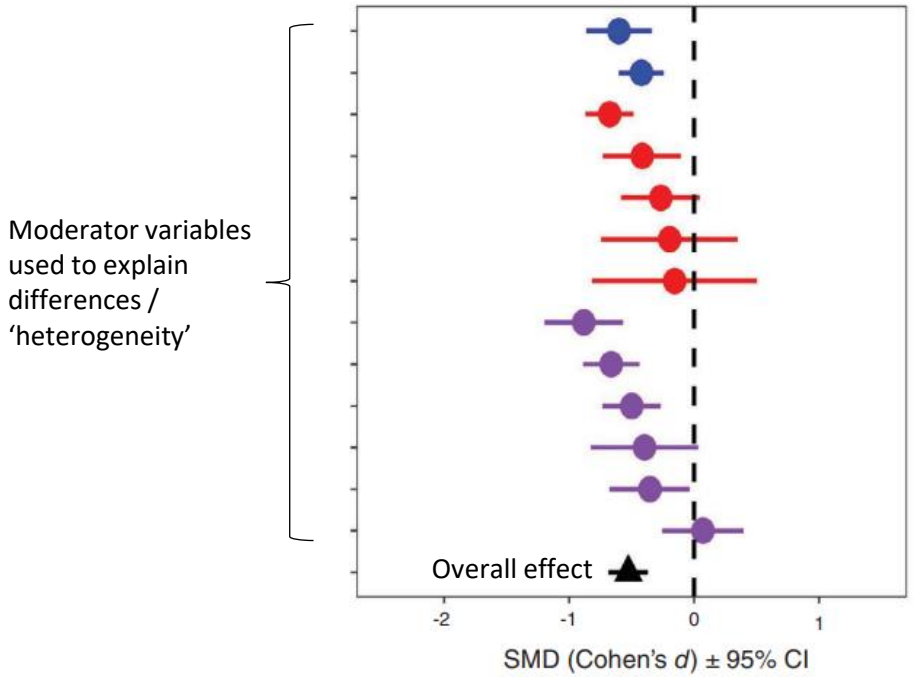
Why do we perform Meta-analysis?

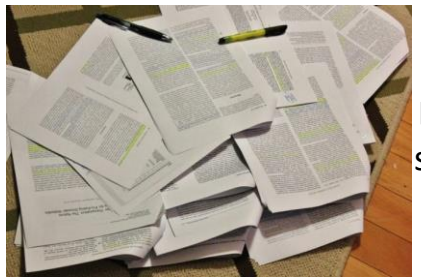
- Assess generalities in the literature (e.g., “does A affect B overall” or “is there a positive correlation between A and B”)
- Address hypotheses
- Increase power and precision
- Explore differences in the literature (e.g., “does A affect B only under some circumstances”)



The process of meta-analysis

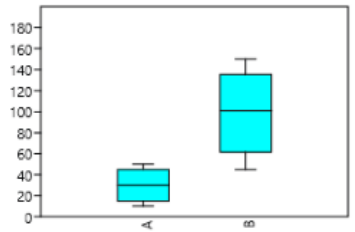
Hypothesis/question formulation

Piloting

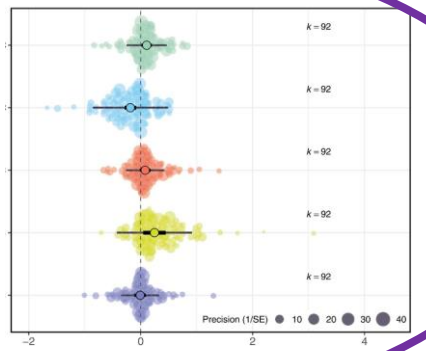


Literature search and screening for relevant papers

Data extraction



ANALYSIS



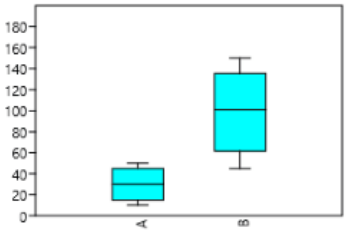
Write up paper and publish!

For help on the first steps:
Nakagawa, S., Noble, D.W.A., Senior, A.M. *et al.* Meta-evaluation of meta-analysis: ten appraisal questions for biologists. *BMC Biol* **15**, 18 (2017). https://doi.org/10.1186/s12915-017-0357-7

Effect sizes

- SMD (e.g., Cohen's D)
- lnRR (log response ratio)
- Zr (correlation)
- OR (odds ratio)

Comparing the mean of two groups (i.e., treatment vs control)



Correlation

Likelihood of an outcome

Example data

First author	Year	Effect size ID	Study ID	Species	Mod1 (e.g., sex)	Mod3 (e.g., age)	Mean control	SD control	N control	Mean treatment	SD treatment	N treatment
Macartney	2022	1	1	Drosophila_melanogaster	M	Juv						
Macartney	2022	2	1	Drosophila_melanogaster	M	Adult						
Macartney	2022	3	1	Drosophila_melanogaster	F	Juv						

Note: can convert median to mean; SE, CI etc to SD; N from df (depending); can use test stats etc.

Basic steps your analysis should include

1. Global meta-analytic mean (overall effect)
2. Heterogeneity (I^2): proportion of variance not due to sampling error
3. Meta-regression (marginal R^2): Variance explained by fixed effects (e.g., moderators)
4. Publication bias (funnel plot, eggers regression etc)
5. Sensitivity analysis (leave on group out analysis) – not covered in code