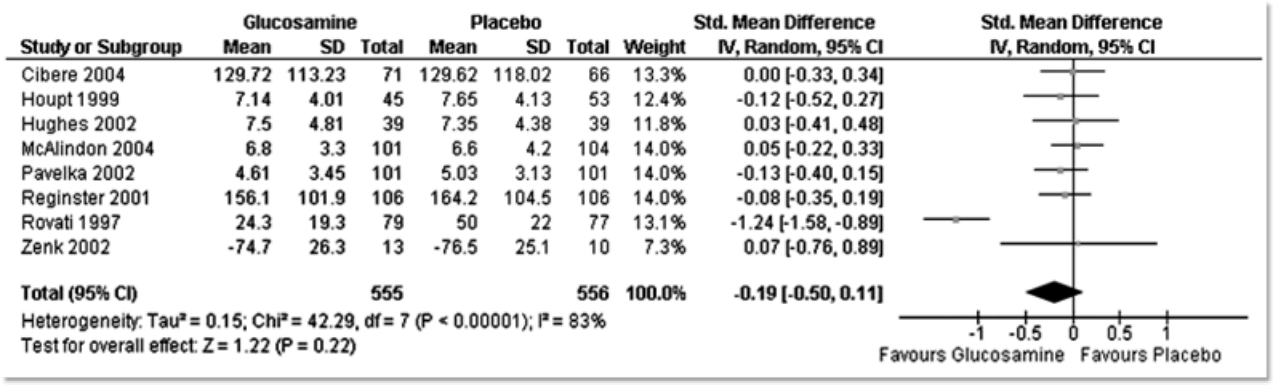
About Re-expressing SMD

When studies have used **different instruments** to measure the same construct, a standardized difference in means (SMD) may be used in meta-analysis for combining continuous data. The SMD expresses the intervention effect in **standard deviation (SD) units** rather than the original units of measurement. The mean difference (whether change from baseline to end of study, or end of study value) is standardized by dividing it by the standard deviation in the control group in this study. The standardized means from the individual studies are then combined in meta-analysis to calculate SMD. Consequently, the value of SMD depends on both the **size of the effect** (the difference between means) and the standard deviation of the outcomes (the inherent **variability among participants**).

Forest plot used in examples below.



There are three options for re-expressing the SMD facilitating its interpretability:

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1. Re-expressing SMDs using rules of thumb for effect sizes

Rules of thumb exist for interpreting SMDs or "effect sizes". If you choose this mode of presenting SMD **you should include a rule of thumb** in the Comments column of a Summary of Findings table. You should bear in mind that some methodologists believe that such interpretations are problematic, because patient importance of a finding is context-dependent and not amenable to generic statements.

Rule of thumb according to Cohen's interpretation of effect size

- 0.2 represents a small effect
- 0.5 represents a moderate effect
- 0.8 represents a large effect

There are variations of Cohen's interpretation. An example might be:

- <0.41 represents a small effect
- 0.40 to 0.70 represents a moderate effect
- >0.70 represents a large effect.

A sample Summary of Findings table presenting SMD from the above example using Cohen's interpretation of effect size

Outcomes	**Illustrative comparative risks*** (95% CI)		**Relative effect (95% CI)**	**Number of participants (studies)**	**Quality of the evidence (GRADE)**	**Comments**
	Assumed risk **With no treatment**	Corresponding risk **With glucosamine**				
Pain Measured with different scales in the different studies. Lower scores mean less pain. (follow–up: 3 months)		The mean pain score in the intervention groups was 0.19 **standard deviations lower** (0.50 lower to 0.11 higher)		1111 (8)	⊕⊕◯◯ **Low**3,4	A standard deviation of 0.2 represents a small difference between groups

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2. Re-expressing SMDs by transformation to odds ratio

A transformation of a SMD to an odds ratio (OR) is possible. Due to the underlying assumptions to make this conversion, the results are only an approximation. To calculate OR use the formula:

$$\ln(OR) = \frac{\Pi}{\sqrt{3}} SMD$$

where Π/√3 is approximately 1.8138

The estimated odds ratio can then be entered similarly as for a dichotomous outcome. The assumed risk (control group risk) refers to the proportion of people who have improved by some unspecified amount (or those without an event) in the continuous outcome ("responders"). GRADEprofiler can then automatically calculate the corresponding risk based on the assumed risk entered and present the results as dichotomous outcome. You should add a comment such as, "numbers estimated using a standardised mean difference of XX (95% CI YY to ZZ)"). If you select this option you will be able to choose more than one assumed risk value as for other dichotomous outcomes.

In the above example the SMD was 0.19 which multiplied by 1.8138 gives 0.34. If ln (OR) = 0.34 then OR = 1.41. The assumed risk was 0.9.

Note

In the SoF below the outcome is number of people who had little or no pain (NOT number of people with pain).

A sample Summary of Findings table presenting SMD from the above example using transformation to odds ratio

Outcomes	**Illustrative comparative risks*** (95% CI)		**Relative effect (95% CI)**	**Number of participants (studies)**	**Quality of the evidence (GRADE)**	**Comments**
	Assumed risk	Corresponding risk				
	With no treatment	**With glucosamine**				
Little or no pain Measured with different scales in different studies (Follow-up: 3 months)	**9 per 100**	**12 per 100** (11 to 20)	**OR 1.41** (1.22 to 2.48)	1111 (8)	⊕⊕◯◯ **Low**	Numbers estimated using a standardised mean difference of -0.19 (-0.50 to 0.11)

3. Re-expressing SMDs using a familiar instrument

Because the SMD is based on standardized means from the included studies and not a specific scale, it is unit-less. This makes the interpretation of the effect very difficult. To better understand the effect it can be re-expressed by applying the calculated SMD back into one of the original studies and depicted on the scale used in that study. To back transform the SMD to familiar scale

- select a study included in the original meta-analysis that is representative of the population and intervention and at a low risk of bias
- multiply the standard deviation of the control group (end of study mean or mean change from baseline to end of study) by the pooled SMD

This resulting number is the mean difference (MD) and can be presented in the Summary of Findings table in the format of MD (mean difference) for the scale used in the representative study.

Note

One should interpret such results with caution since back-translation of the effect size is based on the results of only 1 study.

A sample Summary of Findings table presenting SMD from the above example using back-translation to a familiar instrument

Outcomes	**Illustrative comparative risks*** (95% CI)		**Relative effect (95% CI)**	**Number of participants (studies)**	**Quality of the evidence (GRADE)**	**Comments**
	Assumed risk	Corresponding risk				
	With no treatment	**With glucosamine**				
Pain WOMAC. Scale from 0, no pain, to 20, worst pain (follow –up: 3 months)	The mean pain scores ranged from 5.0 to 7.6	The mean pain score in the intervention group was **0.8 lower** (2.1 lower to 0.5 higher).		1111 (8)	⊕⊕◯◯ **Low**	Scores estimated using a standardised mean difference of -0.19 (-0.50 to 0.11)