

Example name	Multiple outcomes reading and math
Effect size	Standardized mean difference
Analysis type	Multiple outcomes from same subjects
Level	Advanced

### Synopsis

This analysis uses fictional data. Each study in the analysis has one set of subjects, and these subjects provide data for the impact of tutoring. Outcome is the standardized mean difference for the tutored group vs. the control group. Each study reports three outcomes – the effect size (a) for reading (b) for math (c) for music.

We use this example to show

- How to enter data for multiple outcomes within a study
- How compute a combined effect across outcomes (“What is the effect for “Achievement”)
- How to compare the effect size for different outcomes (“Is the effect larger for reading than for math?”)

[To open a CMA file > Download and Save file | Start CMA | Open file from within CMA](#)

[Download CMA file for computers that use a period to indicate decimals](#)

[Download CMA file for computers that use a comma to indicate decimals](#)

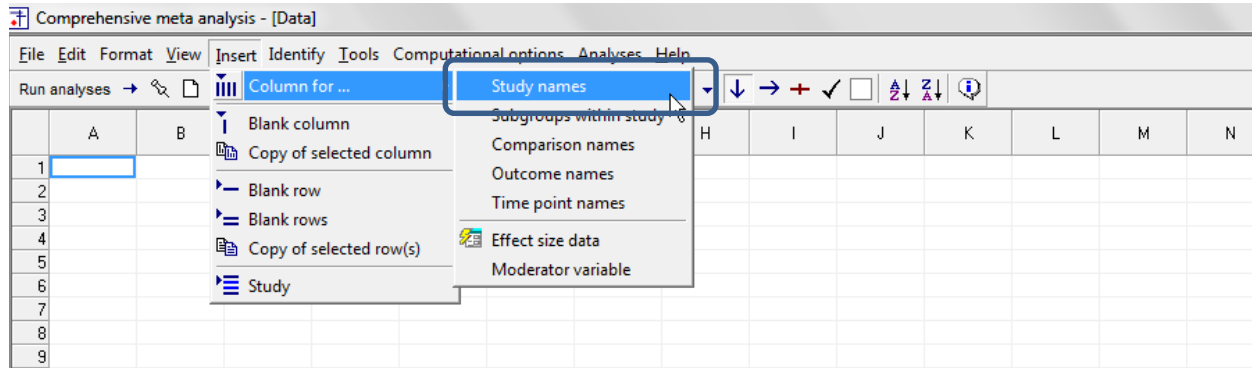
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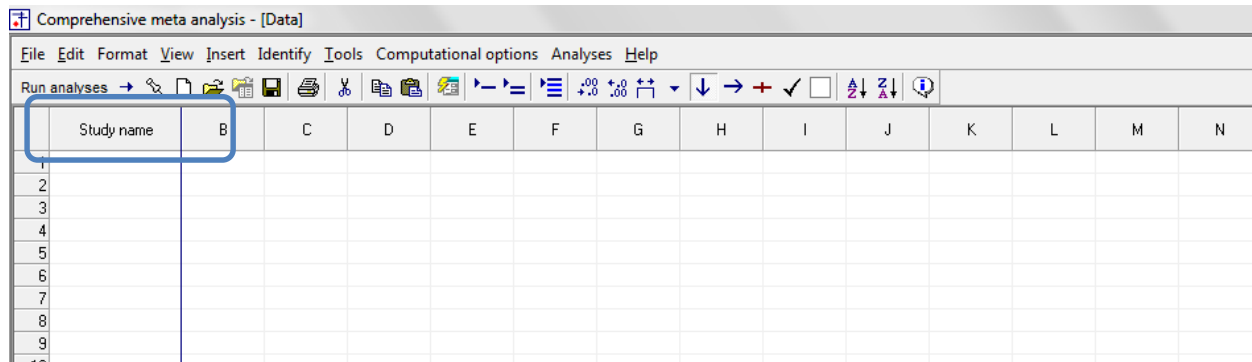
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Start the program

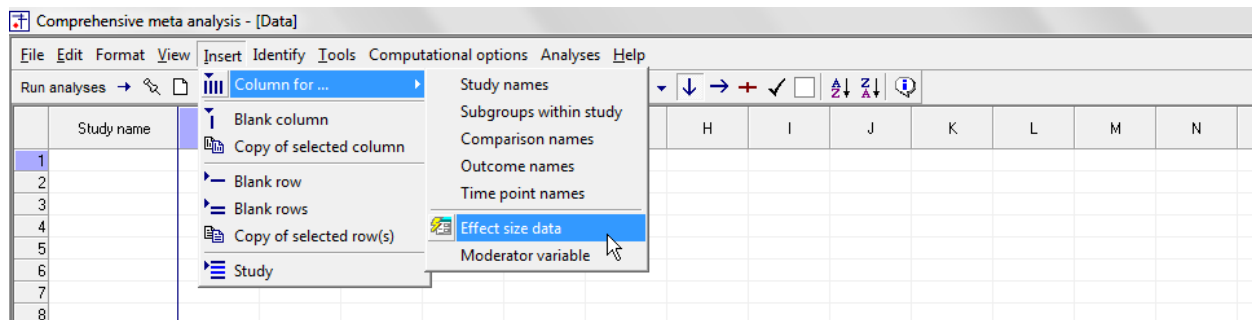
- Select the option [Start a blank spreadsheet]
- Click [OK]
- Click Insert > Column for > Study names



The screen should look like this

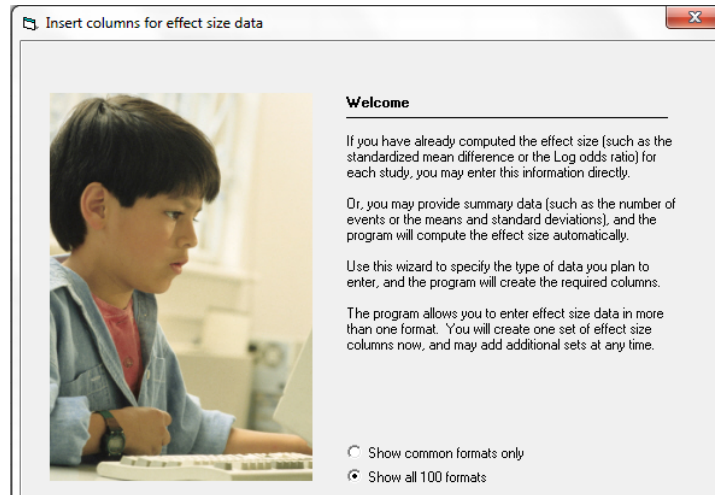


Click Insert > Column for > Effect size data

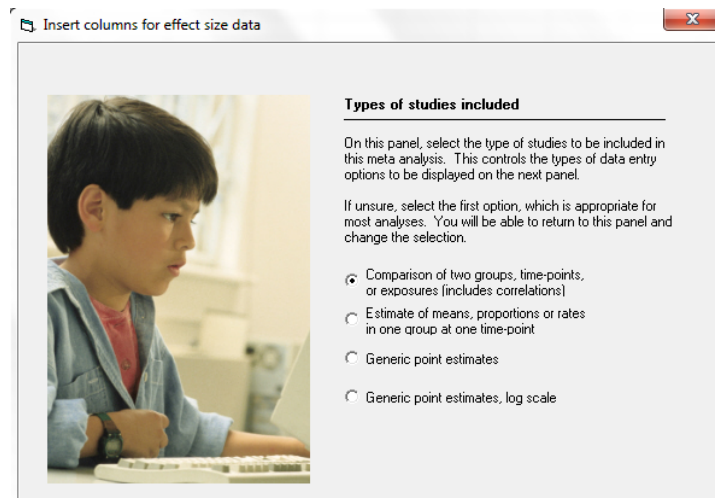


The program displays this wizard

Select [Show all 100 formats]  
Click [Next]

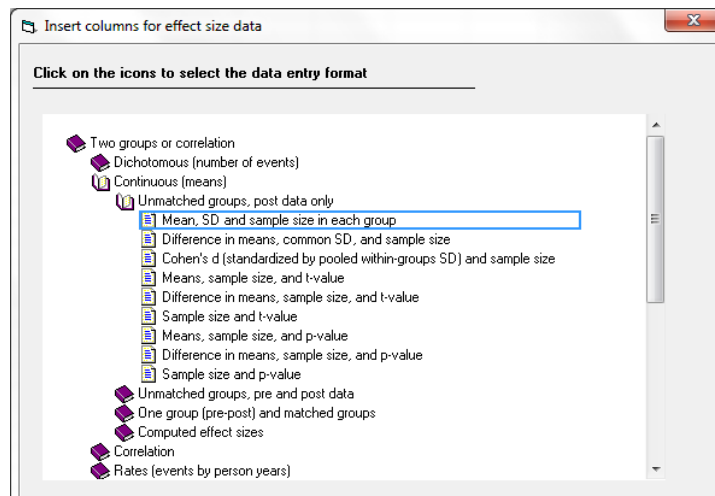


Select [Comparison of two groups...]  
Click [Next]



Drill down to

Continuous (means)  
Unmatched groups, post-data only  
Mean, SD and sample size in each group

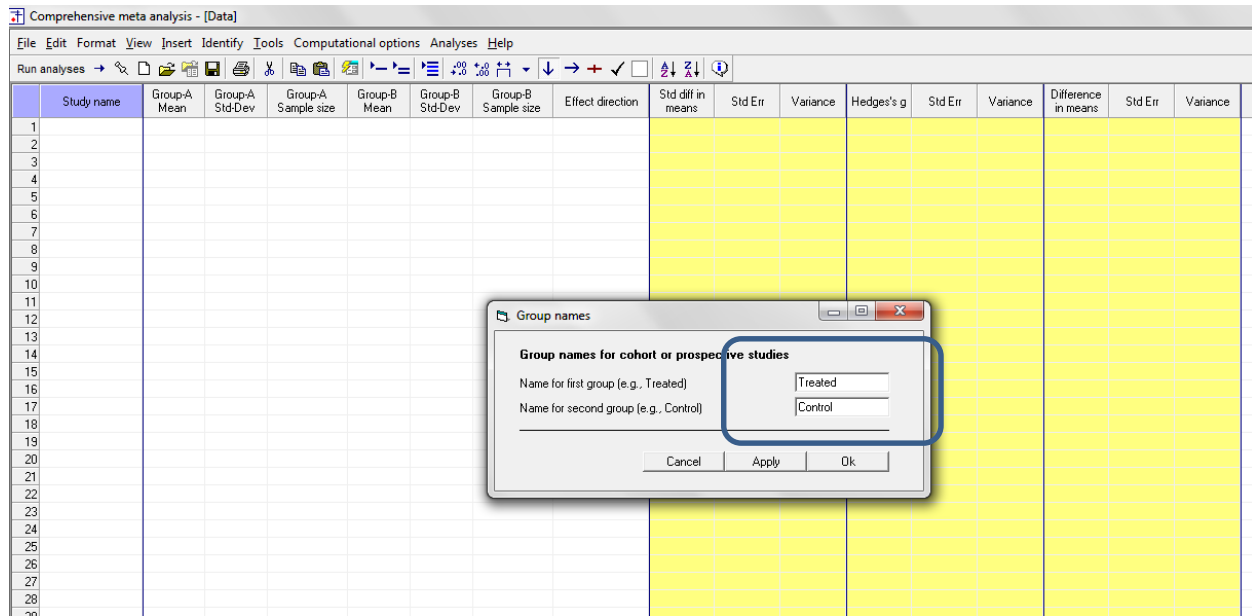


The program displays this wizard

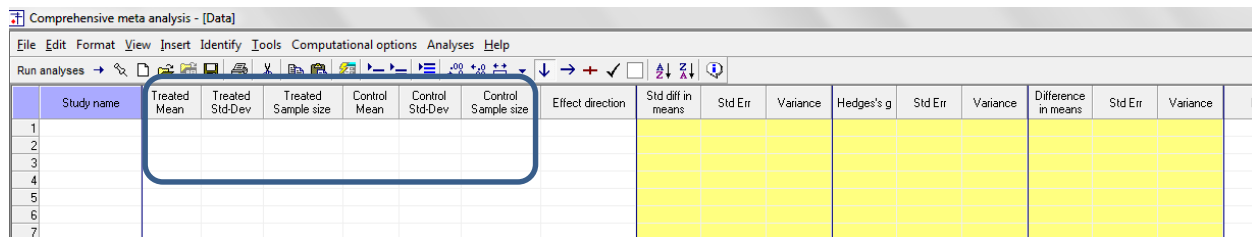
Enter the following labels into the wizard

- First group > Treated
- Second group > Control

Click [Ok] and the program will copy the names into the grid



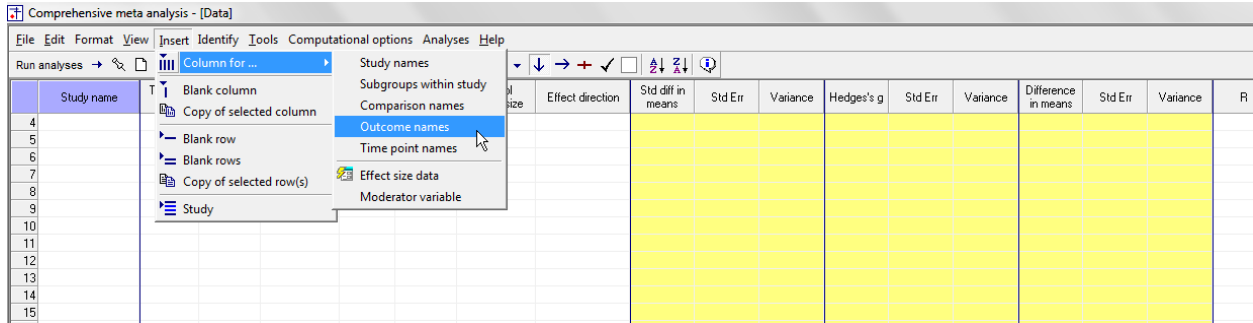
The screen should look like this



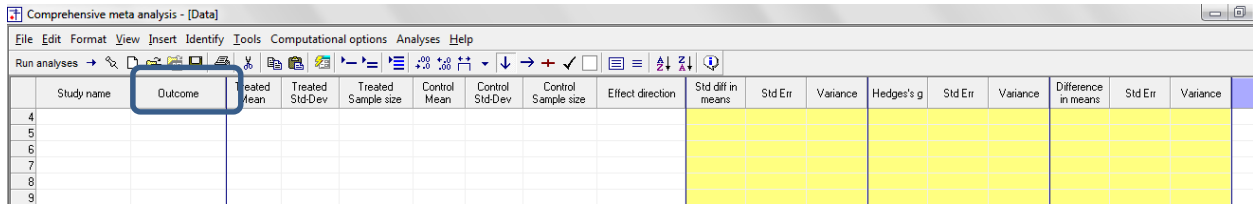
Some (or all) studies will include data for two or more outcomes. These outcomes are based on THE SAME subjects.

The possible outcomes are Reading, Math, and Music. We will be using multiple rows for each study, and need a column that will identify the outcome for each row.

Click Insert > Column for > Outcome names

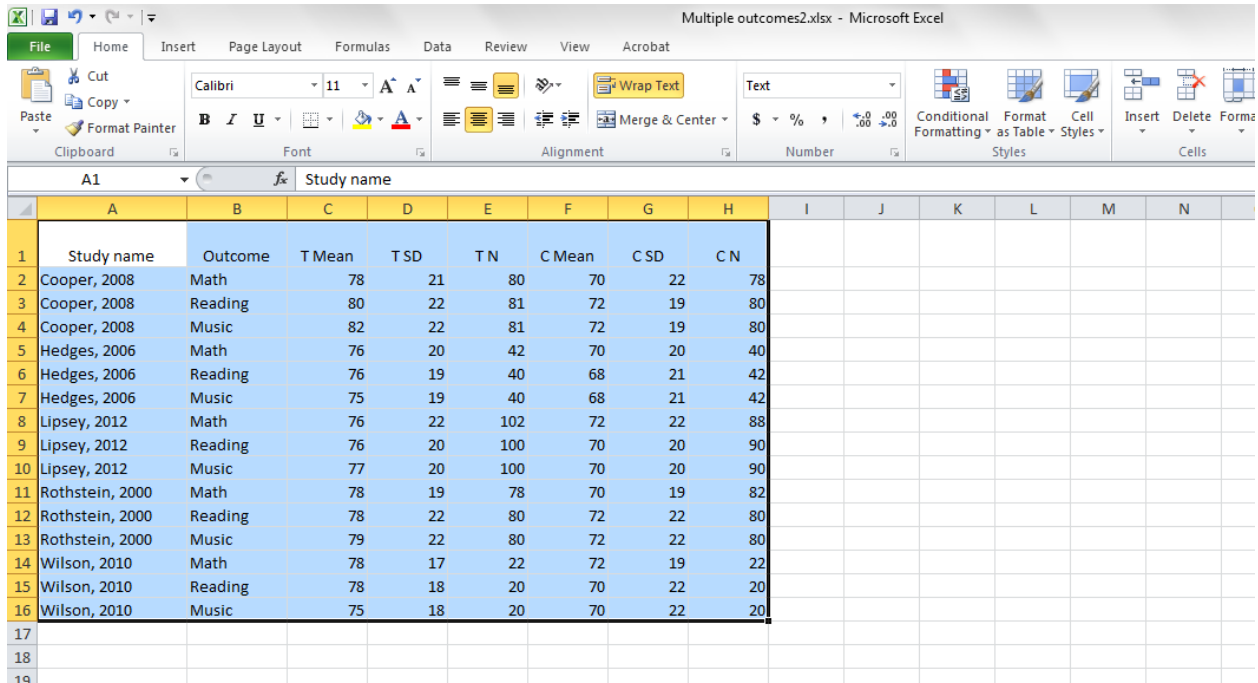


The screen should look like this



Rather than enter the data directly into CMA we will copy the data from Excel

- Switch to Excel and open the file “Multiple Outcomes”
- Highlight the rows and columns as shown, and press CTRL-C to copy to clipboard



Multiple outcomes2.xlsx - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Study name	Outcome	T Mean	T SD	T N	C Mean	C SD	C N						
2	Cooper, 2008	Math	78	21	80	70	22	78						
3	Cooper, 2008	Reading	80	22	81	72	19	80						
4	Cooper, 2008	Music	82	22	81	72	19	80						
5	Hedges, 2006	Math	76	20	42	70	20	40						
6	Hedges, 2006	Reading	76	19	40	68	21	42						
7	Hedges, 2006	Music	75	19	40	68	21	42						
8	Lipsey, 2012	Math	76	22	102	72	22	88						
9	Lipsey, 2012	Reading	76	20	100	70	20	90						
10	Lipsey, 2012	Music	77	20	100	70	20	90						
11	Rothstein, 2000	Math	78	19	78	70	19	82						
12	Rothstein, 2000	Reading	78	22	80	72	22	80						
13	Rothstein, 2000	Music	79	22	80	72	22	80						
14	Wilson, 2010	Math	78	17	22	72	19	22						
15	Wilson, 2010	Reading	78	18	20	70	22	20						
16	Wilson, 2010	Music	75	18	20	70	22	20						
17														
18														
19														

- Switch to CMA
- Click in cell Study-name 1

Click here

The screenshot shows the 'Comprehensive meta analysis - [Data]' window. The table has the following columns: Study name, Outcome, Treated Mean, Treated Std-Dev, Treated Sample size, Control Mean, Control Std-Dev, Control Sample size, Effect direction, Std diff in means, Std Err, Variance, Hedges's g, Std Err, Variance, Difference in means, Std Err, Variance. Row 4 is highlighted, and a blue callout box with the text 'Click here' points to the 'Study name' cell in that row.

- Press [CTRL-V] to paste the data
- The screen should look like this

The screenshot shows the 'Comprehensive meta analysis - [Data]' window with the table populated with 19 studies. The table has the following columns: Study name, Outcome, Treated Mean, Treated Std-Dev, Treated Sample size, Control Mean, Control Std-Dev, Control Sample size, Effect direction, Std diff in means, Std Err, Variance, Hedges's g. Row 4 is highlighted.

	Study name	Outcome	Treated Mean	Treated Std-Dev	Treated Sample size	Control Mean	Control Std-Dev	Control Sample size	Effect direction	Std diff in means	Std Err	Variance	Hedges's g
4	Study name	Outcome	T Mean	T SD	T N	C Mean	C SD	C N					
5	Cooper, 2008	Math	78.000	21.000	80	70.000	22.000	78					
6	Cooper, 2008	Reading	80.000	22.000	81	72.000	19.000	80					
7	Cooper, 2008	Music	82.000	22.000	81	72.000	19.000	80					
8	Hedges, 2006	Math	76.000	20.000	42	70.000	20.000	40					
9	Hedges, 2006	Reading	76.000	19.000	40	68.000	21.000	42					
10	Hedges, 2006	Music	75.000	19.000	40	68.000	21.000	42					
11	Lipsey, 2012	Math	76.000	22.000	102	72.000	22.000	88					
12	Lipsey, 2012	Reading	76.000	20.000	100	70.000	20.000	90					
13	Lipsey, 2012	Music	77.000	20.000	100	70.000	20.000	90					
14	Rothstein, 2000	Math	78.000	19.000	78	70.000	19.000	82					
15	Rothstein, 2000	Reading	78.000	22.000	80	72.000	22.000	80					
16	Rothstein, 2000	Music	79.000	22.000	80	72.000	22.000	80					
17	Wilson, 2010	Math	78.000	17.000	22	72.000	19.000	22					
18	Wilson, 2010	Reading	78.000	18.000	20	70.000	22.000	20					
19	Wilson, 2010	Music	75.000	18.000	20	70.000	22.000	20					
20													

At this point we should check that the data has been copied correctly

The column that had been called “T Mean” is now “Treated Mean”. Similarly, all columns have the intended labels

	Study name	Outcome	Treated Mean	Treated Std-Dev	Treated Sample size	Control Mean	Control Std-Dev	Control Sample size	Effect direction	Std diff in means	Std Err	Variance	Hedges's g
4	Study name	Outcome	T Mean	T SD	T N	C Mean	C SD	C N					
5	Cooper, 2008	Math	78.000	21.000	80	70.000	22.000	78					
6	Cooper, 2008	Reading	80.000	22.000	81	72.000	19.000	80					
7	Cooper, 2008	Music	82.000	22.000	81	72.000	19.000	80					
8	Hedges, 2006	Math	76.000	20.000	42	70.000	20.000	40					
9	Hedges, 2006	Reading	76.000	19.000	40	68.000	21.000	42					
10	Hedges, 2006	Music	75.000	19.000	40	68.000	21.000	42					
11	Lipsey, 2012	Math	76.000	22.000	102	72.000	22.000	88					
12	Lipsey, 2012	Reading	76.000	20.000	100	70.000	20.000	90					
13	Lipsey, 2012	Music	77.000	20.000	100	70.000	20.000	90					
14	Rothstein, 2000	Math	78.000	19.000	78	70.000	19.000	82					
15	Rothstein, 2000	Reading	78.000	22.000	80	72.000	22.000	80					
16	Rothstein, 2000	Music	79.000	22.000	80	72.000	22.000	80					
17	Wilson, 2010	Math	78.000	17.000	22	72.000	19.000	22					
18	Wilson, 2010	Reading	78.000	18.000	20	70.000	22.000	20					
19	Wilson, 2010	Music	75.000	18.000	20	70.000	22.000	20					
20													

- Click anywhere in Row 1
- Select Edit > Delete row, and confirm

Click here

	Treated Mean	Treated Std-Dev	Treated Sample size	Control Mean	Control Std-Dev	Control Sample size	Effect direction	Std diff in means	Std Err	Variance	Hedges's g	Std
4	T Mean	T SD	T N	C Mean	C SD	C N						
5	78.000	21.000	80	70.000	22.000	78						
6	80.000	22.000	81	72.000	19.000	80						
7	82.000	22.000	81	72.000	19.000	80						
8	76.000	20.000	42	70.000	20.000	40						
9	76.000	19.000	40	68.000	21.000	42						
10	75.000	19.000	40	68.000	21.000	42						
11	76.000	22.000	102	72.000	22.000	88						
12	76.000	20.000	100	70.000	20.000	90						
13	77.000	20.000	100	70.000	20.000	90						
14	78.000	19.000	78	70.000	19.000	82						
15	78.000	22.000	80	72.000	22.000	80						
16	79.000	22.000	80	72.000	22.000	80						
17	78.000	17.000	22	72.000	19.000	22						
18	78.000	18.000	20	70.000	22.000	20						
19	75.000	18.000	20	70.000	22.000	20						
20												

The screen should look like this



Comprehensive meta analysis - [Data]

File Edit Format View Insert Identify Tools Computational options Analyses Help

Run analyses → [Icons]

	Study name	Outcome	Treated Mean	Treated Std-Dev	Treated Sample size	Control Mean	Control Std-Dev	Control Sample size	Effect direction	Std diff in means	Std Err	Variance	Hedges's g
4	Cooper, 2008	Math	78.000	21.000	80	70.000	22.000	78					
5	Cooper, 2008	Reading	80.000	22.000	81	72.000	19.000	80					
6	Cooper, 2008	Music	82.000	22.000	81	72.000	19.000	80					
7	Hedges, 2006	Math	76.000	20.000	42	70.000	20.000	40					
8	Hedges, 2006	Reading	76.000	19.000	40	68.000	21.000	42					
9	Hedges, 2006	Music	75.000	19.000	40	68.000	21.000	42					
10	Lipsey, 2012	Math	76.000	22.000	102	72.000	22.000	88					
11	Lipsey, 2012	Reading	76.000	20.000	100	70.000	20.000	90					
12	Lipsey, 2012	Music	77.000	20.000	100	70.000	20.000	90					
13	Rothstein, 2000	Math	78.000	19.000	78	70.000	19.000	82					
14	Rothstein, 2000	Reading	78.000	22.000	80	72.000	22.000	80					
15	Rothstein, 2000	Music	79.000	22.000	80	72.000	22.000	80					
16	Wilson, 2010	Math	78.000	17.000	22	72.000	19.000	22					
17	Wilson, 2010	Reading	78.000	18.000	20	70.000	22.000	20					
18	Wilson, 2010	Music	75.000	18.000	20	70.000	22.000	20					
19													
20													

Click File > Save As and save the file

Comprehensive meta analysis - [C:\Users\Michael\Dropbox\Workshops 2\Multiple outcomes\Multiple outcomes.cma]

File Edit Format View Insert Identify Tools Computational options Analyses Help

New ... [Icons]

Open Ctrl+O  
Opening screen wizard  
Import  
Save Ctrl+S  
Save As...  
Print... Ctrl+P  
Print setup...  
Exit

	Study name	Outcome	Treated Mean	Treated Std-Dev	Treated Sample size	Control Mean	Control Std-Dev	Control Sample size	Effect direction	Std diff in means	Std Err	Variance	Hedges's g	St
			78.000	21.000	80	70.000	22.000	78						
			80.000	22.000	81	72.000	19.000	80						
			82.000	22.000	81	72.000	19.000	80						
			76.000	20.000	42	70.000	20.000	40						
			76.000	19.000	40	68.000	21.000	42						
			75.000	19.000	40	68.000	21.000	42						
			76.000	22.000	102	72.000	22.000	88						
			76.000	20.000	100	70.000	20.000	90						
			77.000	20.000	100	70.000	20.000	90						
13	Rothstein, 2000	Math	78.000	19.000	78	70.000	19.000	82						
14	Rothstein, 2000	Reading	78.000	22.000	80	72.000	22.000	80						
15	Rothstein, 2000	Music	79.000	22.000	80	72.000	22.000	80						
16	Wilson, 2010	Math	78.000	17.000	22	72.000	19.000	22						
17	Wilson, 2010	Reading	78.000	18.000	20	70.000	22.000	20						
18	Wilson, 2010	Music	75.000	18.000	20	70.000	22.000	20						
19														
20														
21														
22														

Note that the file name is now in the header.

- [Save] will over-write the prior version of this file without warning
- [Save As...] will allow you to save the file with a new name

Comprehensive meta analysis - [CAUsers\Michael\Dropbox\Workshops 2\Multiple outcomes\Multiple outcomes.cma]

File Edit Format View Insert Identity Tools Computational options Analyses Help

Run analyses → [Icons]

	Study name	Outcome	Treated Mean	Treated Std-Dev	Treated Sample size	Control Mean	Control Std-Dev	Control Sample size	Effect direction	Std diff in means	Std Err	Variance	Hedges's g
4	Cooper, 2008	Math	78.000	21.000	80	70.000	22.000	78					
5	Cooper, 2008	Reading	80.000	22.000	81	72.000	19.000	80					
6	Cooper, 2008	Music	82.000	22.000	81	72.000	19.000	80					
7	Hedges, 2006	Math	76.000	20.000	42	70.000	20.000	40					
8	Hedges, 2006	Reading	76.000	19.000	40	68.000	21.000	42					
9	Hedges, 2006	Music	75.000	19.000	40	68.000	21.000	42					
10	Lipsey, 2012	Math	76.000	22.000	102	72.000	22.000	88					
11	Lipsey, 2012	Reading	76.000	20.000	100	70.000	20.000	90					
12	Lipsey, 2012	Music	77.000	20.000	100	70.000	20.000	90					
13	Rothstein, 2000	Math	78.000	19.000	78	70.000	19.000	82					
14	Rothstein, 2000	Reading	78.000	22.000	80	72.000	22.000	80					
15	Rothstein, 2000	Music	79.000	22.000	80	72.000	22.000	80					
16	Wilson, 2010	Math	78.000	17.000	22	72.000	19.000	22					
17	Wilson, 2010	Reading	78.000	18.000	20	70.000	22.000	20					
18	Wilson, 2010	Music	75.000	18.000	20	70.000	22.000	20					
19													
20													

We need to tell the program the direction for each effect size

For each study, click in the Direction column and select Auto

Comprehensive meta analysis - [C:\Users\Michael\Dropbox\Workshops 2\Multiple outcomes\Multiple outcomes.cma]

File Edit Format View Insert Identify Tools Computational options Analyses Help

Run analyses →

	Study name	Outcome	Treated Mean	Treated Std Dev	Treated Sample size	Control Mean	Control Std Dev	Control Sample size	Effect direction	Std Eff in means	Std Err	Variance	Hedges's g	Std Err	Variance	Difference in means	Std Err	Variance
4	Cooper, 2008	Math	78.000	21.000	80	70.000	22.000	78	Auto	0.372	0.160	0.026	0.370	0.160	0.026	8.000	3.421	11.704
5	Cooper, 2008	Reading	80.000	22.000	81	72.000	19.000	80	Auto	0.369	0.159	0.025	0.367	0.158	0.025	8.000	3.241	10.507
6	Cooper, 2008	Music	82.000	22.000	81	72.000	19.000	80	Auto	0.486	0.160	0.026	0.464	0.159	0.025	10.000	3.241	10.507
7	Hedges, 2006	Math	76.000	20.000	42	70.000	20.000	40	Auto	0.300	0.222	0.049	0.297	0.220	0.048	6.000	4.419	19.524
8	Hedges, 2006	Reading	76.000	19.000	40	68.000	21.000	42	Auto	0.399	0.223	0.050	0.395	0.221	0.049	8.000	4.430	19.621
9	Hedges, 2006	Music	75.000	19.000	40	68.000	21.000	42	Auto	0.349	0.223	0.050	0.346	0.221	0.049	7.000	4.430	19.621
10	Lipsey, 2012	Math	76.000	22.000	102	72.000	22.000	88	Auto	0.182	0.146	0.021	0.181	0.145	0.021	4.000	3.201	10.245
11	Lipsey, 2012	Reading	76.000	20.000	100	70.000	20.000	90	Auto	0.300	0.146	0.021	0.299	0.146	0.021	6.000	2.906	8.444
12	Lipsey, 2012	Music	77.000	20.000	100	70.000	20.000	90	Auto	0.350	0.146	0.021	0.349	0.146	0.021	7.000	2.906	8.444
13	Rothstein, 2000	Math	78.000	19.000	78	70.000	19.000	82	Auto	0.421	0.160	0.026	0.419	0.159	0.025	8.000	3.005	9.031
14	Rothstein, 2000	Reading	78.000	22.000	80	72.000	22.000	80	Auto	0.273	0.159	0.025	0.271	0.158	0.025	6.000	3.479	12.100
15	Rothstein, 2000	Music	79.000	22.000	80	72.000	22.000	80	Auto	0.318	0.159	0.025	0.317	0.158	0.025	7.000	3.479	12.100
16	Wilson, 2010	Math	78.000	17.000	22	72.000	19.000	22	Auto	0.333	0.304	0.092	0.327	0.298	0.089	6.000	5.436	29.545
17	Wilson, 2010	Reading	78.000	18.000	20	70.000	22.000	20	Auto	0.398	0.319	0.102	0.390	0.313	0.098	8.000	6.356	40.400
18	Wilson, 2010	Music	75.000	18.000	20	70.000	22.000	20	Auto	0.249	0.317	0.101	0.244	0.311	0.097	5.000	6.356	40.400
19																		
20																		
21																		
22																		

- Click the Merge Rows icon

The program will merge the study names for each study

The screenshot shows the 'Comprehensive meta-analysis' software interface. The title bar indicates the file path: [C:\Users\Michael\Dropbox\Workshops 2\Multiple outcomes\Multiple outcomes.cma]. The menu bar includes File, Edit, Format, View, Insert, Identify, Tools, Computational options, Analyses, and Help. The toolbar contains various icons, with the 'Merge Rows' icon (represented by three horizontal lines) highlighted by a blue box. Below the toolbar is a table with the following data:

	Study name	Outcome	Treated Mean	Treated Std-Dev	Treated Sample size	Control Mean	Control Std-Dev	Control Sample size	Effect direction	Std diff in means	Std Err	Variance	Hedges's g
4		Mat	76.000	20.000	42	70.000	20.000	40	Auto	0.300	0.222	0.049	0.297
5	Hedges, 2006	Reading	76.000	19.000	40	68.000	21.000	42	Auto	0.399	0.223	0.050	0.395
6		Musc	75.000	19.000	40	68.000	21.000	42	Auto	0.349	0.223	0.050	0.346
7		Mat	76.000	22.000	102	72.000	22.000	88	Auto	0.182	0.146	0.021	0.181
8	Lipsey, 2012	Reading	76.000	20.000	100	70.000	20.000	90	Auto	0.300	0.146	0.021	0.299
9		Musc	77.000	20.000	100	70.000	20.000	90	Auto	0.350	0.146	0.021	0.349
10		Mat	78.000	19.000	78	70.000	19.000	82	Auto	0.421	0.160	0.026	0.419
11	Rothstein, 2000	Reading	78.000	22.000	80	72.000	22.000	80	Auto	0.273	0.159	0.025	0.271
12		Musc	79.000	22.000	80	72.000	22.000	80	Auto	0.318	0.159	0.025	0.317
13		Mat	78.000	17.000	22	72.000	19.000	22	Auto	0.333	0.304	0.092	0.327
14	Wilson, 2010	Reading	78.000	18.000	20	70.000	22.000	20	Auto	0.398	0.319	0.102	0.390
15		Musc	75.000	18.000	20	70.000	22.000	20	Auto	0.249	0.317	0.101	0.244
16													
17													

The screen should look like this

There are three effect sizes displayed

The screenshot shows a software window titled "Comprehensive meta analysis - [C:\Users\Michael\Dropbox\Workshops 2\Multiple outcomes\Multiple outcomes.cma]". The interface includes a menu bar (File, Edit, Format, View, Insert, Identify, Tools, Computational options, Analyses, Help) and a toolbar. Below the toolbar is a table with columns for Study name, Outcome, Treated Mean, Treated Std-Dev, Treated Sample size, Control Mean, Control Std-Dev, Control Sample size, Effect direction, Std diff in means, Std Err, Variance, Hedges's g, Std Err, Variance, Difference in means, Std Err, and Variance. The table contains 15 rows of data. A context menu is open over the "Hedges's g" column, listing options such as "Sort A-Z", "Sort Z-A", "Column properties", "Data entry assistant", "Formulas", "Show all selected indices", "Show only the primary index", "Set primary index to Hedges's g", and "Customize computed effect size display". The "Set primary index to Hedges's g" option is highlighted.

Study name	Outcome	Treated Mean	Treated Std-Dev	Treated Sample size	Control Mean	Control Std-Dev	Control Sample size	Effect direction	Std diff in means	Std Err	Variance	Hedges's g	Std Err	Variance	Difference in means	Std Err	Variance
4	Math	76.000	20.000	42	70.000	20.000	40	Auto	0.300	0.222	0.049	0.300	0.222	0.049	0.300	0.222	0.049
5	Hedges, 2006	76.000	19.000	40	68.000	21.000	42	Auto	0.399	0.223	0.050	0.399	0.223	0.050	0.399	0.223	0.050
6	Music	75.000	19.000	40	68.000	21.000	42	Auto	0.349	0.223	0.050	0.349	0.223	0.050	0.349	0.223	0.050
7	Math	76.000	22.000	102	72.000	22.000	88	Auto	0.182	0.146	0.021	0.182	0.146	0.021	0.182	0.146	0.021
8	Lipsev, 2012	76.000	20.000	100	70.000	20.000	90	Auto	0.300	0.146	0.021	0.300	0.146	0.021	0.300	0.146	0.021
9	Music	77.000	20.000	100	70.000	20.000	90	Auto	0.350	0.146	0.021	0.350	0.146	0.021	0.350	0.146	0.021
10	Math	78.000	19.000	78	70.000	19.000	82	Auto	0.421	0.160	0.026	0.421	0.160	0.026	0.421	0.160	0.026
11	Rothstein, 2000	78.000	22.000	80	72.000	22.000	80	Auto	0.273	0.159	0.025	0.273	0.159	0.025	0.273	0.159	0.025
12	Music	79.000	22.000	80	72.000	22.000	80	Auto	0.318	0.159	0.025	0.318	0.159	0.025	0.318	0.159	0.025
13	Math	78.000	17.000	22	72.000	19.000	22	Auto	0.333	0.304	0.092	0.333	0.304	0.092	0.333	0.304	0.092
14	Wilson, 2010	78.000	18.000	20	70.000	22.000	20	Auto	0.398	0.319	0.102	0.398	0.319	0.102	0.398	0.319	0.102
15	Music	75.000	18.000	20	70.000	22.000	20	Auto	0.249	0.317	0.101	0.249	0.317	0.101	0.249	0.317	0.101

- Right-click in the section for Hedges's g
- Select Set primary index to Hedges's g

- To run the analysis, click [Run analysis]

	Study name	Outcome	Treated Mean	Treated Std-Dev	Treated Sample size	Control Mean	Control Std-Dev	Control Sample size	Effect direction	Std diff in means	Std Err	Variance	Hedges's g
4		Math	76.000	20.000	42	70.000	20.000	40	Auto	0.300	0.222	0.049	0.297
5	Hedges, 2006	Reading	76.000	19.000	40	68.000	21.000	42	Auto	0.399	0.223	0.050	0.395
6		Music	75.000	19.000	40	68.000	21.000	42	Auto	0.349	0.223	0.050	0.346
7		Math	76.000	22.000	102	72.000	22.000	88	Auto	0.182	0.146	0.021	0.181
8	Lipsey, 2012	Reading	76.000	20.000	100	70.000	20.000	90	Auto	0.300	0.146	0.021	0.299
9		Music	77.000	20.000	100	70.000	20.000	90	Auto	0.350	0.146	0.021	0.349
10		Math	78.000	19.000	78	70.000	19.000	82	Auto	0.421	0.160	0.026	0.419
11	Rothstein, 2000	Reading	78.000	22.000	80	72.000	22.000	80	Auto	0.273	0.159	0.025	0.271
12		Music	79.000	22.000	80	72.000	22.000	80	Auto	0.318	0.159	0.025	0.317
13		Math	78.000	17.000	22	72.000	19.000	22	Auto	0.333	0.304	0.092	0.327
14	Wilson, 2010	Reading	78.000	18.000	20	70.000	22.000	20	Auto	0.398	0.319	0.102	0.390
15		Music	75.000	18.000	20	70.000	22.000	20	Auto	0.249	0.317	0.101	0.244
16													
17													

The issue we need to address when working with multiple outcomes is the fact that the outcomes are not independent of each other, and therefore do not contain independent information

If we compute an effect size for math only, or for reading only, or for math and reading separately, the effect size and its variance are valid. But, if we compute an effect size based on math and reading, a variance that is based on the combined sample size (counting each subject once for math and again for reading) overstates the amount of information contained in the data, over-estimates the precision of the summary effect and under-estimates the variance.

We can see how this plays out in the analyses that follow.

By default the program picks one outcome for each study. Since each study had a row for math, the program is showing an analysis for Math only.

Model	Study name	Outcome	Statistics for each study							Std diff in means and 95% CI				
			Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	-2.00	-1.00	0.00	1.00	2.00
	Cooper, 2008	Math	0.372	0.160	0.026	0.058	0.687	2.318	0.020					
	Hedges, 2006	Math	0.300	0.222	0.049	-0.135	0.735	1.350	0.177					
	Lipsey, 2012	Math	0.182	0.146	0.021	-0.104	0.468	1.247	0.212					
	Rothstein, 2000	Math	0.421	0.160	0.026	0.108	0.734	2.633	0.008					
	Wilson, 2010	Math	0.333	0.304	0.092	-0.262	0.928	1.096	0.273					
Fixed			0.315	0.080	0.006	0.158	0.472	3.935	0.000					

We can run an analysis for math only (that is, selecting math for studies that report an effect size for math, and omitting studies that do not)

Right-click on the Outcome column and click [Select by outcome]

Model	Study name	Outcome	Statistics for each study							Std diff in means and 95% CI				
			Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	-2.00	-1.00	0.00	1.00	2.00
	Cooper, 2008	Math	0.372	0.160	0.026	0.058	0.687	2.318	0.020					
	Hedges, 2006	Math	0.300	0.222	0.049	-0.135	0.735	1.350	0.177					
	Lipsey, 2012	Math	0.182	0.146	0.021	-0.104	0.468	1.247	0.212					
	Rothstein, 2000	Math	0.421	0.160	0.026	0.108	0.734	2.633	0.008					
	Wilson, 2010	Math	0.333	0.304	0.092	-0.262	0.928	1.096	0.273					
Fixed			0.006	0.158	0.472	3.935	0.000							





## Select Math

The screenshot displays the 'Comprehensive meta-analysis - [Analysis]' software interface. A 'Select by...' dialog box is open, allowing the user to choose outcomes for the meta-analysis. The dialog has three tabs: 'Studies', 'Outcomes', and 'Moderator'. The 'Outcomes' tab is active, showing a list of outcomes: Math (checked), Music (unchecked), and Reading (unchecked). There are 'Select all' and 'Clear all' buttons. Below this, there are radio button options for 'For studies with multiple outcomes': 'Use the mean of the selected outcomes', 'Use all of the selected outcomes, assuming independence', and 'Use the first outcome, based on this sequence' (which is selected). A list box below shows 'Math' selected, with 'Move up' and 'Move down' buttons. At the bottom of the dialog are 'Cancel', 'Apply', and 'Ok' buttons.

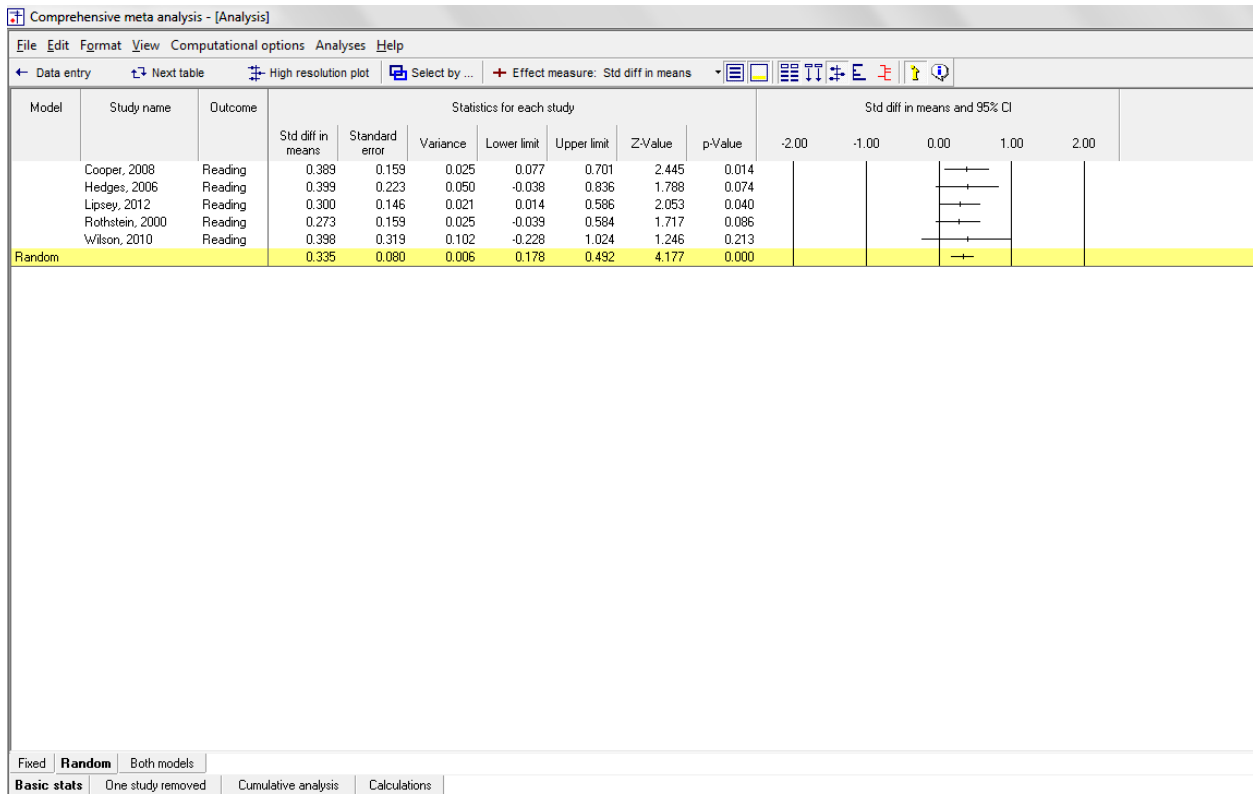
The background shows a table of studies and a forest plot. The table has columns for Model, Study name, Outcome, Std diff in means, and Standard error. The forest plot shows the standard difference in means and 95% confidence intervals for each study.

Model	Study name	Outcome	Std diff in means	Standard error
	Cooper, 2008	Math	0.372	0.000
	Hedges, 2006	Math	0.300	0.000
	Lipsey, 2012	Math	0.182	0.000
	Rothstein, 2000	Math	0.421	0.000
	Wilson, 2010	Math	0.333	0.000
Fixed			0.315	0.000



Follow the same steps to run an analysis for Reading

Note that the variance for the summary effect is 0.006



Suppose we want to run an analysis for math *and* for reading

- Check Math
- Check Reading
- Uncheck Music
- Select Use all of the selected outcomes, assuming independence

As we shall see momentarily, this analysis, which includes information from both math and reading, is incorrect. We need to split this into two separate analyses.

The screenshot shows the 'Comprehensive meta-analysis - [Analysis]' window. The main data table is as follows:

Model	Study name	Outcome	Statistics for each study					Z-Value
			Std diff in means	Standard error	Variance	Lower limit	Upper limit	
	Cooper,	Math	0.372	0.160	0.026	0.058	0.687	2.31
	Cooper,	Reading	0.389	0.159	0.025	0.077	0.701	2.44
	Hedges,	Math	0.300	0.222	0.049	-0.135	0.735	1.35
	Hedges,	Reading	0.399	0.223	0.050	-0.038	0.836	1.78
	Lipsey,	Math	0.182	0.146	0.021	-0.104	0.468	1.24
	Lipsey,	Reading	0.300	0.146	0.021	0.014	0.586	2.05
	Rothstein,	Math	0.421	0.160	0.026	0.108	0.734	2.63
	Rothstein,	Reading	0.273	0.159	0.025	-0.039	0.584	1.71
	Wilson,	Math	0.333	0.304	0.092	-0.262	0.928	1.09
	Wilson,	Reading	0.398	0.319	0.102	-0.228	1.024	1.24
<b>Fixed</b>			<b>0.325</b>	<b>0.057</b>	<b>0.003</b>	<b>0.214</b>	<b>0.436</b>	<b>5.73</b>

The 'Select by' dialog box is open, showing the 'Outcomes' tab. Under 'Include the following outcomes', 'Math' and 'Reading' are checked, while 'Music' is unchecked. Under 'For studies with multiple outcomes', the option 'Use all of the selected outcomes, assuming independence' is selected.

## Select Computational options > Mixed and random effects options

Comprehensive meta analysis - [Analysis]

File Edit Format View Computational options Analyses Help

Data entry Next Effect measure Std diff in means CI Level 95%

Select by ...

Group by ...

Compare groups

Mixed and random effects options

Model	Study name	Outcome	Statistics for each study					Std diff in means and 95% CI				
			Variance	Lower limit	Upper limit	Z-Value	p-Value	-2.00	-1.00	0.00	1.00	2.00
	Cooper, M.		0.026	0.058	0.687	2.318	0.020					
	Cooper, R		0.025	0.077	0.701	2.445	0.014					
	Hedges, M.		0.049	-0.135	0.735	1.350	0.177					
	Hedges, Reading	0.399	0.050	-0.038	0.836	1.788	0.074					
	Lipsey, Math	0.182	0.021	-0.104	0.468	1.247	0.212					
	Lipsey, Reading	0.300	0.021	0.014	0.586	2.053	0.040					
	Rothstein, Math	0.421	0.026	0.108	0.734	2.633	0.008					
	Rothstein, Reading	0.273	0.025	-0.039	0.584	1.717	0.086					
	Wilson, Math	0.333	0.092	-0.262	0.928	1.096	0.273					
	Wilson, Reading	0.398	0.102	-0.228	1.024	1.246	0.213					
Random			0.325	0.057	0.003	0.214	0.436	5.736	0.000			

## Select “Do not assume a common among-study variance”

Comprehensive meta analysis - [Analysis]

File Edit Format View Computational options Analyses Help

Data entry Next table High resolution plot Select by ... Effect measure: Std diff in means

Model	Study name	Outcome	Statistics for each study					Std diff in means and 95% CI					
			Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	-2.00	-1.00	0.00	1.00
	Cooper, Math		0.372	0.160	0.026	0.058	0.687	2.318	0.020				
	Cooper, Reading		0.389	0.159	0.025	0.077	0.701	2.445	0.014				
	Hedges, Math		0.300	0.222	0.049	-0.135	0.735	1.350	0.177				
	Hedges, Reading		0.399	0.223	0.050	-0.038	0.836	1.788	0.074				
	Lipsey, Math		0.182	0.146	0.021	-0.104	0.468	1.247	0.212				
	Lipsey, Reading		0.300	0.146	0.021	0.014	0.586	2.053	0.040				
	Rothstein, Math		0.421	0.160	0.026	0.108	0.734	2.633	0.008				
	Rothstein, Reading		0.273	0.159	0.025	-0.039	0.584	1.717	0.086				
	Wilson, Math		0.333	0.304	0.092	-0.262	0.928	1.096	0.273				
	Wilson, Reading		0.398	0.319	0.102	-0.228	1.024	1.246	0.213				
Random			0.325	0.057	0.003	0.214	0.436	5.736	0.000				

Mixed and random effects options

**Combining studies within a subgroup**

Assume a common among-study variance component across subgroups (pool within-group estimates of tau-squared).

Do not assume a common among-study variance component across subgroups (do not pool within-group estimates of tau-squared). This is the option used by RevMan.

**Combining subgroups to yield an overall effect**

Combine subgroups using fixed effect model

Combine subgroups using random effects model

Cancel Apply Ok

Select Computational options > Group by > Outcome

Leave the two check-boxes unchecked

The screenshot shows the RevMan software interface. The main window displays a forest plot with the following data:

Model	Study name	Variance	Lower limit	Upper limit	Z-Value	p-Value	Std diff in means and 95% CI				
	Cooper, M.	0.026	0.058	0.687	2.318	0.020					
	Cooper, R	0.025	0.077	0.701	2.445	0.014					
	Hedges, M.	0.049	-0.135	0.735	1.350	0.177					
	Hedges, Reading	0.399	0.223	0.050	-0.038	0.836	1.788	0.074			
	Lipsey, Math	0.182	0.146	0.021	-0.104	0.468	1.247	0.212			
	Lipsey, Reading	0.300	0.146	0.021	0.014	0.586	2.053	0.040			
	Rothstein, Math	0.421	0.160	0.026	0.108	0.734	2.633	0.008			
	Rothstein, Reading	0.273	0.159	0.025	-0.039	0.584	1.717	0.086			
	Wilson, Math	0.333	0.304	0.092	-0.262	0.928	1.096	0.273			
	Wilson, Reading	0.398	0.319	0.102	-0.228	1.024	1.246	0.213			
Fixed		0.325	0.057	0.003	0.214	0.436	5.736	0.000			

The 'Group by' dialog box is open, showing the following configuration:

- Run a separate analysis for each level of ...
- Outcome (selected in dropdown)
- Also run analysis across levels of outcome
- Compare effect at different levels of outcome
- Buttons: Cancel, Reset, Ok

Comprehensive meta analysis - [Analysis]															
File Edit Format View Computational options Analyses Help															
← Data entry Next table High resolution plot Select by ... Effect measure: Std diff in means															
Model	Group by Outcome	Study name	Outcome	Statistics for each study							Std diff in means and 95% CI				
				Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	-2.00	-1.00	0.00	1.00	2.00
	Math	Cooper,	Math	0.372	0.160	0.026	0.058	0.687	2.318	0.020					
	Math	Hedges,	Math	0.300	0.222	0.049	-0.135	0.735	1.350	0.177					
	Math	Lipsey,	Math	0.182	0.146	0.021	-0.104	0.468	1.247	0.212					
	Math	Rothstein,	Math	0.421	0.160	0.026	0.108	0.734	2.633	0.008					
	Math	Wilson,	Math	0.333	0.304	0.092	-0.262	0.928	1.096	0.273					
Random	Math			0.315	0.080	0.006	0.158	0.472	3.935	0.000					
	Reading	Cooper,	Reading	0.388	0.159	0.025	0.077	0.701	2.445	0.014					
	Reading	Hedges,	Reading	0.399	0.223	0.050	-0.038	0.836	1.788	0.074					
	Reading	Lipsey,	Reading	0.300	0.146	0.021	0.014	0.586	2.053	0.040					
	Reading	Rothstein,	Reading	0.273	0.159	0.025	-0.039	0.584	1.717	0.086					
	Reading	Wilson,	Reading	0.398	0.319	0.102	-0.228	1.024	1.246	0.213					
Random	Reading			0.335	0.080	0.006	0.178	0.492	4.177	0.000					

The analysis for math is the same as the one we saw before, with a variance of 0.006  
The analysis for reading is the same as the one we saw before, with a variance of 0.006

Each of these analyses is valid, as the variance is based on the actual number of students in the studies.

However, consider what happens if we also compute an overall effect size

Click Computational options > Group by

Add a check-mark as shown

The screenshot shows the 'Comprehensive meta-analysis - [Analysis]' window. The main table displays data for two outcomes: Math and Reading. The 'Group by' dialog box is open, showing 'Outcome' selected in the dropdown menu. The checkbox 'Also run analysis across levels of outcome' is checked, and 'Compare effect at different levels of outcome' is unchecked. The dialog box has 'Cancel', 'Reset', and 'Ok' buttons.

Model	Group by Outcome	Study name	Outcome	Statistics for each study							Std diff in means and 95% CI				
				Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	-2.00	-1.00	0.00	1.00	2.00
	Math	Cooper,	Math	0.372	0.160	0.026	0.058	0.687	2.318	0.020					
	Math	Hedges,	Math	0.300	0.222	0.049	-0.135	0.735	1.350	0.177					
	Math	Lipsey,	Math	0.182	0.146	0.021	-0.104	0.468	1.247	0.212					
	Math	Rothstein,	Math	0.421	0.160	0.026	0.108	0.734	2.633	0.008					
	Math	Wilson,	Math	0.333	0.304	0.092	-0.262	0.928	1.096	0.273					
Random	Math			0.315	0.080	0.006	0.158	0.000							
	Reading	Cooper,	Reading	0.389	0.159	0.025	0.077	0.000							
	Reading	Hedges,	Reading	0.399	0.223	0.050	-0.038	0.000							
	Reading	Lipsey,	Reading	0.300	0.146	0.021	0.014	0.000							
	Reading	Rothstein,	Reading	0.273	0.159	0.025	-0.039	0.000							
	Reading	Wilson,	Reading	0.398	0.319	0.102	-0.228	1.111							
Random	Reading			0.335	0.080	0.006	0.178	0.000							



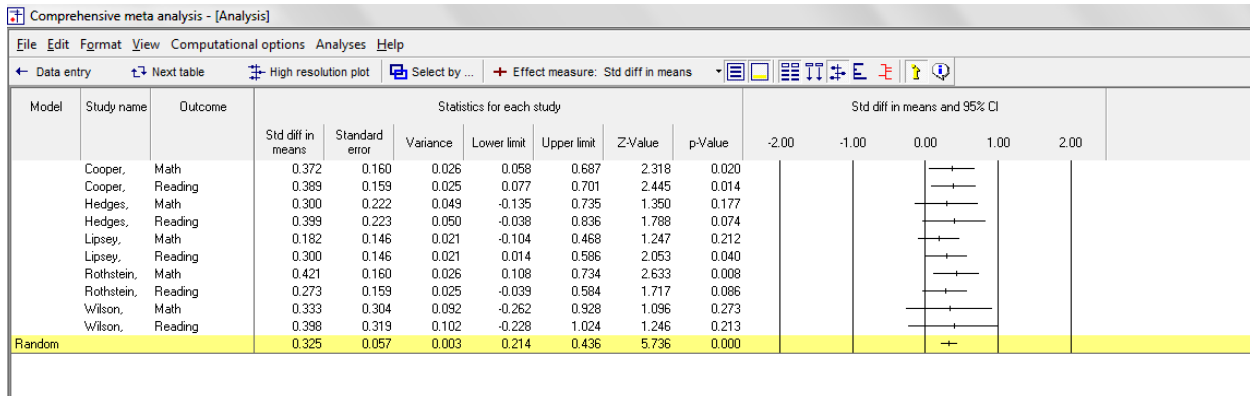
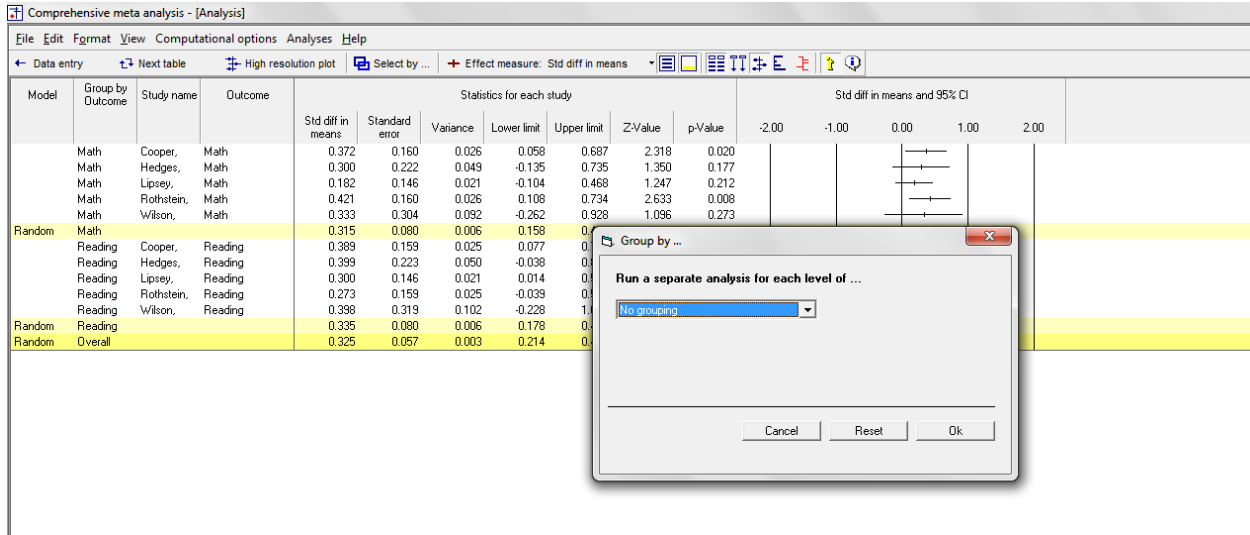
Comprehensive meta analysis - [Analysis]															
File Edit Format View Computational options Analyses Help															
← Data entry → Next table ⇄ High resolution plot Select by ... Effect measure: Std diff in means															
Model	Group by Outcome	Study name	Outcome	Statistics for each study							Std diff in means and 95% CI				
				Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	-2.00	-1.00	0.00	1.00	2.00
	Math	Cooper,	Math	0.372	0.160	0.026	0.058	0.687	2.318	0.020					
	Math	Hedges,	Math	0.300	0.222	0.049	-0.135	0.735	1.350	0.177					
	Math	Lipsey,	Math	0.182	0.146	0.021	-0.104	0.468	1.247	0.212					
	Math	Rothstein,	Math	0.421	0.160	0.026	0.108	0.734	2.633	0.008					
	Math	Wilson,	Math	0.333	0.304	0.092	-0.262	0.928	1.096	0.273					
Random	Math			0.315	0.080	0.006	0.158	0.472	3.935	0.000					
	Reading	Cooper,	Reading	0.389	0.159	0.025	0.077	0.701	2.445	0.014					
	Reading	Hedges,	Reading	0.399	0.223	0.050	-0.038	0.836	1.788	0.074					
	Reading	Lipsey,	Reading	0.300	0.146	0.021	0.014	0.586	2.053	0.040					
	Reading	Rothstein,	Reading	0.273	0.159	0.025	-0.039	0.584	1.717	0.086					
	Reading	Wilson,	Reading	0.398	0.319	0.102	-0.228	1.024	1.246	0.213					
Random	Reading			0.335	0.080	0.006	0.178	0.492	4.177	0.000					
Random	Overall			0.325	0.057	0.003	0.214	0.436	5.736	0.000					

The program now computes the overall effect size. Where the variance for reading was 0.006 and the variance for math was 0.006, the variance for the overall effect is shown as 0.003.

This would be the correct value if the math studies and the reading studies were based on different sets of students, and (it follows) the correlation between the two effect sizes was zero. Indeed, this is the assumption that we made when we said “Assuming independence”. However, it’s very unlikely that this assumption is valid. To the extent that the true correlation is greater than 0.0, the information provided by math will overlap with the information provided by reading, and the true variance will be greater than 0.003. In the extreme, if the actual correlation is 1.0, the true variance will be 0.006.

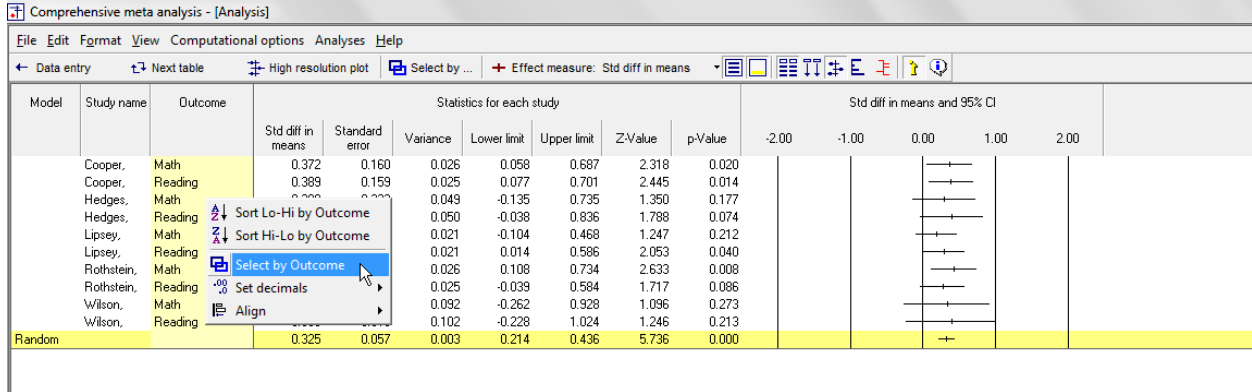
As we see here, when we assume independence the program assumes the correlation between effect sizes for math and reading is 0.0. We can also tell the program NOT to treat these as independent, but rather to compute a composite score for each study (using the mean of math and reading), assuming that the correlation between them is 1.0.

First, turn off grouping



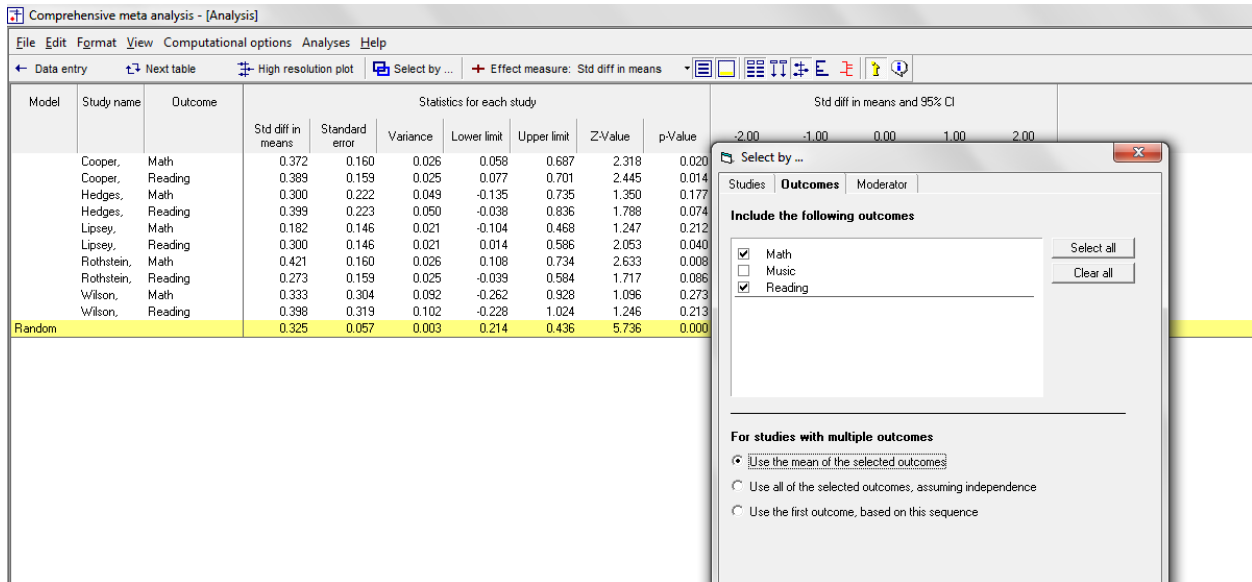
We see that the variance, based on a correlation of zero between effects for math and effects for reading, is still 0.003

Click Select by Outcome



Check math  
 Check reading  
 Un-check Music

Select Use the mean of the selected outcomes



Comprehensive meta analysis - [Analysis]

File Edit Format View Computational options Analyses Help

Data entry Next table High resolution plot Select by ... Effect measure: Std diff in means

Model	Study name	Outcome	Statistics for each study							Std diff in means and 95% CI				
			Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	-2.00	-1.00	0.00	1.00	2.00
	Cooper,	Combined	0.381	0.160	0.026	0.067	0.634	2.381	0.017					
	Hedges,	Combined	0.350	0.223	0.050	-0.087	0.786	1.570	0.116					
	Lipsey,	Combined	0.241	0.146	0.021	-0.045	0.527	1.651	0.099					
	Rothstein,	Combined	0.347	0.159	0.025	0.035	0.659	2.177	0.030					
	Wilson,	Combined	0.365	0.312	0.097	-0.245	0.976	1.173	0.241					
Random			0.325	0.080	0.006	0.168	0.482	4.059	0.000					

Comprehensive meta analysis - [Analysis]

File Edit Format View Computational options Analyses Help

Data entry Next table High resolution plot Select by ... Effect measure: Std diff in means

Model	Study name	Outcome	Statistics for each study					Std diff in means and 95% CI				
			Std diff in means	Standard error	Variance	Lower limit	Upper limit	-2.00	-1.00	0.00	1.00	2.00
	Cooper, 2008	Reading	0.389	0.159	0.025	0.077	0.70					
	Hedges, 2006	Reading	0.399	0.223	0.050	-0.038	0.83					
	Lipsey, 2012	Reading	0.300	0.146	0.021	0.014	0.58					
	Rothstein, 2000	Reading	0.273	0.159	0.025	-0.039	0.58					
	Wilson, 2010	Reading	0.398	0.319	0.102	-0.228	1.02					
Random			0.335	0.080	0.006	0.178	0.49					

Select by ...

Studies Outcomes Moderator

**Include the following outcomes**

Math

Music

Reading

Select all

Clear all

---

**For studies with multiple outcomes**

Use the mean of the selected outcomes

Use all of the selected outcomes, assuming independence

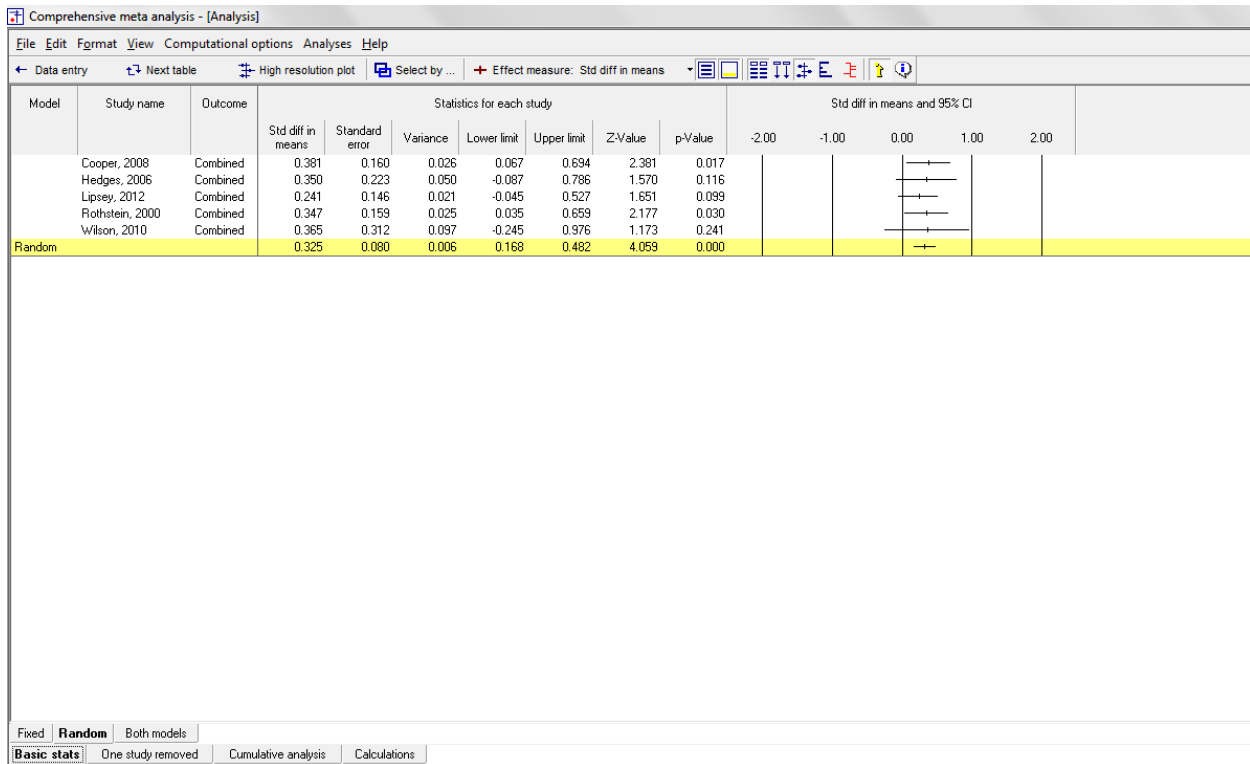
Use the first outcome, based on this sequence

Cancel

Apply

Ok

Fixed Random Both models



- The program computes a composite score for each study using the mean of reading and math
- The program assumes that the correlation between reading and math is 1.0, and so the variance of the composite is the same as the variance of either outcome alone
- Therefore, the variance of the summary score is still 0.006

In sum,

If we tell the program to treat effect size for math and reading as independent, the program assumes the correlation between them is 0, which over-estimates the precision of the summary effect (since the correlation is probably higher than 0).

If we tell the program to form a composite for math and reading, the program assumes the correlation between them is 1.0, which under-estimates the precision of the summary effect (since the correlation is probably less than 1.0).

Between the two, it's probably better to use the composite approach. This could be considered the more conservative approach in the sense that it under-estimates the precision.

Also, this approach is likely to yield a pretty good estimate of the correct variance if most studies contribute only one effect size (and a few contribute two), and/or the actual correlation is near 1.0. For example, this would be the case if the different outcomes are scores on various math tests, where some schools use A, others B, others C, others A and B, others B and C, and so on.

However, there are cases where we want to get the most precise estimate possible for the variance. And, if studies contribute more than two effects and we treat the correlation as 1.0, we will be seriously underestimating the precision of the summary effect size.

In these cases we can step outside CMA, compute composite effects with a variance based on any correlation, and then copy these values back into CMA

While we may not know the actual correlation, this process allows us to use correlations that are more plausible than 0 or 1. For example, if we expect that the correlation falls in the range of 0.50 to 0.80 we may elect to use 0.80 (which yields the highest estimate of the variance), or perhaps 0.75 (which is near the upper end of the range).

The procedure for computing the composite score and variance is as follows

## Open the spreadsheet Computing composite score and variance

The screenshot shows an Excel spreadsheet with the following data:

ES	Y	V	S	Count	Mean	vbar	sbar	Vmean	ES	Variance	
Cooper	0.370312	0.026	0.159722	2	0.427	0.025	0.159	0.013	Cooper	0.427	0.013
	0.483984	0.025	0.159182								
Hedges	0.297179	0.048	0.220078	2	0.322	0.049	0.220	0.024	Hedges	0.322	0.024
	0.345845	0.049	0.220511								
Lipsey	0.181092	0.021	0.145207	2	0.265	0.021	0.146	0.011	Lipsey	0.265	0.011
	0.348602	0.021	0.145817								
Rothstein	0.419051	0.025	0.159145	2	0.368	0.025	0.159	0.013	Rothstein	0.368	0.013
	0.316669	0.025	0.158355								
Wilson	0.326841	0.089	0.298138	2	0.285	0.093	0.305	0.046	Wilson	0.285	0.046
	0.243817	0.097	0.311142								

- Enter the correlation between the two effect sizes in cell D2 (Here, 0.0)
- Copy the effect size and variance for each study from CMA to Excel, in columns C and D
- Start a new spreadsheet in CMA and copy the data from columns N and O

The screenshot shows a table with the following data:

Study name	Hedges's g	Variance	Group-A N (Optional)	Group-B N (Optional)	Effect direction	Std diff in means	Variance	Hedges's g	Variance	Difference in means	Variance	M	N
1 Cooper	0.427	0.013			Auto			0.427	0.013				
2 Hedges	0.322	0.024			Auto			0.322	0.024				
3 Lipsey	0.265	0.011			Auto			0.265	0.011				
4 Rothstein	0.368	0.013			Auto			0.368	0.013				
5 Wilson	0.285	0.046			Auto			0.285	0.046				

The screenshot shows a forest plot with the following data:

Model	Study name	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Hedges's g and 95% CI				
	Cooper	0.427	0.114	0.013	0.204	0.650	3.745	0.000					
	Hedges	0.322	0.155	0.024	0.018	0.626	2.079	0.038					
	Lipsey	0.265	0.105	0.011	0.059	0.471	2.527	0.012					
	Rothstein	0.368	0.114	0.013	0.145	0.591	3.228	0.001					
	Wilson	0.285	0.214	0.046	-0.135	0.705	1.329	0.184					
Random		0.340	0.057	0.003	0.229	0.452	5.973	0.000					

Here, the correlation was 0.0 and the variance is 0.003

Open the spreadsheet Computing composite score and variance

The screenshot shows an Excel spreadsheet with the following data:

	ES	Y	V	S	Count	Mean	vbar	sbar	Vmean	ES	Variance	
Cooper	0.370312	0.026	0.159722		2	0.427	0.025	0.159	0.025	Cooper	0.427	0.025
Hedges	0.297179	0.048	0.220078		2	0.322	0.049	0.220	0.049	Hedges	0.322	0.049
Lipsey	0.181092	0.021	0.145207		2	0.265	0.021	0.146	0.021	Lipsey	0.265	0.021
Rothstein	0.419051	0.025	0.159145		2	0.368	0.025	0.159	0.025	Rothstein	0.368	0.025
Wilson	0.326841	0.089	0.298138		2	0.285	0.093	0.305	0.093	Wilson	0.285	0.093

- Enter the correlation between the two effect sizes in cell D2 (Here, 1.0)
- Copy the effect size and variance for each study from CMA to Excel, in columns C and D
- Start a new spreadsheet in CMA and copy the data from columns N and O

The screenshot shows a table of study data in Comprehensive meta analysis software:

Study name	Hedges's g	Variance	Group-A N (Optional)	Group-B N (Optional)	Effect direction	Std diff in means	Variance	Hedges's g	Variance	Difference in means	Variance	M	N
1 Cooper	0.427	0.025			Auto			0.427	0.025				
2 Hedges	0.322	0.049			Auto			0.322	0.049				
3 Lipsey	0.265	0.021			Auto			0.265	0.021				
4 Rothstein	0.368	0.025			Auto			0.368	0.025				
5 Wilson	0.285	0.093			Auto			0.285	0.093				

The screenshot shows a forest plot of Hedges's g and 95% CI for five studies:

Model	Study name	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	-2.00	-1.00	0.00	1.00	2.00
	Cooper	0.427	0.158	0.025	0.117	0.737	2.701	0.007					
	Hedges	0.322	0.221	0.049	-0.112	0.756	1.455	0.146					
	Lipsey	0.265	0.145	0.021	-0.019	0.549	1.829	0.067					
	Rothstein	0.368	0.158	0.025	0.058	0.678	2.327	0.020					
	Wilson	0.285	0.305	0.093	-0.313	0.883	0.935	0.350					
Random		0.340	0.079	0.006	0.185	0.496	4.290	0.000					

Here, the correlation was 1.0 and the variance is 0.006



Open the spreadsheet Computing composite score and variance

ES	Y	V	S	Count	Mean	vbar	sbar	Vmean	ES	Variance	
Cooper	0.370312	0.026	0.159722	2	0.427	0.025	0.159	0.022	Cooper	0.427	0.022
	0.483984	0.025	0.159182								
Hedges	0.297179	0.048	0.220078	2	0.322	0.049	0.220	0.041	Hedges	0.322	0.041
	0.345845	0.049	0.220511								
Lipsey	0.181092	0.021	0.145207	2	0.265	0.021	0.146	0.018	Lipsey	0.265	0.018
	0.348602	0.021	0.145817								
Rothstein	0.419051	0.025	0.159145	2	0.368	0.025	0.159	0.021	Rothstein	0.368	0.021
	0.316669	0.025	0.158355								
Wilson	0.326841	0.089	0.298138	2	0.285	0.093	0.305	0.079	Wilson	0.285	0.079
	0.243817	0.097	0.311142								

- Enter the correlation between the two effect sizes in cell D2 (Here, 0.7)
- Copy the effect size and variance for each study from CMA to Excel, in columns C and D
- Start a new spreadsheet in CMA and copy the data from columns N and O

Study name	Hedges's g	Variance	Group-A N (Optional)	Group-B N (Optional)	Effect direction	Std diff in means	Variance	Hedges's g	Variance	Difference in means	Variance	M	N	O
1 Cooper	0.427	0.022			Auto			0.427	0.022					
2 Hedges	0.322	0.041			Auto			0.322	0.041					
3 Lipsey	0.265	0.018			Auto			0.265	0.018					
4 Rothstein	0.368	0.021			Auto			0.368	0.021					
5 Wilson	0.285	0.079			Auto			0.285	0.079					

Model	Study name	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Hedges's g and 95% CI					
	Cooper	0.427	0.148	0.022	0.136	0.718	2.879	0.004						
	Hedges	0.322	0.202	0.041	-0.075	0.719	1.590	0.112						
	Lipsey	0.265	0.134	0.018	0.002	0.528	1.975	0.048						
	Rothstein	0.368	0.145	0.021	0.084	0.652	2.539	0.011						
	Wilson	0.285	0.281	0.079	-0.266	0.836	1.014	0.311						
Random		0.340	0.073	0.005	0.196	0.484	4.632	0.000						

Here, the correlation was 1.0 and the variance is 0.005



So it turns out in this case that the variance was not too much larger if we assumed a correlation of 1.0 rather than 0.70, but (as outlined earlier) this will not always be the case.

A similar situation exists if we want to assess the difference between effect sizes for math and reading. We would assume independence, group by outcome, and test the difference.

However, there is a critical difference here. When we compute an overall effect, the higher correlation yields largest variance for the overall effect. By contrast, when we compute a difference, the lower correlation yield the largest variance for the difference.

Thus, for computing an overall effect the composite (with a correlation of 1.0) is the “conservative” estimate. By contrast, for the difference, “Assuming independence” is the “conservative” estimate.