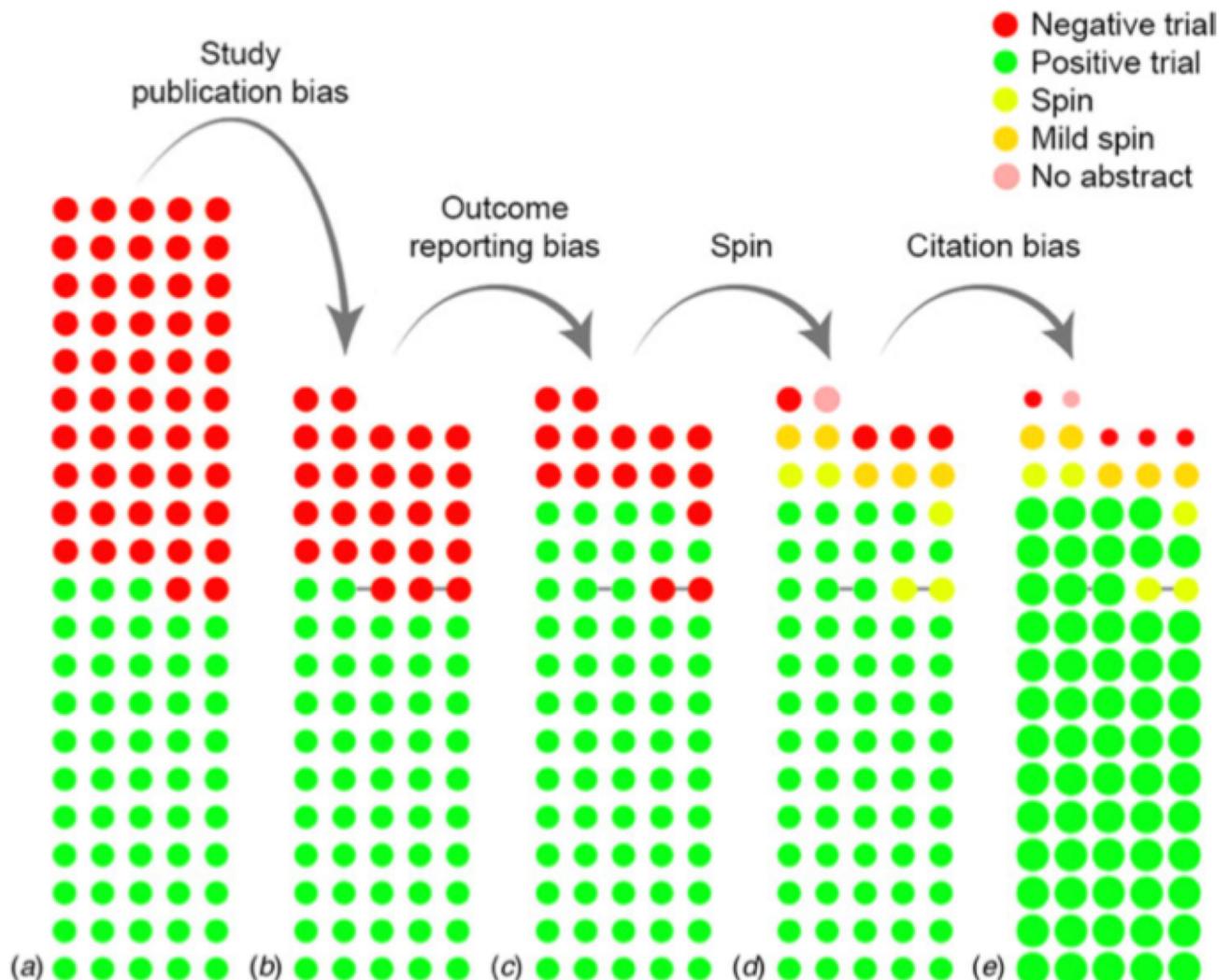


# Evidence-based Decision Making: Session 10

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Rui Mata, FS 2021

# An interlude: Reporting and citation biases...



**Fig. 1.** The cumulative impact of reporting and citation biases on the evidence base for antidepressants. (a) displays the initial, complete cohort of trials, while (b) through (e) show the cumulative effect of biases. Each circle indicates a trial, while the color indicates the results or the presence of spin. Circles connected by a grey line indicate trials that were published together in a pooled publication. In (e), the size of the circle indicates the (relative) number of citations received by that category of studies.

De Vries, Y. A., Roest, A. M., De Jonge, P., Cuijpers, P., Munafò, M. R., & Bastiaansen, J. A. (2018). The cumulative effect of reporting and citation biases on the apparent efficacy of treatments: The case of depression. *Psychological Medicine*, 48(15), 2453–2455. <http://doi.org/10.1017/S0033291718001873>

# Goals

- Discuss the use of guidelines (PRISMA) and their importance
- Not all research synthesis is created equal: types of research synthesis
- Talk about good/bad examples of research synthesis

# Definitions

**Table 1 PROSPERO and PRISMA-P**

| <b>Definition and objective</b>   |   |
|---|---|
| PROSPERO: International Prospective Register of Systematic Reviews                    | An online portal through which to register the intention to conduct a systematic review, with health-related outcomes, before it is initiated [16]. One of the main goals of PROSPERO is to make the intent of systematic reviews known before they are conducted in order to reduce the unplanned duplication of systematic reviews [15]. In addition, by requiring the documentation of <i>a priori</i> methods, the register facilitates increased transparency in the review process by allowing readers of systematic reviews to compare methods, outcomes, and analyses carried out with those planned in advance and judge whether such changes impact the results of a review.  |
| PRISMA-P: Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols | A guideline to help authors prepare protocols for planned systematic reviews and meta-analyses that provides them with a minimum set of items to be included in the protocol. A protocol is intended to provide the rationale for the review and pre-planned methodological and analytic approach, prior to embarking on a review. Investigators should prepare a review protocol in advance of registering it in PROSPERO so that details requiring further consideration may be thought through in advance, avoiding the need for multiple amendments to registration information. PRISMA-P items have been derived largely from the PRISMA checklist and items of the PROSPERO register, in order to facilitate seamless registration. |

<https://www.crd.york.ac.uk/PROSPERO/>

PRISMA-P Group, Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., et al. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews*, 4(1), e1000326–9. <http://doi.org/10.1186/2046-4053-4-1>

# PRISMA and PRISMA-P Guidelines

## **Box 2 |** Helping to develop the research question(s): the PICOS approach

Formulating relevant and precise questions that can be answered in a systematic review can be complex and time consuming. A structured approach for framing questions that uses five components may help facilitate the process. This approach is commonly known by the acronym “PICOS” where each letter refers to a component: the patient population or the disease being addressed (P), the interventions or exposure (I), the comparator group (C), the outcome or endpoint (O), and the study design chosen (S).<sup>186</sup> Issues relating to PICOS affect several PRISMA items (items 6, 8, 9, 10, 11, and 18).

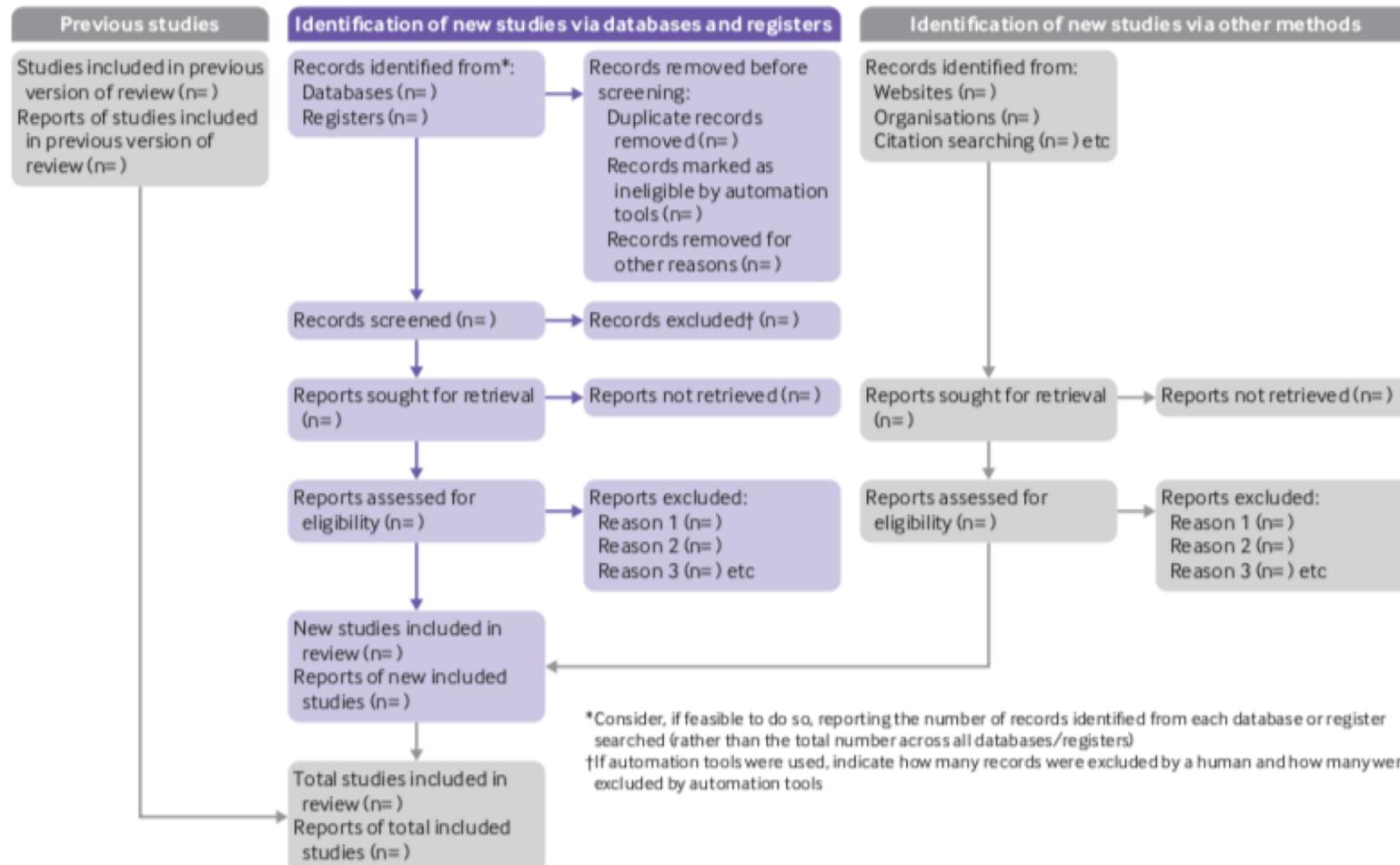
- P—Providing information about the population requires a precise definition of a group of participants (often patients), such as men over the age of 65 years, their defining characteristics of interest (often disease), and possibly the setting of care considered, such as an acute care hospital.
- I—The interventions (exposures) under consideration in the systematic review need to be transparently reported. For example, if the reviewers answer a question regarding the association between a woman’s prenatal exposure to folic acid and subsequent offspring’s neural tube defects, reporting the dose, frequency, and duration of folic acid used in different studies is likely to be important for readers to interpret the review’s results and conclusions. Other interventions (exposures) might include diagnostic, preventive, or therapeutic treatments; arrangements of specific processes of care; lifestyle changes; psychosocial or educational interventions; or risk factors.
- C—Clearly reporting the comparator (control) group intervention(s)—such as usual care, drug, or placebo—is essential for readers to fully understand the selection criteria of primary studies included in the systematic review, and might be a source of heterogeneity investigators have to deal with. Comparators are often poorly described. Clearly reporting what the intervention is compared with is important and may sometimes have implications for the inclusion of studies in a review—many reviews compare with “standard care,” which is otherwise undefined; this should be properly addressed by authors.
- O—The outcomes of the intervention being assessed—such as mortality, morbidity, symptoms, or quality of life improvements—should be clearly specified as they are required to interpret the validity and generalisability of the systematic review’s results.
- S—Finally, the type of study design(s) included in the review should be reported. Some reviews include only reports of randomised trials, whereas others have broader design criteria and include randomised trials and certain types of observational studies. Still other reviews, such as those specifically answering questions related to harms, may include a wide variety of designs ranging from cohort studies to case reports. Whatever study designs are included in the review, these should be reported.

Independently from how difficult it is to identify the components of the research question, the important point is that a structured approach is preferable, and this extends beyond systematic reviews of effectiveness. Ideally the PICOS criteria should be formulated *a priori*, in the systematic review’s protocol, although some revisions might be required because of the iterative nature of the review process. Authors are encouraged to report their PICOS criteria and whether any modifications were made during the review process. A useful example in this realm is the appendix of the “systematic reviews of water fluoridation” undertaken by the Centre for Reviews and Dissemination.<sup>187</sup>

PRISMA-P Group, Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., et al. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement.

*Systematic Reviews*, 4(1), e1000326–9. <http://doi.org/10.1186/2046-4053-4-1>

# PRISMA 2020



Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Bmj*, 372, n71. <http://doi.org/10.1136/bmj.n71>

# PRISMA and PRISMA-P Guidelines: Benefits

**Table 4 Proposed stakeholders, actions, and potential benefits for supporting adherence to PRISMA-P**

| Stakeholder  | Proposed action   | Potential benefits   |
|--|---|--|
| <b>Funders</b>   | Promote or mandate adherence to PRISMA-P or use PRISMA-P as a template for systematic review proposals for grant applications                                       | Improved quality, completeness, and consistency of systematic review proposal submissions<br><br>Standardized protocol content will improve peer review efficiency and investigator understanding of requirements  |
| <b>Systematic review authors/ groups/organizations</b> | Use/adhere to PRISMA-P during protocol development  | Improved quality, completeness, and consistency of protocol content<br><br>Enables reviewers to anticipate and avoid future changes to review methods (i.e., outcomes)<br><br>Increased awareness of minimum content for protocol reporting<br><br>Improved completeness of reporting of completed reviews |
| <b>PROSPERO (and other review registries)</b>          | Encourage the development of PRISMA-P-based protocols   | Improved quality of registry entries<br><br>Improved consistency across registry entries, protocols, and systematic reviews  |
| <b>Practice guideline developers</b>                   | Use PRISMA-P to gauge the completeness of protocols and facilitate detection of selective reporting when considering reviews for guideline inclusion                | Enables easy comparison across protocols, registry entries, and completed systematic reviews   |
| <b>Policymakers</b>                                    | Advocate use of PRISMA-P by those funding and carrying out systematic reviews   | May yield better quality, more complete, and more consistent reviews to inform decision-making   |
| <b>Journal editors</b>                                 | Encourage compliance to PRISMA-P for authors submitting protocols for publication<br><br>Offer PRISMA-P as a template to assist in protocol writing for publication | Improved quality, completeness, and consistency of protocols over those published in journals not endorsing PRISMA-P<br><br>Increased efficiency in protocol peer and author understanding of journal requirements<br><br>Improved transparency and interpretation of reviews by readers                   |
| <b>Educators</b>                                       | Use PRISMA-P as a training tool<br><br>Encourage adherence in students submitting protocols for coursework  | Simplified teaching and grading of protocols<br><br>Improved quality, completeness, and consistency of protocol content  |
| <b>Students</b>  | Develop protocols for coursework or research using PRISMA-P   | Improved understanding of the minimum protocol content<br><br>Well-trained systematic reviewer going into the workforce  |

# Other types of research synthesis: Scoping reviews

Scoping reviews can be conducted to meet various objectives. They may examine the extent (that is, size), range (variety), and nature (characteristics) of the evidence on a topic or question; determine the value of undertaking a systematic review; summarize findings from a body of knowledge that is heterogeneous in methods or discipline; or identify gaps in the literature to aid the planning and commissioning of future research. (...) Systematic reviews are useful for answering clearly defined questions (for example, “Does this intervention improve specified outcomes when compared with a given comparator in this population?”), whereas scoping reviews are useful for answering much broader questions (such as “What is the nature of the evidence for this intervention?” or “What is known about this concept?”).

| Section   | Item | PRISMA-ScR Checklist Item  |
|---|------|--|
| <b>Title</b>  | 1    | Identify the report as a scoping review.   |
| <b>Abstract</b><br>Structured summary                 | 2    | Provide a structured summary that includes (as applicable) background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.   |
| <b>Introduction</b><br>Rationale                      | 3    | Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.   |
| Objectives  | 4    | Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.                                  |
| <b>Methods</b><br>Protocol and registration           | 5    | Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.   |
| Eligibility criteria                                  | 6    | Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.   |
| Information sources*                                  | 7    | Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.  |
| Search  | 8    | Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.  |
| Selection of sources of evidence†                     | 9    | State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.  |
| Data charting process‡                                | 10   | Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators. |
| Data items  | 11   | List and define all variables for which data were sought and any assumptions and simplifications made.   |
| Critical appraisal of individual sources of evidence§ | 12   | If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).  |
| Summary measures                                      | 13   | Not applicable for scoping reviews.  |
| Synthesis of results                                  | 14   | Describe the methods of handling and summarizing the data that were charted.   |
| Risk of bias across studies                           | 15   | Not applicable for scoping reviews.  |
| Additional analyses                                   | 16   | Not applicable for scoping reviews.  |
| <b>Results</b><br>Selection of sources of evidence    | 17   | Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.   |
| Characteristics of sources of evidence                | 18   | For each source of evidence, present characteristics for which data were charted and provide the citations.  |
| Critical appraisal within sources of evidence         | 19   | If done, present data on critical appraisal of included sources of evidence (see item 12).   |
| Results of individual sources of evidence             | 20   | For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.  |
| Synthesis of results                                  | 21   | Summarize and/or present the charting results as they relate to the review questions and objectives.   |
| Risk of bias across studies                           | 22   | Not applicable for scoping reviews.  |
| Additional analyses                                   | 23   | Not applicable for scoping reviews.  |
| <b>Discussion</b><br>Summary of evidence              | 24   | Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.  |
| Limitations   | 25   | Discuss the limitations of the scoping review process.   |
| Conclusions   | 26   | Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.  |
| <b>Funding</b>  | 27   | Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.  |

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., et al. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine*, 169(7), 467–473.  
<http://doi.org/10.7326/M18-0850>

# Other types of research synthesis: Rapid reviews

“Rapid reviews are a form of knowledge synthesis in which components of the systematic review process are simplified or omitted to produce information in a timely manner.”

**Table 5** Summary of rapid review streamlined approaches (n = 82 application studies)

| Rapid review methods                        | Count (%) |
|---|-----------|
| General                                     |           |
| Duration of review                          |           |
| >6 months                                   | 3 (4 %)   |
| ≤6 months                                   | 19 (23 %) |
| Not reported                                | 60 (73 %) |
| Published protocol                          |           |
| Mentioned                                   | 2 (2 %)   |
| Not mentioned                               | 80 (98 %) |
| Review question                             |           |
| Clearly reported                            | 81 (99 %) |
| Unclear/inferred                            | 1 (1 %)   |
| Identifying relevant studies                |           |
| Databases searched                          |           |
| Searched more than one database             | 67 (82 %) |
| Searched one database only                  | 2 (2 %)   |
| Used a previous review(s) as starting point | 8 (10 %)  |
| Not reported                                | 5 (6 %)   |
| Grey literature                             |           |
| Searched grey literature                    | 57 (70 %) |
| No grey literature search                   | 20 (24 %) |
| Not reported                                | 5 (6 %)   |
| Search strategy                             |           |
| Clearly reported                            | 64 (78 %) |
| Unclear                                     | 7 (9 %)   |
| Not reported                                | 11 (13 %) |
| Scanned references                          |           |
| Yes   | 41 (50 %) |
| No  | 8 (10 %)  |
| Not reported                                | 33 (40 %) |
| Contacted authors                           |           |
| Yes   | 18 (22 %) |
| No  | 9 (11 %)  |
| Not reported                                | 55 (67 %) |
| Limits applied                              |           |
| Date  |           |
| No limit                                    | 10 (12 %) |
| Limited by date                             | 56 (68 %) |
| Not reported                                | 16 (20 %) |
| Language                                    |           |
| No limit                                    | 14 (17 %) |
| Limited by language                         | 40 (49 %) |
| Not reported                                | 28 (34 %) |

**Table 5** Summary of rapid review streamlined approaches (n = 82 application studies) (Continued)

|  |           |
|--|-----------|
| Selecting relevant studies                             |           |
| Titles and abstracts                                   |           |
| Two or more independent reviewers                      | 28 (34 %) |
| One reviewer and one verifier                          | 4 (5 %)   |
| One reviewer only                                      | 15 (18 %) |
| Done but unclear number of reviewers                   | 20 (24 %) |
| Not done   | 1 (1 %)   |
| Not reported   | 14 (17 %) |
| Full-texts   |           |
| Two or more independent reviewers                      | 20 (24 %) |
| One reviewer and one verifier                          | 5 (6 %)   |
| One reviewer only                                      | 9 (11 %)  |
| Done but unclear number of reviewers                   | 23 (28 %) |
| Not done   | 1 (1 %)   |
| Not reported   | 24 (29 %) |
| Data abstraction and quality appraisal                 |           |
| Data abstraction                                       |           |
| Two or more independent reviewers                      | 8 (10 %)  |
| One reviewer and one verifier                          | 19 (23 %) |
| One reviewer only                                      | 6 (7 %)   |
| Done but unclear number of reviewers                   | 30 (37 %) |
| Not done   | 1 (1 %)   |
| Not reported   | 18 (22 %) |
| Quality appraisal                                      |           |
| Two or more independent reviewers                      | 14 (17 %) |
| One reviewer and one verifier                          | 11 (13 %) |
| One reviewer only                                      | 6 (7 %)   |
| Done but unclear number of reviewers                   | 24 (29 %) |
| Not done   | 6 (7 %)   |
| Not reported   | 21 (26 %) |
| Data synthesis   |           |
| Data synthesis   |           |
| Meta-analysis or clear reasons for not pooling results | 18 (22 %) |
| Narrative/descriptive summary only                     | 64 (78 %) |

colleagues (2000) examined the impact of 20 rapid review products [43] and found that 14 had an influence on policy decision-making, four provided guidance, and two had no perceived impact. McGregor

# Other types of research synthesis: Umbrella reviews

“Systematic reviews and meta-analyses aim to synthesise the findings and investigate the biases. However, as the number of reviews of meta-analyses also increased, clinicians may also feel overwhelmed with too many of them. Umbrella reviews have been developed to overcome such a gap of knowledge. They are reviews of previously published systematic reviews or meta-analyses, and consist in the repetition of the meta-analyses following a uniform approach for all factors to allow their comparison.”

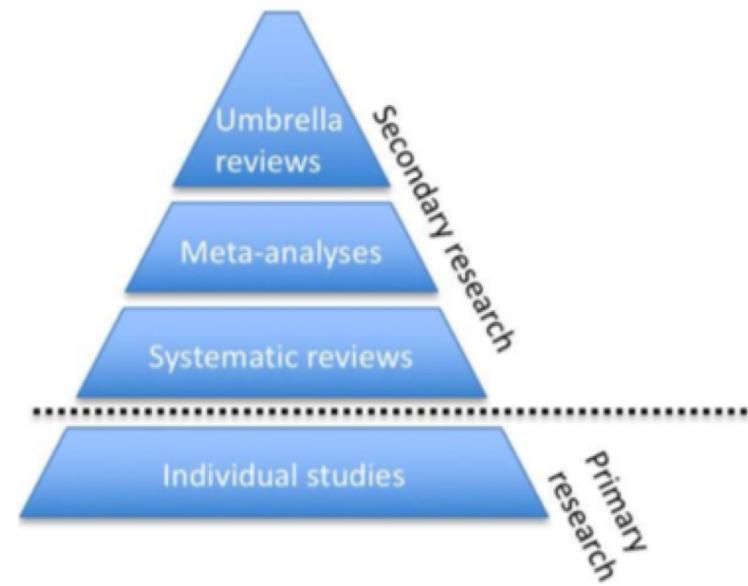
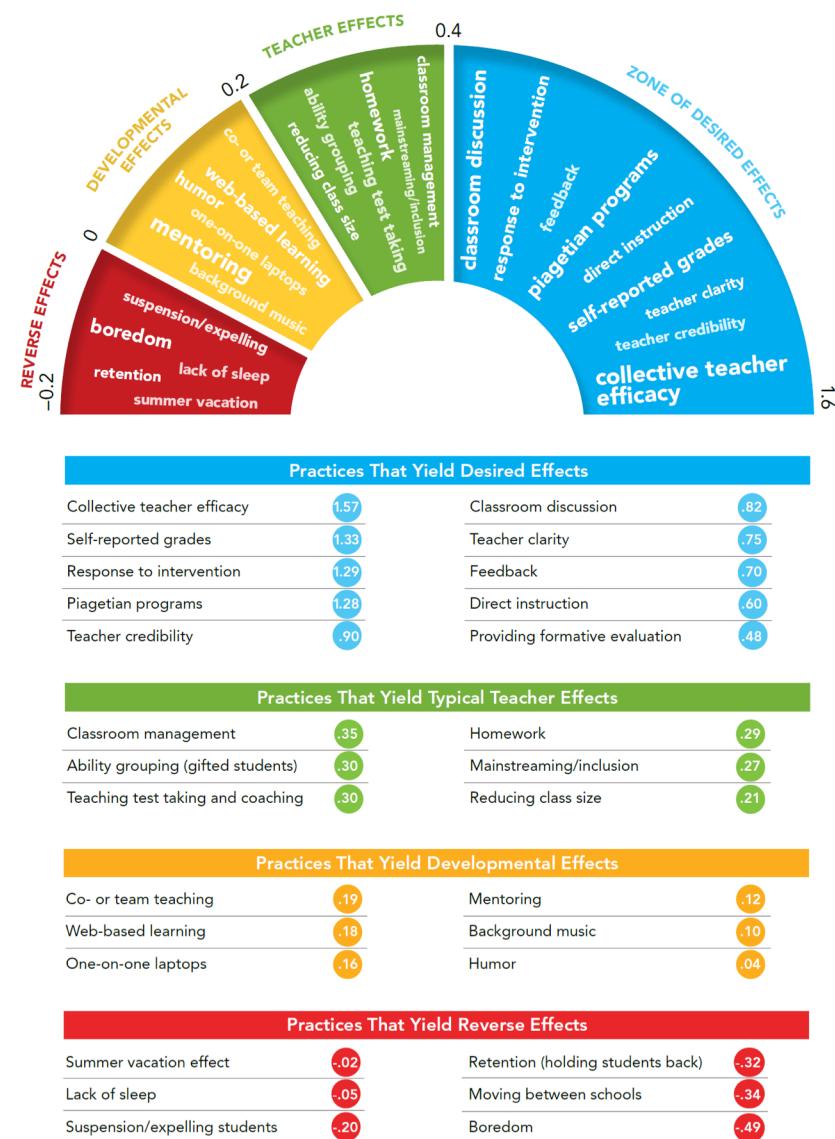
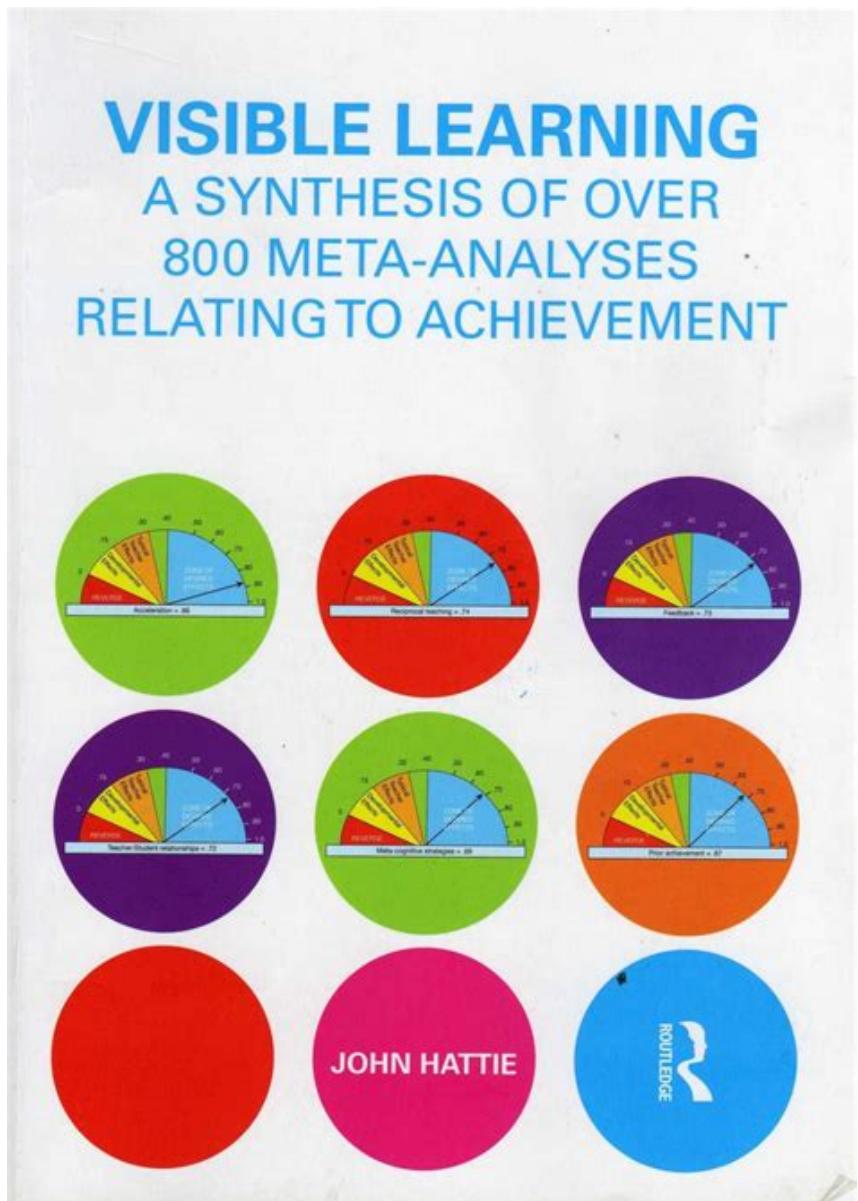


Figure 1 Hierarchy of evidence synthesis methods.

Fusar-Poli, P., & Radua, J. (2018). Ten simple rules for conducting umbrella reviews. *Evidence Based Mental Health*, 21(3), 95–100. <http://doi.org/10.1136/ebmental-2018-300014>



# Variables Associated With Achievement in Higher Education: A Systematic Review of Meta-Analyses

Michael Schneider and Franzis Preckel  
University of Trier

The last 2 decades witnessed a surge in empirical studies on the variables associated with achievement in higher education. A number of meta-analyses synthesized these findings. In our systematic literature review, we included 38 meta-analyses investigating 105 correlates of achievement, based on 3,330 effect sizes from almost 2 million students. We provide a list of the 105 variables, ordered by the effect size, and summary statistics for central research topics. The results highlight the close relation between social interaction in courses and achievement. Achievement is also strongly associated with the stimulation of meaningful learning by presenting information in a clear way, relating it to the students, and using conceptually demanding learning tasks. Instruction and communication technology has comparably weak effect sizes, which did not increase over time. Strong moderator effects are found for almost all instructional methods, indicating that how a method is implemented in detail strongly affects achievement. Teachers with high-achieving students invest time and effort in designing the microstructure of their courses, establish clear learning goals, and employ feedback practices. This emphasizes the importance of teacher training in higher education. Students with high achievement are characterized by high self-efficacy, high prior achievement and intelligence, conscientiousness, and the goal-directed use of learning strategies. Barring the paucity of controlled experiments and the lack of meta-analyses on recent educational innovations, the variables associated with achievement in higher education are generally well investigated and well understood. By using these findings, teachers, university administrators, and policymakers can increase the effectiveness of higher education.

*Keywords:* academic achievement, meta-analysis, tertiary education, instruction, individual differences

*Supplemental materials:* <http://dx.doi.org/10.1037/bul0000098.supp>

Table 3

*Absolute Frequencies of Data Points and Percentage of Variables by Effect Size (Ordered by the Combined Frequency of Medium and Large Effects)*

|                                    | Absolute frequency of data points |              |           | % of variables |              |               |              |
|------------------------------------|-----------------------------------|--------------|-----------|----------------|--------------|---------------|--------------|
|                                    | Students <sup>a</sup>             | Effect sizes | Variables | No effect      | Small effect | Medium effect | Large effect |
| Overall                            | 1,920,239                         | 3,330        | 105       | 12             | 36           | 36            | 15           |
| Instruction variables              | 208,711                           | 1,595        | 42        | 5              | 26           | 45            | 24           |
| Social interaction                 | 26,860                            | 123          | 5         | 0              | 0            | 40            | 60           |
| Stimulating meaningful learning    | 49,272                            | 229          | 9         | 0              | 22           | 56            | 22           |
| Assessment                         | 41,493                            | 316          | 8         | 0              | 25           | 50            | 25           |
| Presentation                       | 46,157                            | 354          | 9         | 0              | 33           | 33            | 33           |
| Technology                         | 29,022                            | 401          | 6         | 17             | 33           | 50            | 0            |
| Extracurricular training programs  | 15,907                            | 172          | 5         | 20             | 40           | 40            | 0            |
| Student variables                  | 1,711,528                         | 1,735        | 63        | 18             | 43           | 30            | 10           |
| Intelligence and prior achievement | 74,711                            | 95           | 4         | 0              | 0            | 50            | 50           |
| Strategies                         | 133,757                           | 343          | 18        | 11             | 28           | 50            | 11           |
| Motivation                         | 137,880                           | 390          | 12        | 17             | 42           | 25            | 17           |
| Personality                        | 1,093,174                         | 694          | 16        | 31             | 44           | 25            | 0            |
| Context                            | 272,006                           | 213          | 13        | 15             | 77           | 8             | 0            |

*Note.* No effect =  $|d| < .11$ ; small effect =  $.11 \leq |d| < .35$ ; medium effect =  $.35 \leq |d| < .66$ ; large effect =  $|d| \geq .66$ .

<sup>a</sup> Estimated by replacing missing values of a meta-analysis by the median value of all meta-analyses.

Schneider, M., & Preckel, F. (2017). Variables associated with achievement in higher education: A systematic review of meta-analyses. *Psychological Bulletin, 143*(6), 565–600. <http://doi.org/10.1037/bul0000098>

# Summary

- research synthesis can be helpful in dealing with information explosion and quantification of effects of interest
- the history of research synthesis is defined by a progressive standardisation through the development of terminology (i.e., systematic review, meta-analysis), guidelines (e.g., PRISMA), and procedures with the goal of increasing clarity, transparency, and reduce bias (e.g., transparent exclusion criteria, protocols)
- the key statistical ingredient of quantitative research synthesis is weighted aggregation in which the information from several estimates is aggregated as a function of the confidence in each study (precision)
- research synthesis is not a panacea and cannot provide accurate estimates of effects in the face of large reporting biases (publication bias & file-drawer problem)...