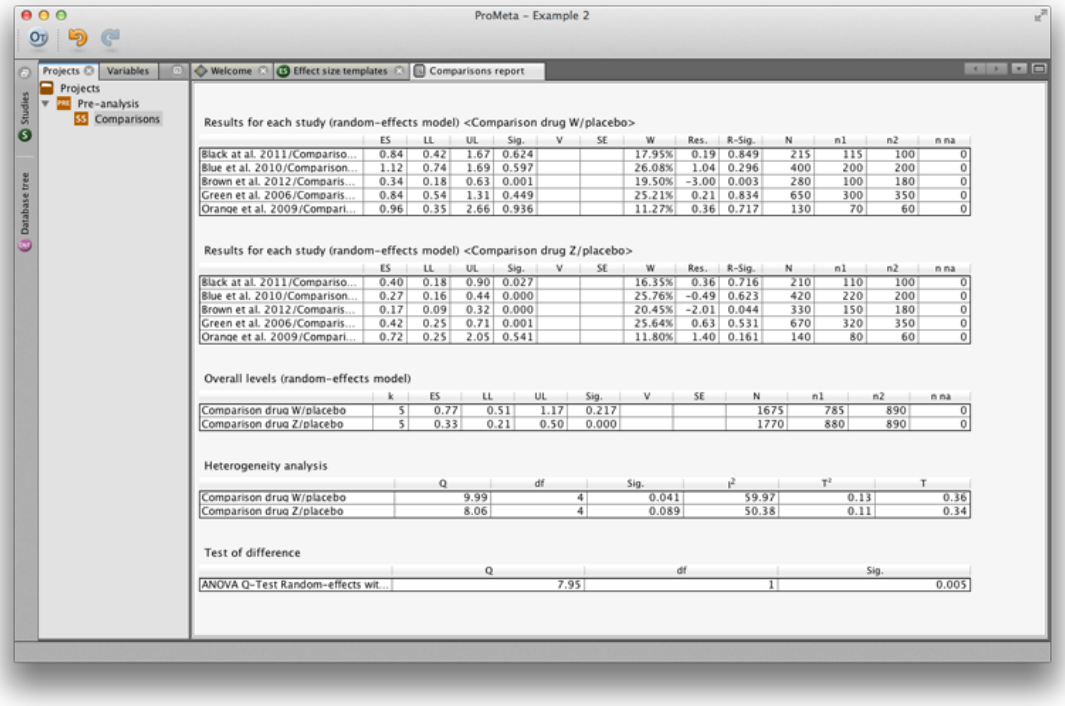
Pre-analysis

In the Pre-analysis you can test if there are significant differences between subgroups, comparisons, waves, and/or outcomes. In this example, you have multiple comparisons:



Run the pre-analysis and visualize the results:

1) results for each study: these results are grouped for each comparison. For instance in this example you have two comparisons (i.e., drug W/placebo and drug Z/placebo). Thus, ProMeta displays two tables: in the first table (1A) you see results related to comparison drug W/placebo, in the second table (1B) you see results related to comparison drug Z/placebo
2) overall levels: overall effect sizes are reported for each comparison
3) heterogeneity analysis: results of heterogeneity are reported for each comparison
4) test of difference: this test is conducted to ascertain whether the effect sizes for the two comparisons are significantly different



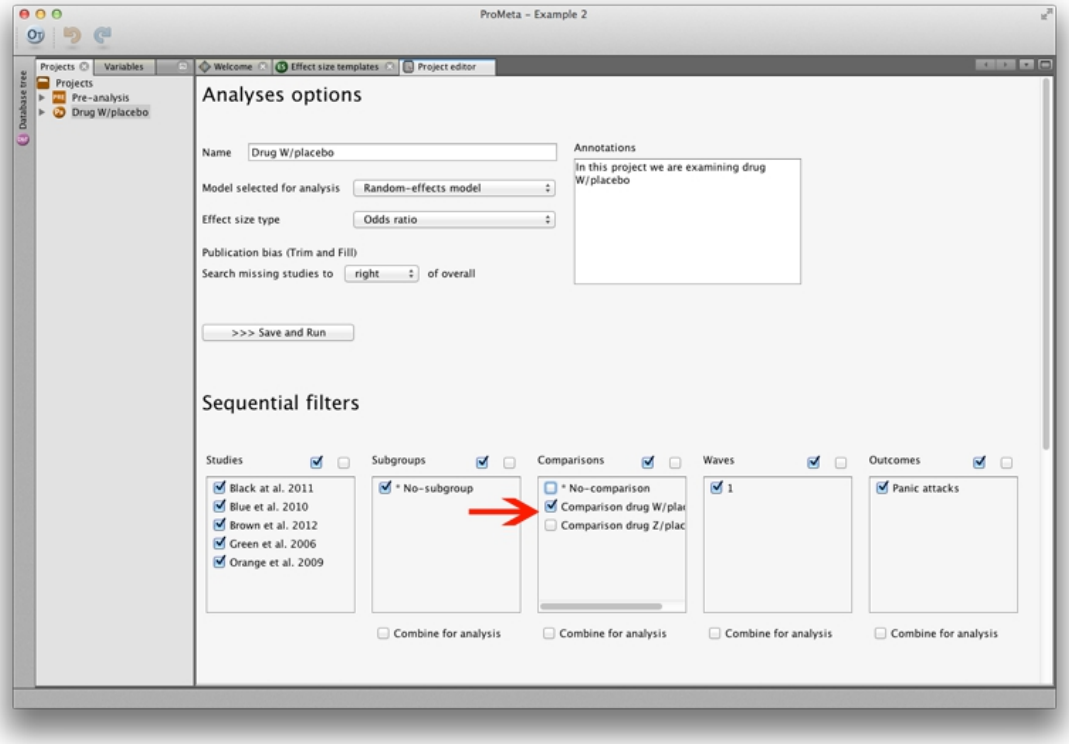
These preliminary analyses offer a first look on the data and can provide statistical support to your data analytic strategy. For instance, in this example your aim was to analyse the two comparisons separately given your interests in each of them. Results of Pre-Analysis further support your choice, by showing significant differences.

New project

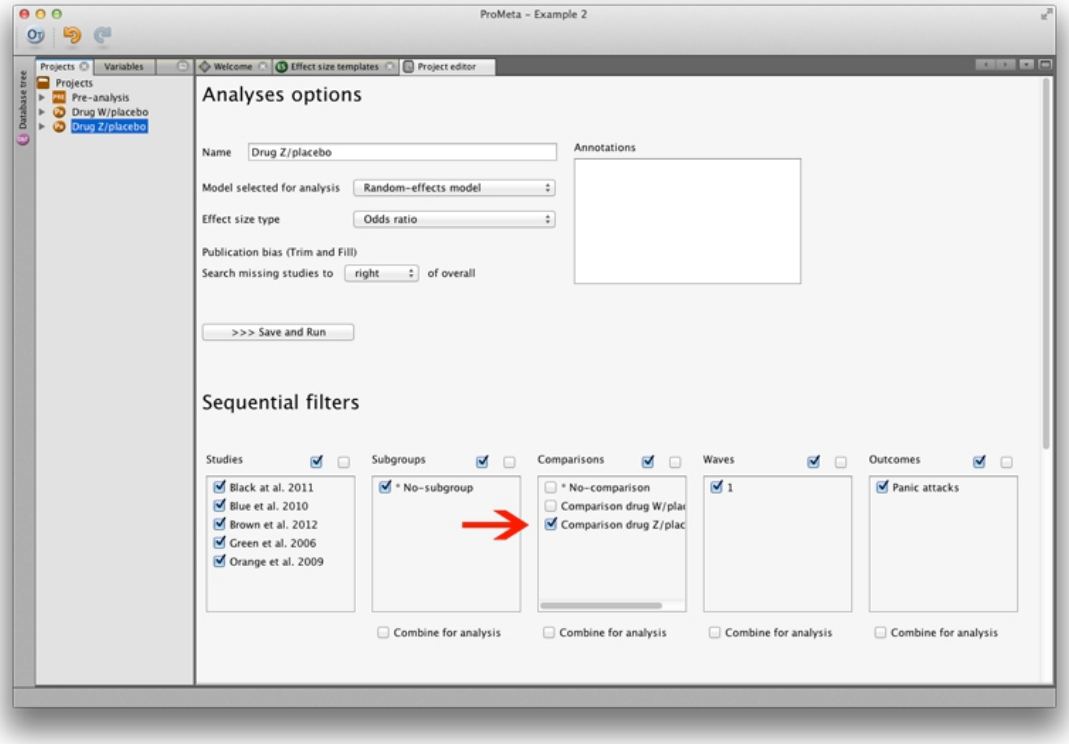
After you have verified, in line with your expectations, that the two drugs perform differently, you continue conducting two separate projects. In the first project (Project drug W), you focus only on the comparison drug W/placebo. Thus, in the panel control:

- specify in the title (and eventually in the annotations) that you are going to work on this comparison
- choose the models for analysis
- choose the effect size type
- specify where to search for missing studies in the trim and fill analysis of publication bias;
- select the comparison (W/placebo) you are going to consider

- exclude the moderator from the analysis since you are not interested in it
- save and run analyses



In the second project (Project drug Z) you repeat the same procedure but this time you focus on the comparison between drug Z and placebo:



In this example 2 there are not further news. You can now navigate through the results as you have done in Example 1.

Example 3

In this last example you will learn how to manage complex projects.

Topic of this third meta-analysis: to examine the health status of cancer and cardiac patients.

We have selected ten studies (all journal articles) that compare these two groups of patients. We have found in these primary studies five sources of complexity:

- ✗ multiple subgroups: some studies report differences between cancer and cardiac patients separately for women and men
- ✗ multiple waves: some studies report differences between cancer and cardiac patients assessed in different moments (wave1 = immediately after the diagnosis; wave2 = one year after the diagnosis)
- ✗ multiple outcomes: all studies report differences between cancer and cardiac patients on health status for both physical and mental health
- ✗ multiple data formats: studies report differences between cancer and cardiac patients using different formats (e.g., mean scores, standard deviations, and sample size of each group; results of the t-test; level of statistical significance)
- ✗ moderators: in some studies the moderators assume the same value for the entire study while in some other studies moderators assume different values for various combinations of multiple outcomes/subgroups/waves

On the basis of our research aims, we are interested in examining waves and outcomes separately, while we do not have specific hypotheses about differences detected in men and women.

We have reported in Table 3 main characteristics of the studies included in this meta-analysis.

Table 3. *Study Characteristics of Example 3*

Study names	Country	Mean age of the sample	Subgroup	Wave	Outcome (health)	Number of cancer patients	Number of cardiac patients	Data
Black et al. 2002	USA	58.36	Men	T0	Mental	25	30	Cancer patients: M = 3.55, SD = 0.56 Cardiac patients: M = 3.23, SD = 0.58

Study names	Country	Mean age of the sample	Subgroup	Wave	Outcome (health)	Number of cancer patients	Number of cardiac patients	Data
		58.92	Women	T0	Physical	26	31	Cancer patients: M = 2.51, SD = 0.52 Cardiac patients: M = 2.32, SD = 0.53
					Mental	28	32	Cancer patients: M = 3.52, SD = 0.55 Cardiac patients: M = 3.20, SD = 0.59
					Physical	28	32	Cancer patients: M = 2.56, SD = 0.50 Cardiac patients: M = 2.32, SD = 0.54
Black et al. 2011	USA	45.26		T0	Mental	100	100	Results of the t-test: Cancer patients scored higher than cardiac patients (p = .05, 2-tailed)
					Physical	100	100	Results of the t-test: Cancer patients scored higher than cardiac patients (p = .001, 2-tailed)
Blue et al. 2000	China	36.58	Men	T0	Mental	28	32	Results of the t-test: Cancer patients scored higher than cardiac patients (p =.10, 2-tailed)
					Physical	28	32	Results of the t-test: Cancer patients scored higher than cardiac patients (p =.21, 2-tailed)
		37.57	Men	T1	Mental	25	30	Results of the t-test: Cancer patients scored higher than cardiac patients (p =.80, 2-tailed)
					Physical	26	31	Results of the t-test: Cancer patients scored higher than cardiac patients (p =.91, 2-tailed)
		38.55	Women	T0	Mental	50	60	Results of the t-test: Cancer patients scored higher

Study names	Country	Mean age of the sample	Subgroup	Wave	Outcome (health)	Number of cancer patients	Number of cardiac patients	Data
								than cardiac patients (p =.08, 2-tailed)
					Physical	50	60	Results of the t-test: Cancer patients scored higher than cardiac patients (p =.20, 2-tailed)
					Mental	25	31	Results of the t-test: Cancer patients scored higher than cardiac patients (p =.78, 2-tailed)
		39.55	Women	T1				
					Physical	26	30	Results of the t-test: Cancer patients scored higher than cardiac patients (p =.89, 2-tailed)
Blue et al. 2008	Japan	61.05		T0	Mental	210	225	Cancer patients: M = 4.02, SD = 0.88; Cardiac patients: M = 4.01, SD =0.89
					Physical	209	224	Cancer patients: M = 2.96, SD = 0.94; Cardiac patients: M = 2.88, SD = 1.02
		62.05		T1	Mental	200	215	Cancer patients: M = 3.76, SD = 0.85; Cardiac patients: M = 4.60, SD =1.05
					Physical	200	215	Cancer patients: M = 3.05, SD = 0.85; Cardiac patients: M = 4.02, SD = 0.89
Brown et al. 2003	NL	38.59		T0	Mental	530	520	Results of the t-test: Cancer patients scored higher than cardiac patients (p < .05, 2-tailed)
					Physical	530	520	Results of the t-test: Cancer patients scored lower than cardiac patients (p < .01, 2-tailed)
		39.45		T1	Mental	525	515	Results of the t-test:

Study names	Country	Mean age of the sample	Subgroup	Wave	Outcome (health)	Number of cancer patients	Number of cardiac patients	Data
								Cancer patients scored higher than cardiac patients ($p < .05$, 2-tailed)
								Results of the t-test:
					Physical	525	515	Cancer patients scored lower than cardiac patients ($p < .05$, 2-tailed)
Green et al. 2005	UK	32.41		T0	Mental	52	55	Cancer patients: M = 4.27; Cardiac patients: M = 4.08; t = 1.58
					Physical	52	55	Cancer patients: M =2.51; Cardiac patients: M = 2.45; t = 0.39
Orange et al. 2008	Italy	41.23		T0	Mental	100	95	Cancer patients: M = 3.20 , SD = 0.65; Cardiac patients: M = 3.02, SD = 0.74
					Physical	100	95	Cancer patients: M = 2.06 , SD = 1.15; Cardiac patients: M = 2.58, SD = 0.96;
Red et al. 2011	India	41.36.00		T0	Mental	25	30	Cancer patients: M = 3.25 , SD = 0.68; Cardiac patients: M = 3.09, SD = 0.76
					Physical	27	33	Cancer patients: M = 2.08 , SD = 1.19; Cardiac patients: M = 2.51, SD = 0.92;
Red et al. 2012	Canada	54.69	Men	T0	Mental	145	160	Cancer patients: M =3.65; Cardiac patients: M =3.12; $p < .05$
					Physical	145	160	Cancer patients: M = 2.57; Cardiac patients: M = 3.05; $p < .05$
		55.60	Women	T0	Mental	150	170	Cancer patients: M =3.69; Cardiac patients: M =3.06; $p < .05$
					Physical	150	170	Cancer patients: M = 2.59; Cardiac patients: M = 3.08; $p < .05$

Study names	Country	Mean age of the sample	Subgroup	Wave	Outcome (health)	Number of cancer patients	Number of cardiac patients	Data
White et al. 2009	Sweden	41.2		T0	Mental	350	345	Results of the t-test: Cancer patients scored higher than cardiac patients (p = .001, 2-tailed)
					Physical	350	345	Results of the t-test: Cancer patients scored lower than cardiac patients (p = .001, 2-tailed)
		42.02.00		T1	Mental	300	312	Results of the t-test: Cancer patients scored higher than cardiac patients (p = .05, 2-tailed)
					Physical	300	312	Results of the t-test: Cancer patients scored lower than cardiac patients (p = .05, 2-tailed)

Note. M = Mean score; SD = Standard deviation; t = t value; p = statistical significance

We do not want to lose all this complexity, so we are going to see how to include it in the creation of the topic.

Step 1: Creating a new topic

Click on OT for creating a new topic that you label Example 3.

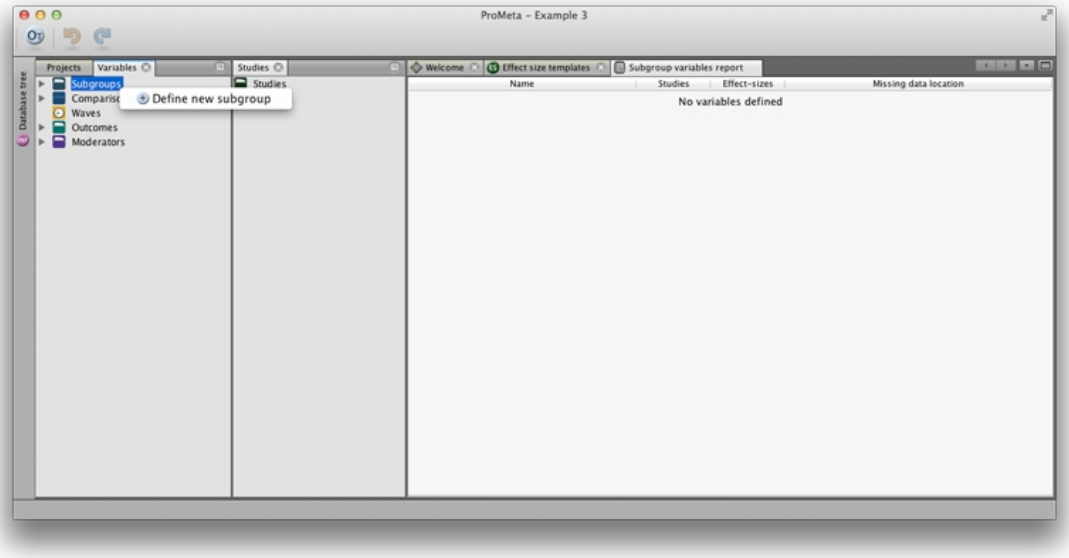
Step 2: Defining variables

In this example you have a complex data structure, since you have multiple subgroups, waves, and outcomes.

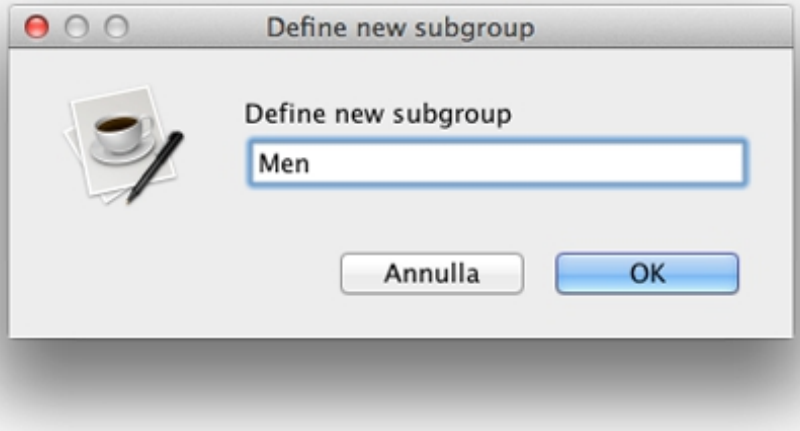
Subgroups

You have two subgroups (i.e., men and women). Right-clicking on Subgroups you can define a new

subgroup:



Your first subgroup is Men:



Repeat the same procedure for defining the second subgroup (i.e., Women).

Comparisons

In this example you are not managing multiple comparisons. You have seen them in the Example 2.

Waves

In this example you have two waves (i.e., wave1 and wave2). However, you do not need to specify them now. You will see later how to assign them directly to each study.

Outcomes

In this example you have two outcomes (i.e., mental and physical health). Right-clicking on Outcomes you can define them.

Moderators

ProMeta has already prepared two default moderators (i.e., publication type and publication year). In this example you have two additional moderators:

- country (categorical moderator)
- age (numerical decimal moderator)

Define them by right-clicking on Moderators.

Step 3: Entering data

Now that you have prepared your topic, you can start entering the studies. Since you are managing a complex data structure you cannot apply the Useful tip B. On the contrary, you need to prepare each study assigning to it pertinent variables and data entry formats.

Let's start with the first study. Enter Black et al., 2002 by right-clicking on Studies:

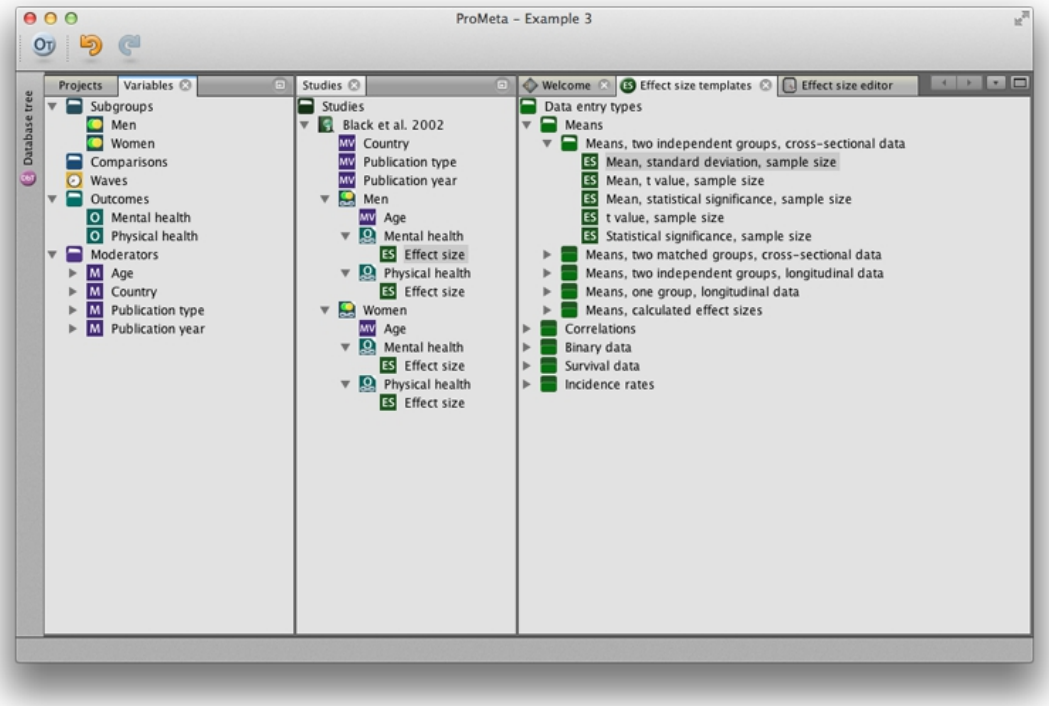
Drag and drop in this study (Black et al., 2002):

- the two subgroups (i.e., men and women)
- the two outcomes (i.e., mental and physical health)
- the correct data entry type (means > two independent groups, cross-sectional data > means, standard deviation, sample size)

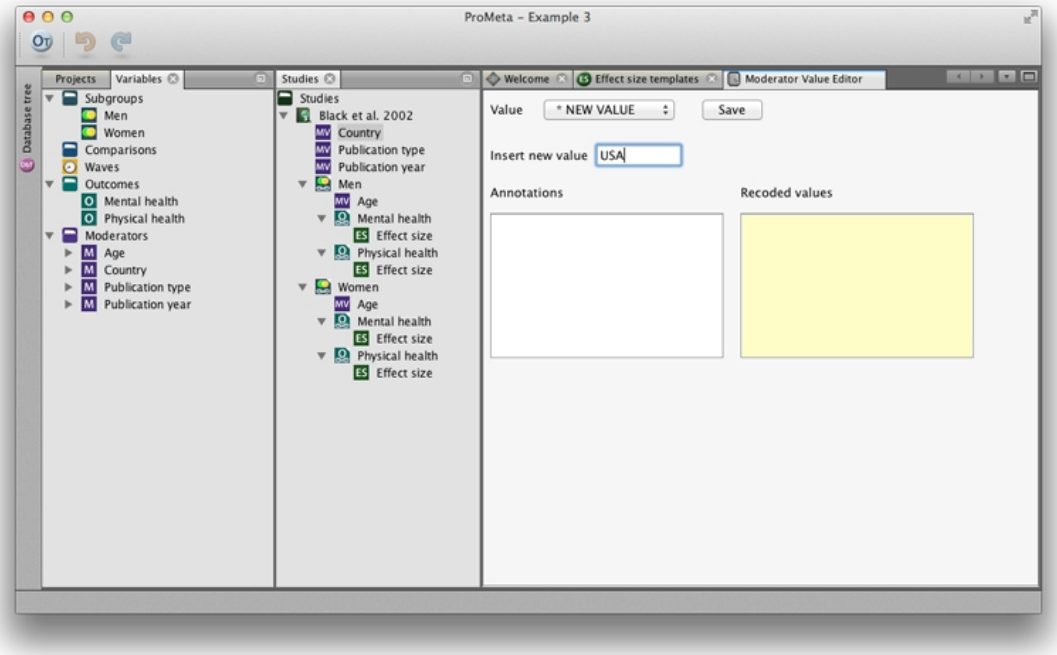
Now, you have to check the moderators:

- the two default moderators (i.e., publication type and publication year) are always study-level moderators, so they are already in the right position
- country is a study-level moderator, so it is also in the right position

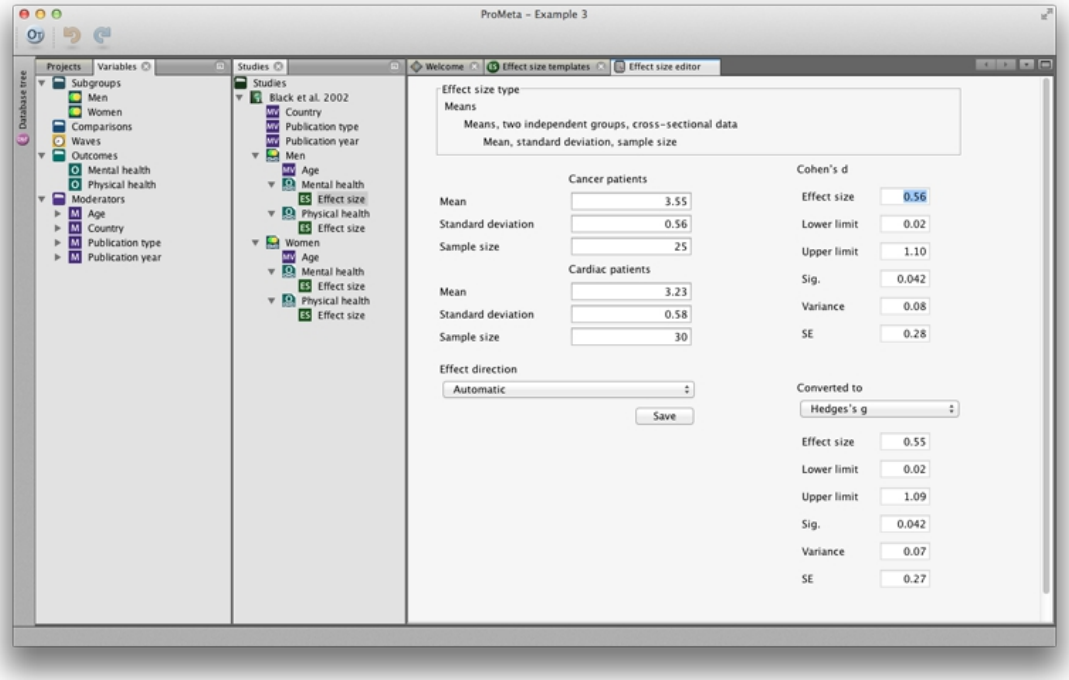
- age, in this study, is a subgroup-level moderator: age assumes different values for the two subgroups (56.36 for men and 58.92 for women). Therefore, you move the moderator at the subgroup level



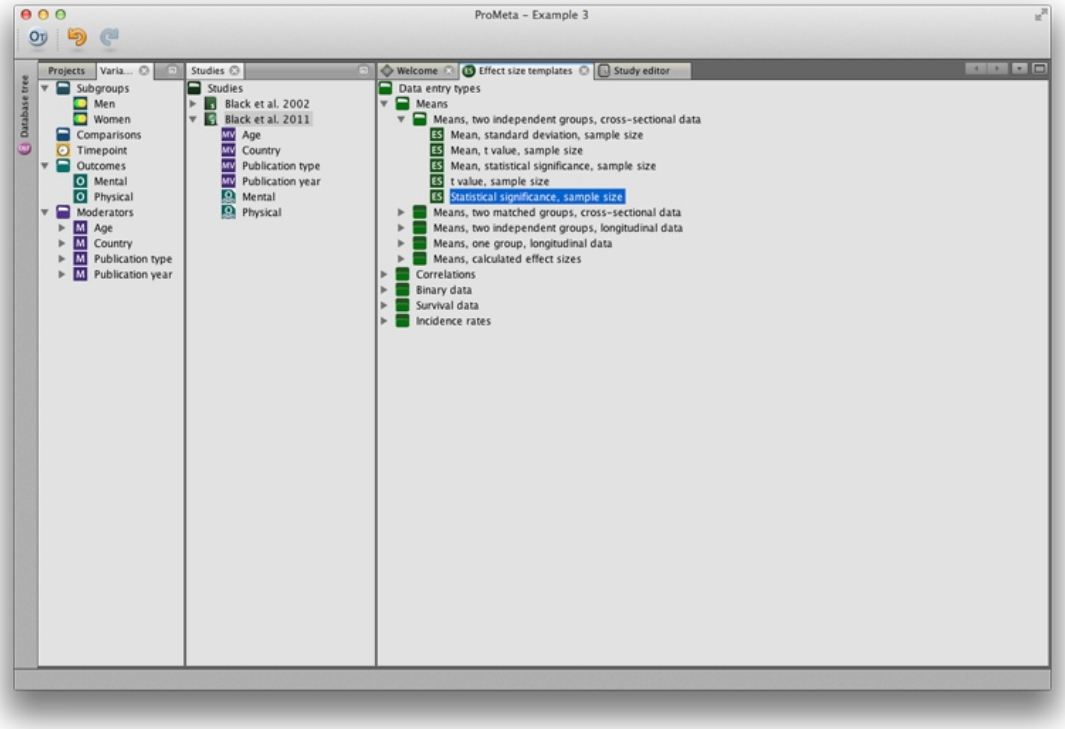
You are now ready for entering data of the first study (Black et al., 2002). Start with the value of the moderator Country: assign a new value (USA) and save it. This value will be available for following data entry:



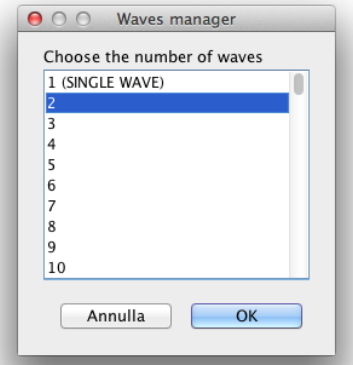
Continue entering data for the other moderators and for the effect size:



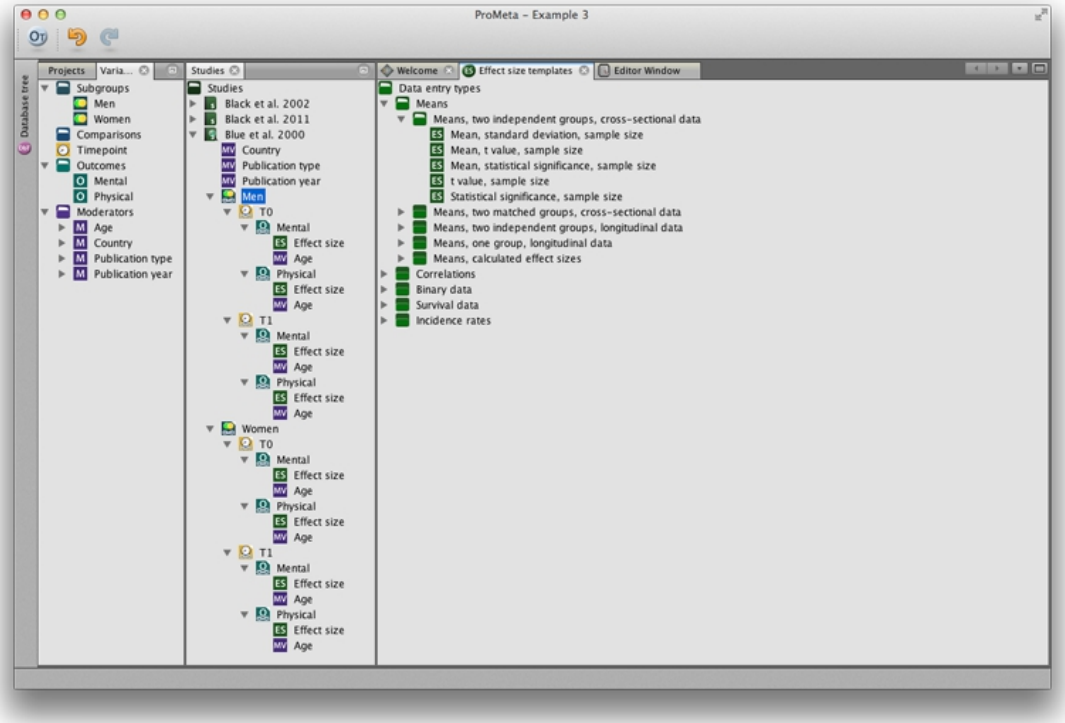
Let's know insert the second study (i.e., Black et al., 2011). Repeat the same procedure seen above. In this case you have two outcomes and all study-level moderators. The data entry format is different from the one you have used for Black et al. 2002. So, in the Effect size templates window select the Data entry type that corresponds to your data (means > two independent groups, cross-sectional data > statistical significance, sample size) and assign it to the second study:



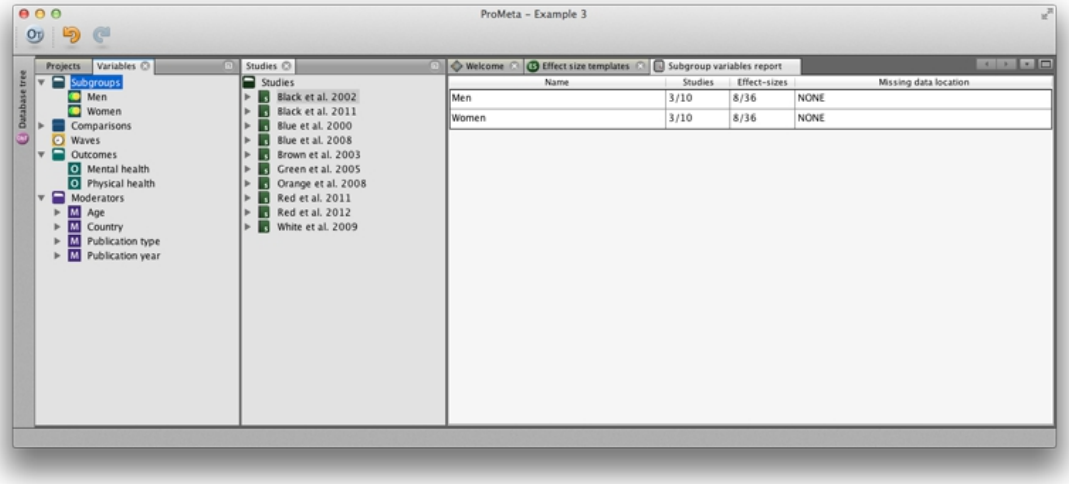
Proceed with the third study (Blue et al. 2000). This is the most complex one since it has a combination of two subgroups, two waves, and two outcomes. Start assigning the two subgroups. The novelty is represented by the waves. To include them, drag the wave icon to the study. Doing so, a new window appears when you can indicate how many waves you are using. Select two waves:



Continue assigning the outcomes to the study. Then, check the position of the moderators. In this study, Age is Wave-level moderator. Select the data entry type and start filling each field with the study data:



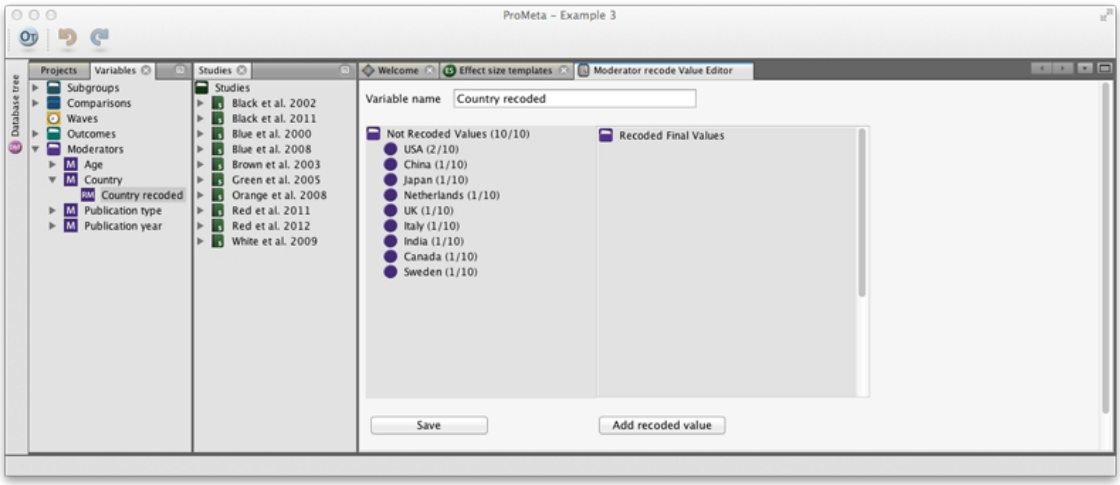
Now, you are ready to repeat the same procedure for the other seven studies. After this, you can check the report for each variable. For instance, this is the report for the Subgroups:

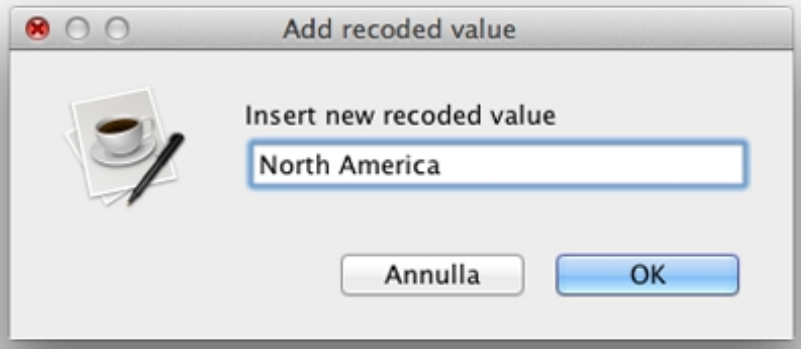


Step 4: Recoding moderators

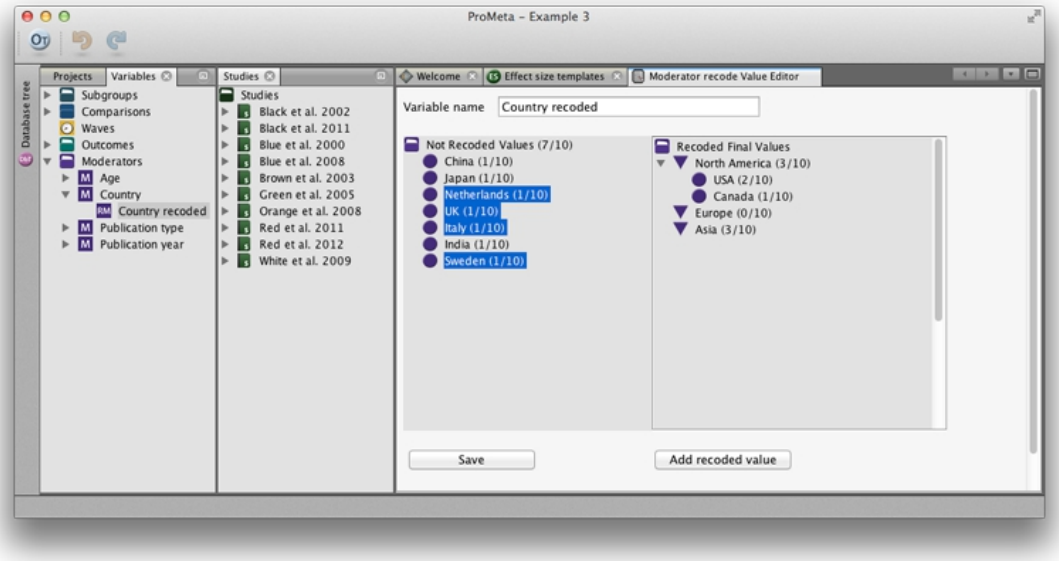
Categorical moderators

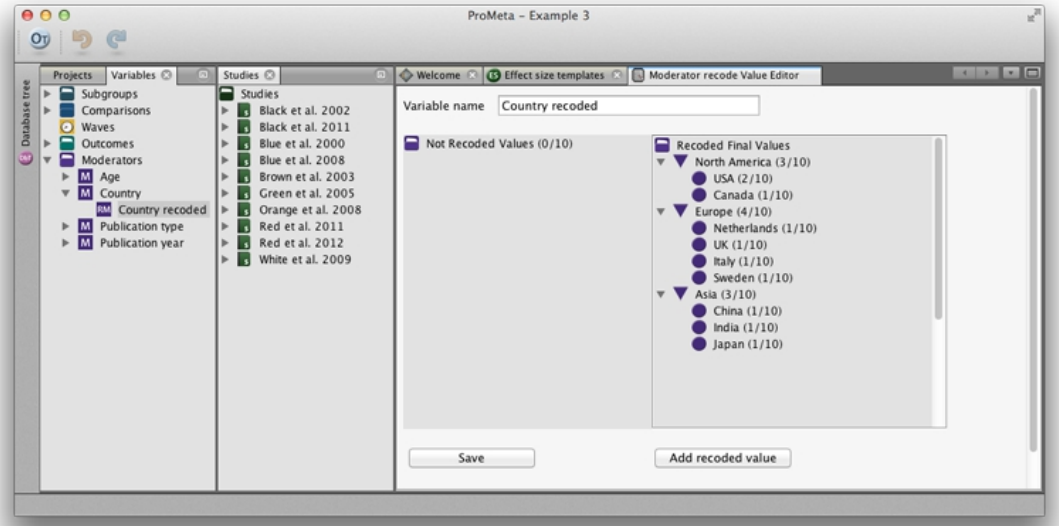
Recode the categorical moderator Country. Recode current values in three categories: North America, Europe, and Asia. Thus, add three new recoded values:





Then, select and drag your old values to each corresponding new recoded value:





Numerical moderators

Recode the numerical moderator Age into two categories (i.e., under 40, over 40) repeating the same procedure seen in Example 1.

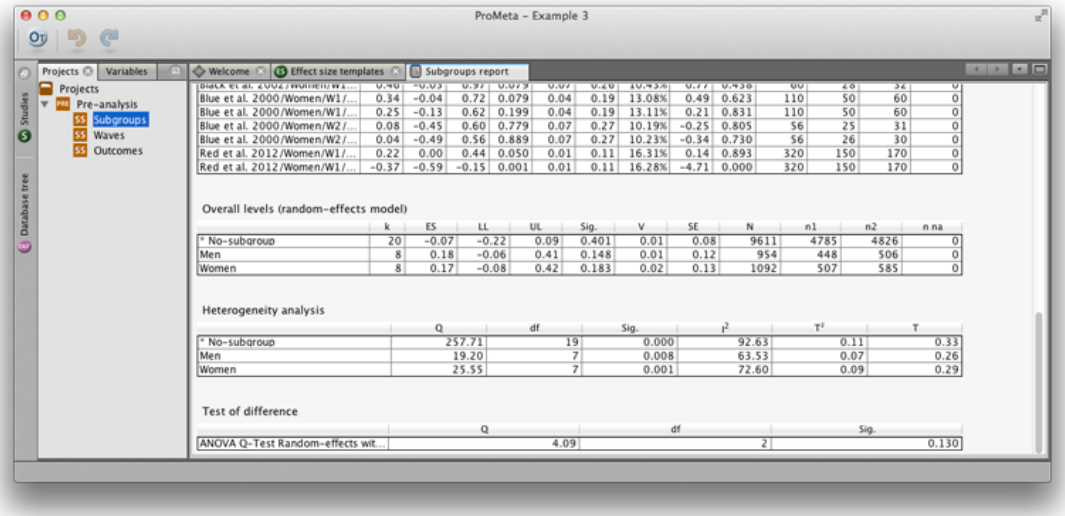
Step 5: Performing analyses

Pre-analysis

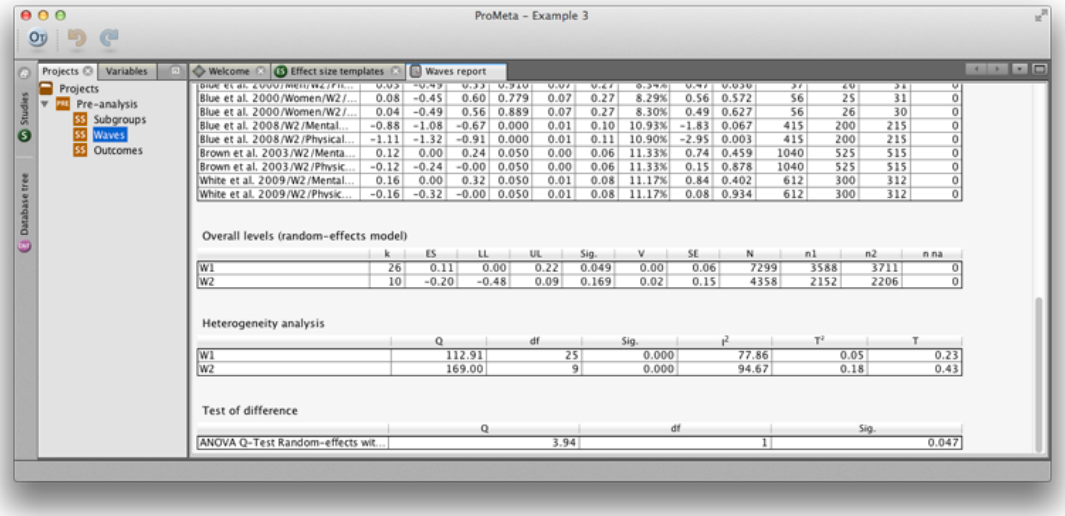
In the Pre-analysis you can test if there are significant differences between subgroups, comparisons, waves, and outcomes. These preliminary analyses provide you with information that can be useful for deciding whether or not combining subgroups, comparisons, waves, and outcomes. For instance, in this example we did not have specific hypotheses about differences between subgroups, whereas we were interested in examining the two waves and outcomes separately.

Results reported in the Pre-Analysis support this analytic strategy showing:

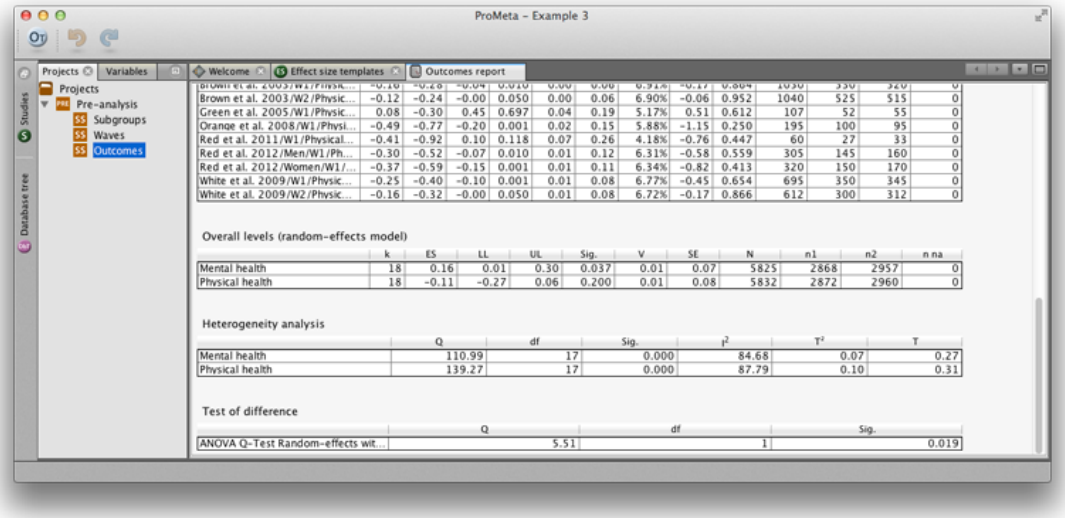
- no significant differences between effect sizes computed in the men and women subgroups



- significant differences between effect sizes computed in Wave1 and Wave2



- significant difference between effect sizes computed for the two outcomes (i.e., mental and physical health)

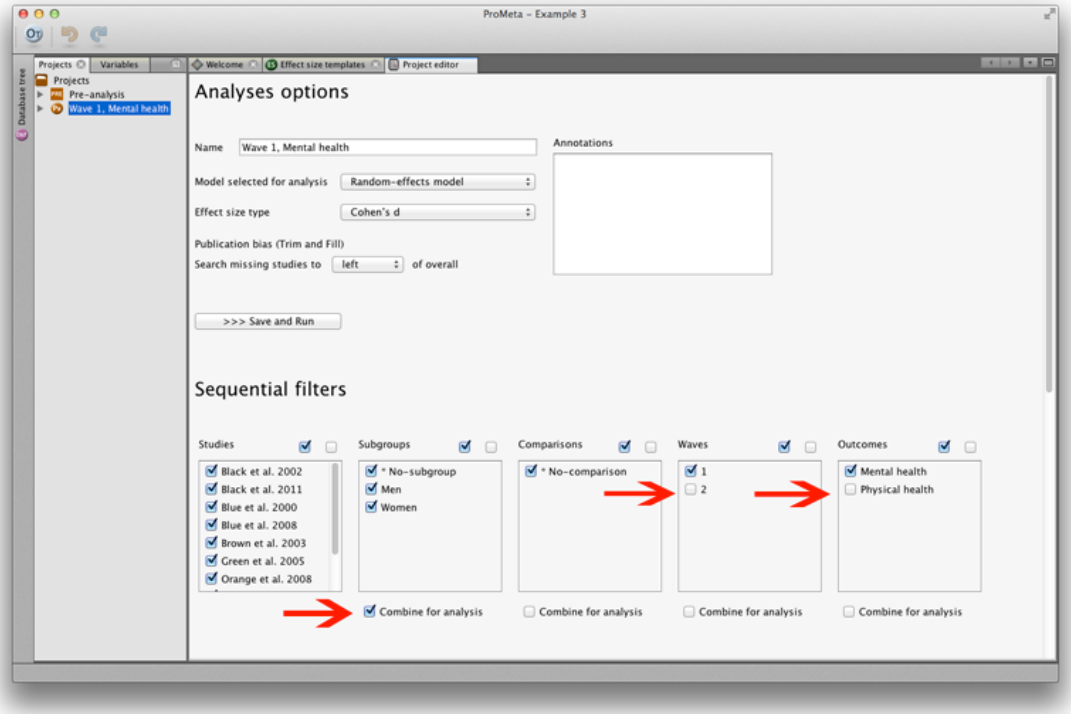


New project

In line with research aims, the plan of analysis will include four distinct projects: one for each combination of Waves and Outcomes. Within each project, combine subgroups to obtain an overall estimate for each study. This choice is motivated by multiple reasons (i.e., we did not have specific hypotheses about differences between subgroups, in the pre-analysis we have verified that the effect sizes computed across subgroups are not significantly different, and we have only three studies that report data separately for the two subgroups). When you combine subgroups, ProMeta combines also, where possible, corresponding moderators that are at the subgroup-level (i.e., categorical moderators are combined if they assumed the same value for the two subgroups and numerical moderators are combined computing a weighted means of original values).

On the basis of these considerations, in the first project (labeled Wave 1, Mental health):

- combine subgroups (i.e., it implies that ProMeta will compute an overall effect size for the three studies in which data were reported separately for men and women)
- select Wave 1 (i.e., in this project data from Wave 2 will not be analyzed)
- select the outcome Mental health (i.e., in this project the outcome Physical health will not be analyzed)



After clicking on Save and run you can navigate through the results as you have already done in Example 1.

Continue saving and running other three projects:

- Project 2: combine subgroups, select Wave 2, select the outcome mental health
- Project 3: combine subgroups, select Wave 1, select the outcome physical health
- Project 4: combine subgroups, select Wave 2, select the outcome physical health

You can see the results of each project and report them in your publication.

Reference

ProMeta (Version 2) [Computer software]. Cesena, Italy: Internovi.

We hope that you will enjoy using ProMeta!