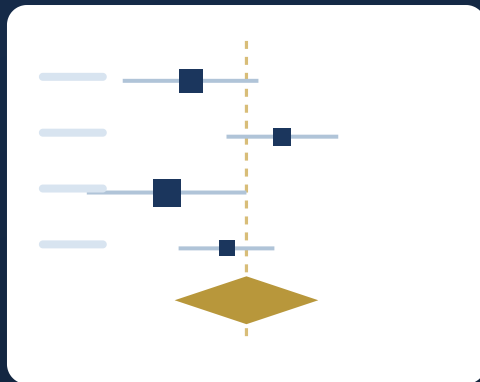


# Is Your Data Ready for Meta-Analysis?

How to tell whether your studies can be pooled, which effect size to use, and what to extract from every paper, before you open the software. A readiness guide from PhD methodologists.



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Written by PhD methodologists [researchgold.org](https://researchgold.org)

# Not every set of studies should be pooled

A meta-analysis is not a button you press at the end of a systematic review. It is a decision about whether combining the studies produces a number that means something. Pool studies that should not be combined and you manufacture a precise answer to the wrong question.

## PRINCIPLE

The first meta-analysis question is never "what is the pooled effect". It is "are these studies similar enough that one pooled effect is meaningful". If the answer is no, the right output is a careful narrative synthesis, not a forest plot.

## The three things that decide readiness

- 1 Are the studies asking the same question?**

Similar populations, interventions, comparators, and outcomes. If the clinical or conceptual question differs across studies, a single pooled estimate hides more than it reveals.
- 2 Do the studies report what you need to compute an effect size?**

You need the right numbers from every study: means and variability, or events and totals, or an effect estimate with its uncertainty. Missing inputs shrink your usable sample fast.
- 3 Is the heterogeneity explainable?**

Some variation between studies is normal. The question is whether it is small enough to pool, or large enough that you must explain it before, or instead of, pooling.

# Choose one effect size, driven by your data

The effect size is the common currency that lets different studies be combined. The right choice is dictated by the type of outcome, not by preference.

OUTCOME TYPE TO EFFECT SIZE

Your outcome	Typical effect size	What each study must report
Continuous, same scale	Mean difference	Group means, standard deviations, and sample sizes
Continuous, different scales	Standardised mean difference	Group means, standard deviations, and sample sizes
Binary or event	Risk ratio, odds ratio, or risk difference	Events and totals in each group
Time to event	Hazard ratio	Hazard ratio with confidence interval, or data to derive it
Correlation	Correlation coefficient	The correlation and the sample size

**WATCH OUT FOR**

Decide the effect size before extraction, not after. Switching from a mean difference to a standardised mean difference partway through means re-reading every paper. Pick once, in the protocol.

# Extract everything the model needs, the first time

The most common reason a meta-analysis stalls is an extraction sheet that is missing the variability terms. A study with a mean but no standard deviation, and no way to recover it, cannot enter the pooled estimate.

## Minimum columns for a poolable extraction sheet

Study ID | Year | Design | N (intervention) | N (comparator)

Intervention: [mean] [standard deviation] or [events] [total]

Comparator: [mean] [standard deviation] or [events] [total]

Effect estimate as reported: [value] [95% confidence interval]

Outcome timepoint: [when measured]

Risk of bias judgement: [domain ratings]

Notes: [unit of analysis, imputation, anything unusual]

- Record the variability term for every continuous outcome, a standard deviation, standard error, confidence interval, or exact p-value you can convert.

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- Record both group sizes, not just the total; the model needs them separately.

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- Note the timepoint, because pooling outcomes measured at different times needs an explicit rule.

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- Capture the unit of analysis, so you can catch clustering or repeated measures before they distort the weights.

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- Flag any number you had to derive or impute, and how, so it can be checked and reported.

### PRINCIPLE

When a study reports a median and range instead of a mean and standard deviation, there are defensible ways to convert, and indefensible ones. Decide and document the conversion method in advance, rather than improvising per study.

# Understand the variation before you pool

Heterogeneity is the variation in effects across studies that is more than chance alone would produce. You measure it, you decide what model it implies, and you investigate its sources.

## READING HETEROGENEITY, IN PLAIN TERMS

What you see	What it suggests	What to do
Low heterogeneity	Studies broadly agree	Pooling is reasonable; report the model and move on
Moderate heterogeneity	Real differences are present	Use a random-effects model and explore likely sources
High heterogeneity	Studies disagree substantially	Investigate sources first; consider not pooling a single estimate

- 1 Fixed-effect or random-effects, decided in advance**  
 A fixed-effect model assumes one true effect; a random-effects model assumes a distribution of true effects. Most reviews of real-world studies use random-effects, and that choice belongs in the protocol.
- 2 Pre-specify the subgroups**  
 If you suspect the effect differs by population, dose, or design, name those subgroups before you look. Post-hoc subgroups discovered in the data are hypothesis-generating, not confirmatory.
- 3 Plan the sensitivity analyses**  
 Decide which studies you will remove to test robustness, such as high risk of bias studies or outliers, before you see how the result moves.

### WATCH OUT FOR

Three choices inside the random-effects model that reviewers now probe. First, name the between-study variance estimator: DerSimonian-Laird is the historic default but is biased downward, so restricted maximum likelihood (REML) or Paule-Mandel is the better choice and should be stated. Second, with few studies the conventional random-effects confidence interval is too narrow and its coverage fails; the Hartung-Knapp-Sidik-Jonkman adjustment, which uses a *t* rather than *z* distribution, restores honest coverage and is the recommended default. Third, report a prediction interval alongside the diamond: it shows the range a future study's true effect would plausibly fall in, and when it crosses the line of no effect it tells the reader the intervention may not help in every setting, which the pooled interval alone hides.

# Plan for publication bias before it undermines you

Studies with striking results are more likely to be published, which can inflate a pooled estimate. Reviewers will ask how you checked. Have an answer ready in the protocol.

- ✓ Plan a funnel plot and a formal test for small-study effects when you have enough studies for it to be meaningful, conventionally around ten or more.

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- ✓ State the threshold in advance, because a funnel plot with five studies tells you almost nothing and should not be over-interpreted.

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- ✓ Treat asymmetry as a prompt to investigate, not as proof of bias; it can also reflect genuine heterogeneity or chance.

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- ✓ Where bias is plausible, discuss its likely direction and magnitude rather than asserting the pooled estimate is unaffected.

## WATCH OUT FOR

Do not run a battery of bias tests and report only the reassuring one. Pre-specify the method, report what it shows, and interpret it honestly. Reviewers are alert to selective reporting of the diagnostics, not just the results.

# The meta-analysis readiness checklist

If you can tick every box, your data is ready to pool. If you cannot, the gaps below are exactly what a reviewer will find first.

- The studies share a population, intervention, comparator, and outcome similar enough to combine.
- One effect size is chosen and matches the outcome type across all studies.
- Every included study reports, or allows you to derive, the inputs that effect size needs.
- The extraction sheet records both group sizes and a variability term for every estimate.
- Any derived or imputed values are flagged with the method used.
- The model, fixed-effect or random-effects, is chosen in advance, with a named tau-squared estimator and a Hartung-Knapp adjustment when studies are few.
- A prediction interval will be reported alongside the pooled estimate.
- Subgroup and sensitivity analyses are pre-specified, not discovered in the data.
- A plan for assessing small-study effects is set, with a sensible minimum number of studies.
- Risk of bias is assessed and will be carried into the interpretation, not just reported.
- You can state, before pooling, what result would make you decide not to pool.

WHEN THE POOLING HAS TO BE RIGHT

## A defensible meta-analysis is more than a forest plot

If you have the studies and need the effect sizes extracted, the right model fitted, heterogeneity explored, publication bias assessed, and journal-ready forest and funnel plots with a written results and methods section, our PhD methodologists deliver the complete, publication-ready meta-analysis. You make every judgement call; we do the analysis and the plots to a standard that holds up in review.

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