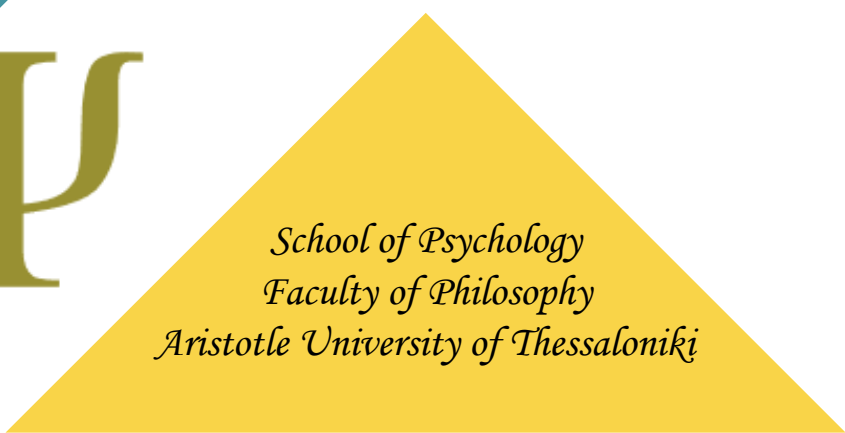




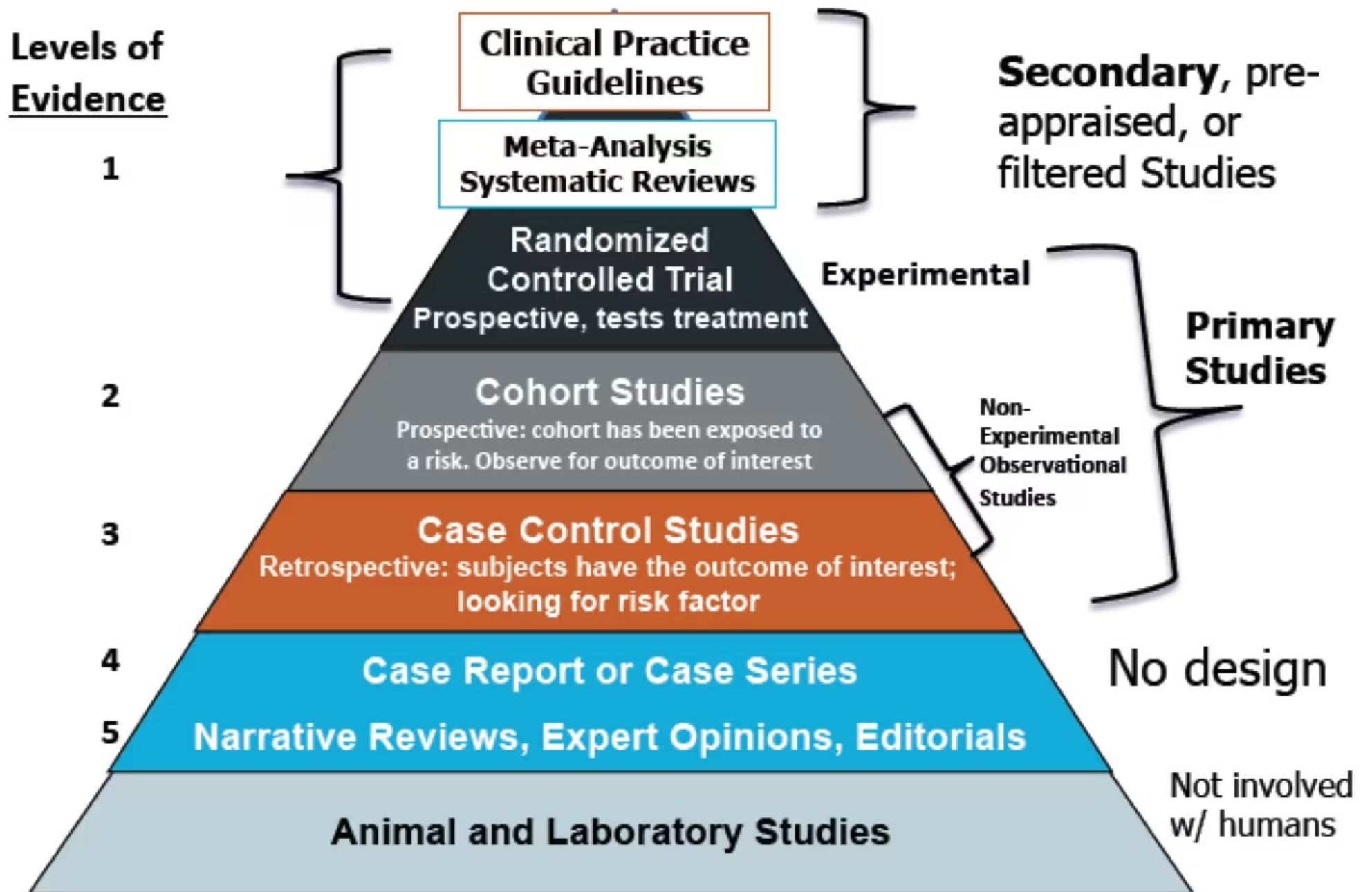
# **Systematic Review & Meta-analysis (1)**

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*School of Psychology  
Faculty of Philosophy  
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## Review Article

# Meeting the review family: exploring review types and associated information retrieval requirements

Anthea Sutton\* , Mark Clowes, Louise Preston & Andrew Booth

School of Health and Related Research (SchARR), The University of Sheffield, Sheffield, UK

<https://doi.org/10.1111/hir.12276>

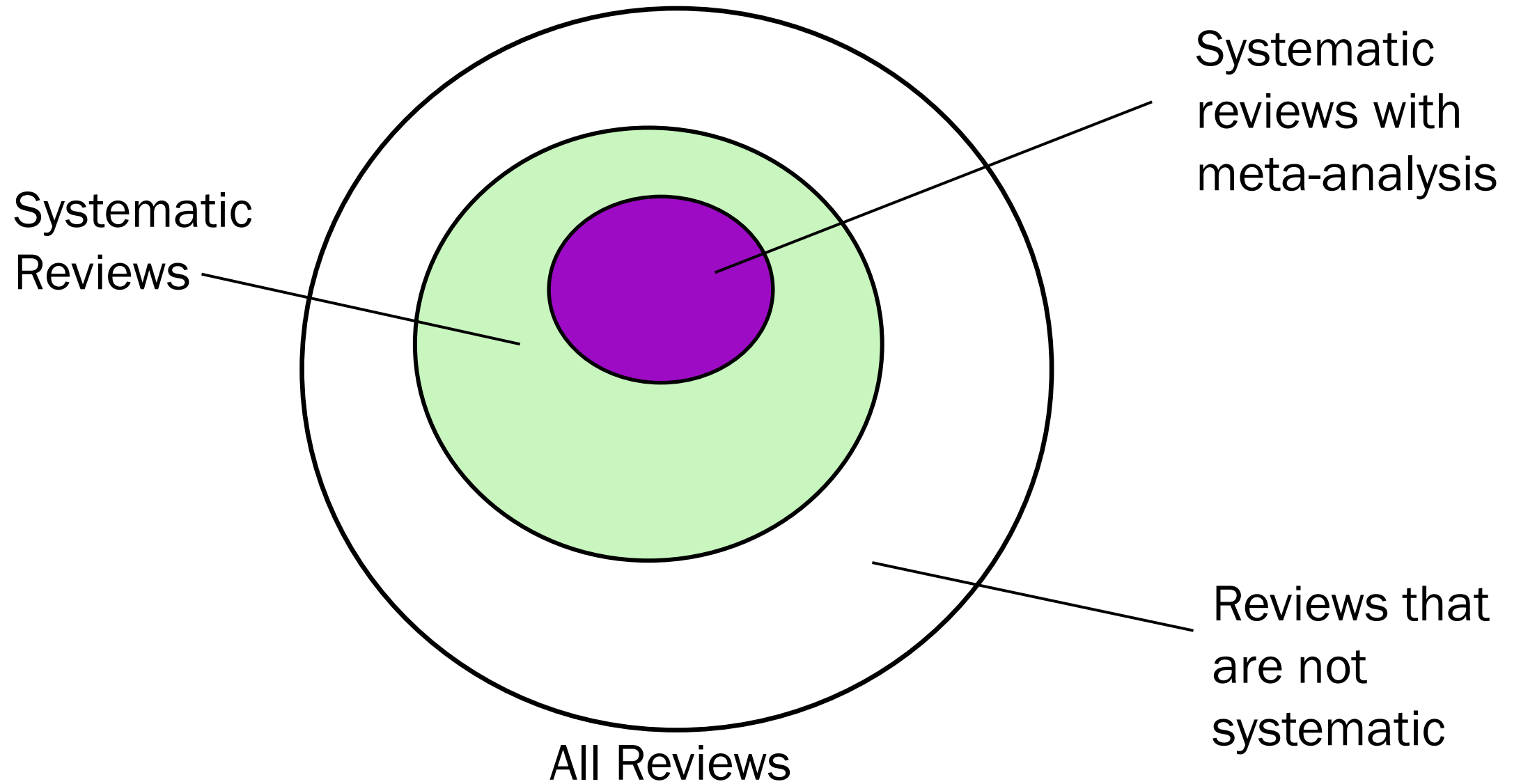
# Meeting the review family

Forty-eight review types were identified and categorised into **seven** families.

- **Traditional review**
- **Systematic review**
- Rapid review
- **Qualitative review**
- **Mixed-methods review**
- Purpose-specific review (HTA)
- **Review of reviews**

But there are much more:

- **Scoping review**
- Living review
- Economic evaluation review
- **Measurement properties review**



# Systematic Review (SR)

Systematic review is a review of clearly formulated question that uses explicit, pre-planned scientific methods to:

- Identify
- Select
- Appraise
- Synthesize results

from similar but separate **primary studies**.

**NOTE:** Meta-analysis (MA), the **statistical analysis** of a large collection of results from individual studies is an optional component of a systematic review

# Who Is Doing Systematic Reviews?

- Independent researchers
- Universities, Institutes, and Organizations: Cochrane Collaboration, Joanna Briggs Institute (JBI), University of York—Centre for Reviews and Dissemination.
- Groups interested in policy (professional societies, governments, payers)



# Who Is Using Systematic Reviews? Decision Makers

- Individual doctors, psychologists and researchers
- Patients
- Guidelines producers
- Policy makers
- Purchasers
- Regulatory authorities





# Classifying Question Types

Question	Classification/type
What proportion of the population is newly diagnosed with this problem each year?	Incidence
What proportion of the population is currently living with this problem?	Prevalence
What should be done to treat this problem?	Therapy
Will detecting this problem early, before symptoms, make a difference in my health?	Screening
How good is this test at detecting this problem?	Diagnostic accuracy
What is the likely outcome of this problem?	Prognosis
Will there be any negative effects (of an intervention)?	Harm
What causes this problem?	Etiology
How can this problem be prevented?	Prevention

# Examples of Types of Questions

Type question	Example
Incidence, prevalence	What is the incidence of low birth weight in minority populations compared to the white population?
Therapy	Is exercise effective in improving quality of life in persons with COPD?
Screening	Is PSA to detect prostate cancer effective in reducing mortality?
Diagnostic accuracy	How effective is an MRI at detecting new breast cancers in follow-up of women with breast cancer having lumpectomy?
Prognosis	What is the effect of pregnancy on exacerbating the symptoms of MS
Harm	What proportion of postmenopausal women receiving Ca++/vita D can expect to have kidney stones?
Etiology	Is coffee consumption causally associated with developing pancreatic cancer?

# One Size Does NOT Fit All! Use Your Question Classification to Seek the Appropriate Type of Evidence

Question	Look for evidence from:
Incidence, prevalence	Surveys, cohort studies
Therapy	Clinical trials
Screening	Clinical trials
Diagnostic accuracy	Clinical trials, cross sectional studies
Prognosis	Clinical trials, cohort studies
Harm	Clinical trials, cohort studies, case control studies
Etiology	Cohort studies, case control

# How Do You Do a Systematic Review?

**Step 1:** Gather together your team and develop a focused research question

**Step 2:** Develop your research plan i.e., protocol (pre-registration, registration)

**Step 3:** Screen and collect studies

**Step 4:** Abstract data, appraise risk of bias in the individual studies and heterogeneity


**Step 5:** Synthesize findings, interpret, and assess overall body of evidence

**Step 6:** Write report

**Step 7:** Update

# Define Research Question

Establish in detail the primary and secondary aims of the study (focused or broad, scanning the literature to identify gaps in the field)

- **P**opulation
  - **I**ntervention(s)
  - **C**omparison(s)
  - **O**utcome
- 

## EXAMPLE

# Psychological therapies for anxiety and depression in children and adolescents with long-term physical conditions

**P** children and adolescents aged up to 18 years with depression or anxiety or both with 'long-term conditions'

**I** individual or group-based psychological or psychologically-oriented therapy excluding e-health therapies

**C** placebo

**O** changes in severity of anxiety and depression symptoms measured separately using validated scales

# Search Methods for Identification of Studies

## Major bibliographic databases for RCTs and observational studies:


- MEDLINE/PubMED ([www.ncbi.nlm.nih.gov/sites/entrez?](http://www.ncbi.nlm.nih.gov/sites/entrez?))
- EMBASE ([www.embase.com](http://www.embase.com))
- Cochrane Central Register of Controlled Trials (CENTRAL) ([www.thecochranelibrary.com](http://www.thecochranelibrary.com))
- National and regional databases (often local language)
  - LILACS (<http://lilacs.bvsalud.org>)
- Subject-specific databases
  - CINAHL (<http://www.ebscohost.com/academic/cinahl-plus-with-full-text/> )
  - PsychINFO (<http://www.apa.org/pubs/databases/psycinfo/index.aspx>)
  - OTSeeker ([www.otseeker.com](http://www.otseeker.com))

# Other Bibliographic Databases to Consider

- Citation databases
  - Web of Science
  - Scopus ([www.scopus.com](http://www.scopus.com))
    - ✓ Dissertations, thesis databases
      - ProQuest ([www.Proquest.com](http://www.Proquest.com))
- Gray literature databases
  - Opengrey ([www.opengrey.eu](http://www.opengrey.eu)): Industry files or internal reports
  - National Guidelines Clearing House ([www.guideline.gov/](http://www.guideline.gov/))



# Development of Search Strategy

1. Start with simple search strategy
  2. Run search, and retrieve reports
  3. Analyze controlled vocabulary terms and keywords of studies fitting your criteria, and revise strategy
  4. Re-run search with revised strategy
  5. Repeat steps 2 through 4 if necessary
  6. Run optimal search strategy
  7. Retrieve reports identified with optimal search strategy
- 
- Decorative geometric shapes in teal, yellow, and green are located in the bottom-left corner of the slide.

# Controlled Vocabulary

e.g., MeSH terms, Emtree terms



## Consistency

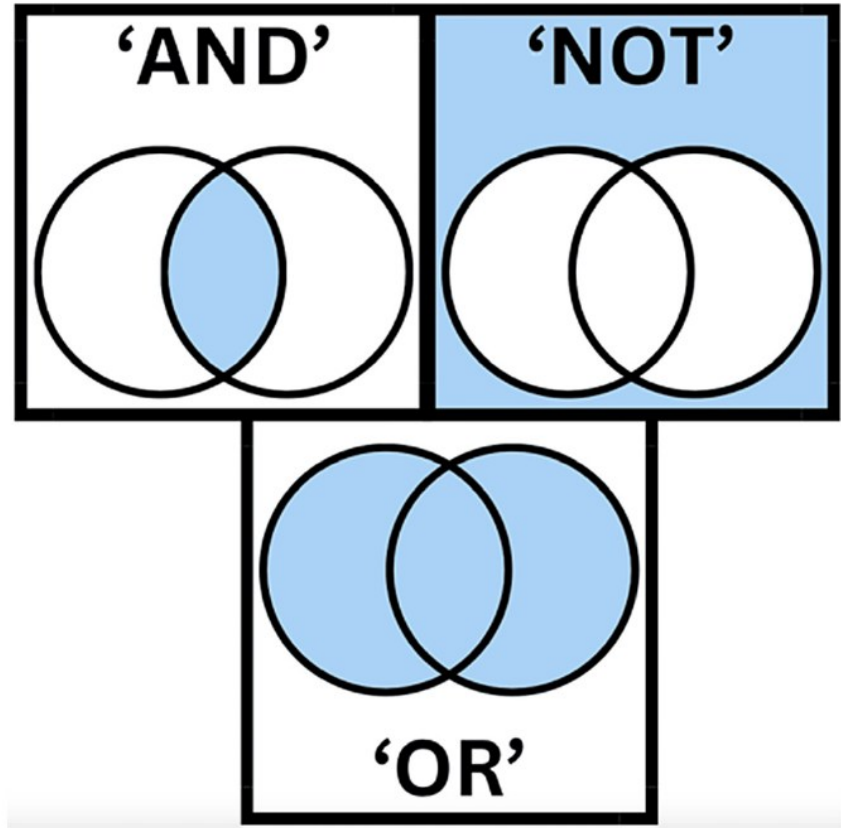
- Alternative spellings
- Synonyms
- Plurals
- Related terms



For systematic review searches, use controlled vocabulary ***and*** keywords

- If you use only keywords, you could miss articles that don't use your precise terms
- If you use only controlled vocabulary, you could miss articles that have not been indexed yet or that have older indexing

# Boolean operators



Start with the **general format**:

- (**P**opulation OR synonym #1 OR synonym #2) AND
- (**I**ntervention OR synonym #1 OR synonym #2) AND
- (**C**omparator OR synonym #1 OR synonym #2) AND
- (**O**utcome OR synonym #1 OR synonym #2) AND



Add study type filter terms

Condition = (anxiety OR depressi\* OR mood OR mutism  
or neuroses OR neurotic OR "obsessive compulsive" OR  
panic OR \*phobi\* OR psychoneuroses OR "stress  
disorder\*" OR "psychological stress" OR "school  
refusal")

AND Comorbidity = not empty

AND Age Group = (child OR adolescent)

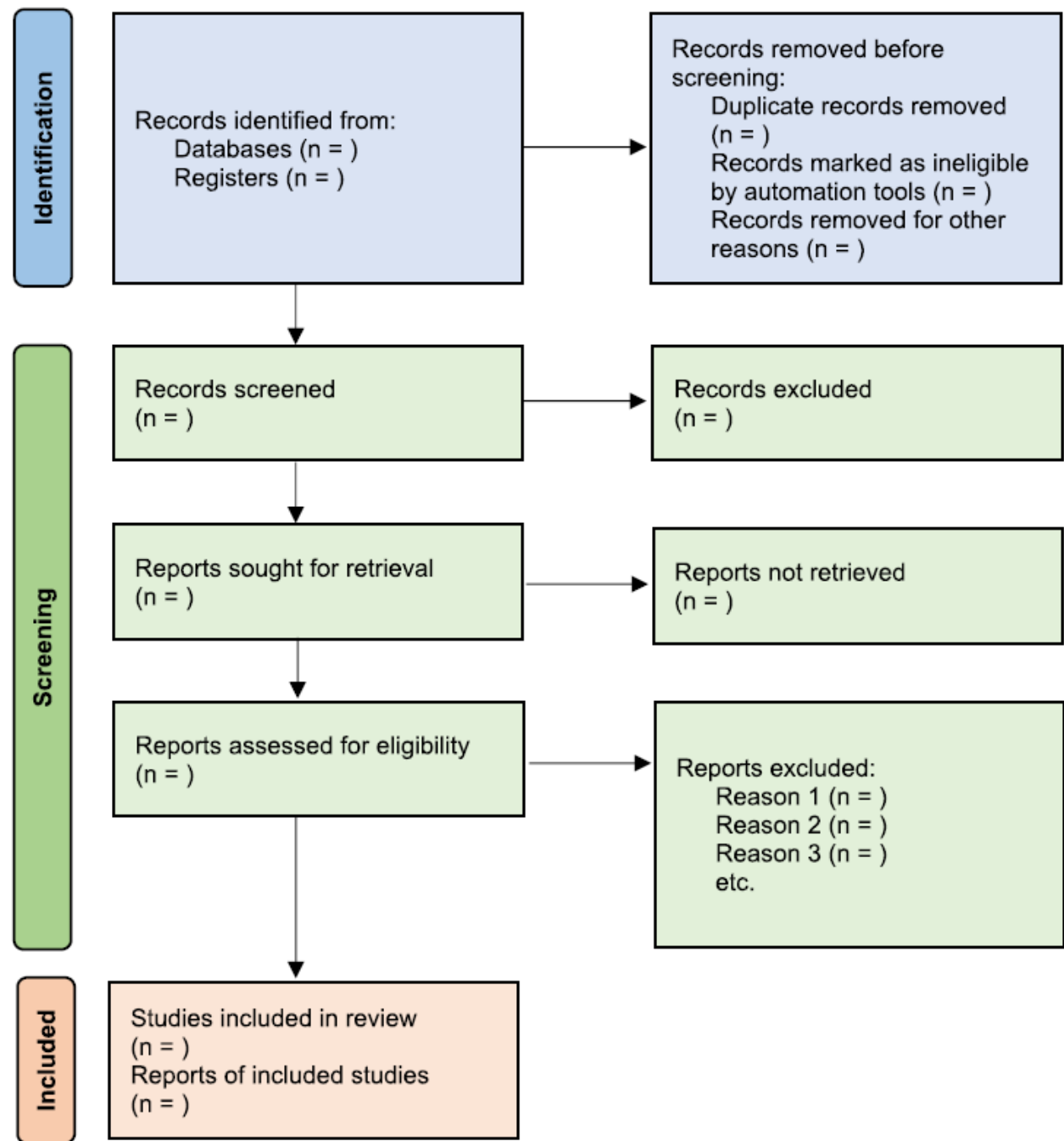
# Screening and selection of studies

It is necessary to upload all our reference files (RIS, BibText, CSV, bib, or txt file) into a predetermined tool for the collection and management of records.

- Rayyan (<https://www.rayyan.ai/>)
- Covidence (<https://www.covidence.org/>)
- EPPI (<https://eppi.ioe.ac.uk/cms/Default.aspx?tabid=2914>)
- CADIMA (<https://www.cadima.info/>)
- DistillerSR (<https://www.distillersr.com/products/distillersr-systematic-review-software> )

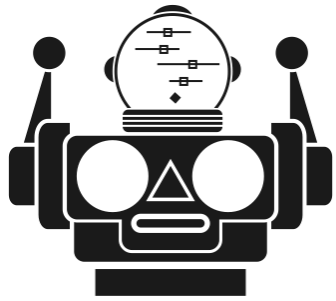
Screening **titles and abstracts** of studies that are identified by the search (2 reviewers, 1 reviewer + AI). Eligible or potentially-eligible articles are retrieved for **full-text** inspection by two authors independently.

# PRISMA flow chart



# Data extraction

At least two authors independently extract data on trial characteristics, the methodology, participant characteristics, intervention characteristics, outcome measures, and outcome data.



**RobotReviewer**

It uses AI to summarize uploaded papers into PICO-based research questions.

<https://www.robotreviewer.net/>

Challenges in study selection and extraction	Acceptable solution
Different measurements	<ul style="list-style-type: none"> <li>• Choose the most common or valid measure</li> <li>• Convert to a common measure</li> <li>• Request more information from author</li> </ul>
Different statistical analysis	<ul style="list-style-type: none"> <li>• Set a spreadsheet for data overview before transfer to statistical software</li> </ul>
Incompatible results	<ul style="list-style-type: none"> <li>• Report them in the text as a narrative synthesis</li> <li>• Report them in a separate table</li> </ul>
Unclear data	<ul style="list-style-type: none"> <li>• Contact authors for clarification</li> </ul>
Unusable or non-numerical data	<ul style="list-style-type: none"> <li>• Report in the review to avoid bias</li> </ul>
No outcome of interest or selective reporting of outcomes	<ul style="list-style-type: none"> <li>• Request more information from authors</li> <li>• Can exclude the study if specific outcome is not included in the eligibility criteria</li> </ul>

# Assessment of risk of bias in included studies

## Randomized trials

RoB2 - Revised Cochrane Risk-of-Bias tool for randomized trials

## Non-randomized studies

ROBINS-I - Cochrane's Risk of Bias In Non-randomized Studies – of Interventions

ROBINS-E - Cochrane's Risk of Bias In Non-randomized Studies - of Exposure

The Newcastle-Ottawa Scale (NOS) for assessing the quality of non-randomized studies

NIH Study Quality Assessment Tools - for Controlled Intervention, Observational Cohort and Cross-Sectional, Case-Control, Case Series Studies

QUADAS – Quality Assessment of Diagnostic Accuracy Studies

QUIPS – Quality in Prognosis Studies

The Joanna Briggs Institute Prevalence Critical Appraisal Tool - for studies reporting prevalence data

PROBAST - Prediction model Risk Of Bias ASsessment Tool



# Traffic light plots

The risk-of-bias judgment in each domain for each study, as well as the overall risk-of-bias judgement for that study.



**NOTE:** RobotReviewer provides a preliminary risk of bias assessment for RCTs, which can streamline users' own assessments

	Risk of bias domains					
	D1	D2	D3	D4	D5	Overall
Study 1	+	+	+	+	+	+
Study 2	-	+	+	+	+	+
Study 3	-	+	-	+	+	-
Study 4	+	+	X	+	-	X
Study 5	X	X	+	+	-	+

Domains:

D1: Bias due to randomisation.

D2: Bias due to deviations from intended intervention.

D3: Bias due to missing data.

D4: Bias due to outcome measurement.

D5: Bias due to selection of reported result.

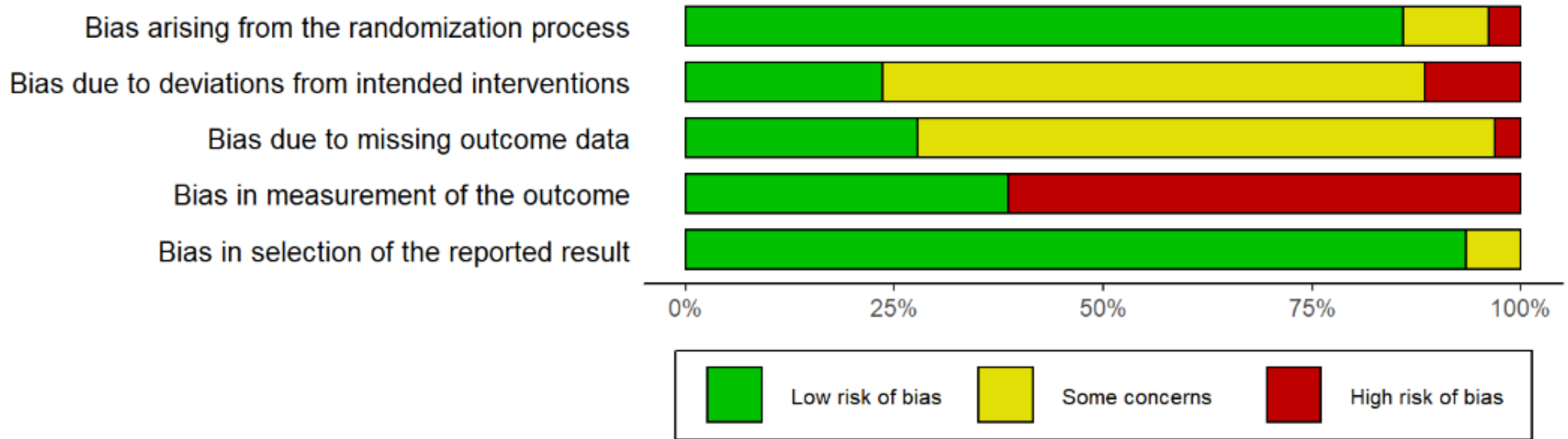
Judgement

X High

- Some concerns





+ Low

# Overall risk-of-bias judgments



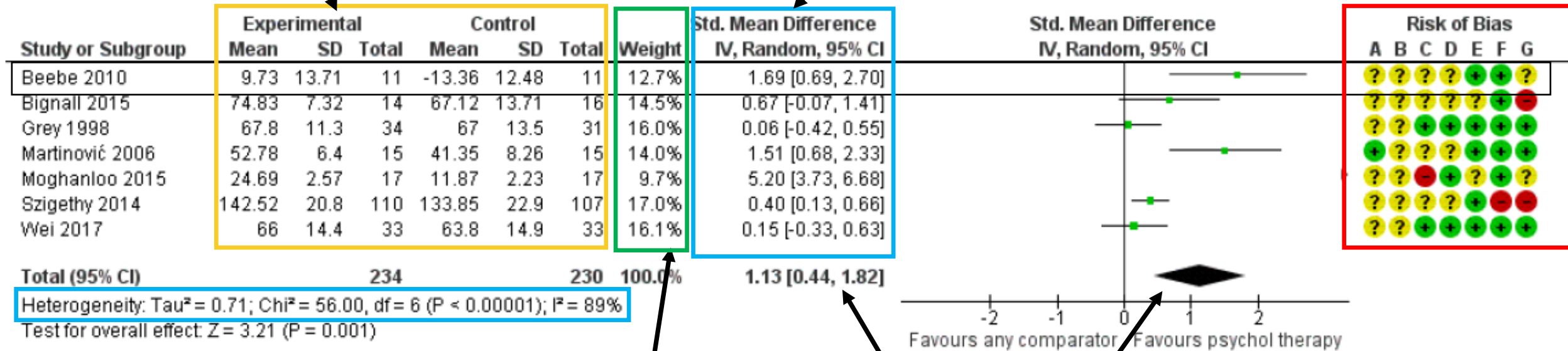
# Data synthesis

## Example

- When available and sufficiently clinically and statistically homogenous, we combined final score data from included trials in **meta-analyses**.  Type of synthesis
- As we were anticipating heterogeneity of data, we planned on analysing the data using RevMan 5.3 using a **random effects model** for analysis.  Type of model
- We presented the 'Risk of bias' assessment in a 'Risk of bias' graph. We presented results for each comparison as **forest plots**, when appropriate.  Presentation of results
- We provided narrative summaries for comparisons with fewer than two available studies and those with a moderate or high level of statistical heterogeneity following **exploration of heterogeneity**.  Heterogeneity

## Extracted Data from studies

## Effect size (95% CI)



### Risk of bias legend

- (A) Random sequence generation (selection bias)
- (B) Allocation concealment (selection bias)
- (C) Blinding of participants and personnel (performance bias)
- (D) Blinding of outcome assessment (detection bias)
- (E) Incomplete outcome data (attrition bias)
- (F) Selective reporting (reporting bias)
- (G) Other bias

# Grading of Recommendations Assessment Development and Evaluation (GRADE) criteria



<https://book.gradeapro.org/>

<https://www.gradeworkinggroup.org/>



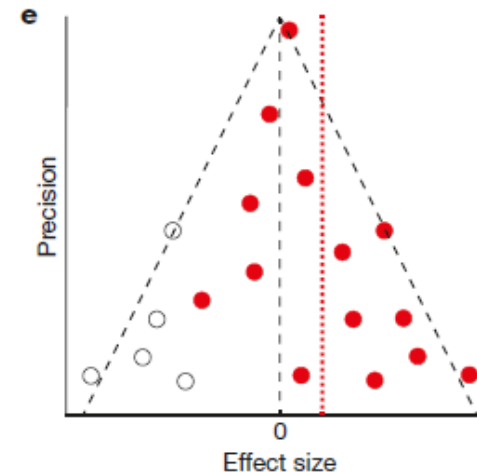
- **High** ⊕⊕⊕⊕ Very confident that the true effect lies close to the estimate of the effect.
- **Moderate** ⊕⊕⊕○ Moderately confident in the effect estimate: true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
- **Low** ⊕⊕○○ Limited confidence in the effect estimate: true effect may be substantially different from the estimate of effect.
- **Very low** ⊕○○○ Very little confidence in the effect estimate: true effect is likely to be substantially different from the estimate of effect.

# A summary of GRADE's approach to rating quality of evidence

Study design	Initial quality of a body of evidence		Lower if	Higher if	Quality of a body of evidence
Randomized trials	High		<div>Risk of Bias</div> <div>-1 Serious</div> <div>-2 Very serious</div>	<div>Large effect</div> <div>+1 Large</div> <div>+2 Very large</div>	High (four plus: ⊕ ⊕ ⊕ ⊕)
			<div>Inconsistency</div> <div>-1 Serious</div> <div>-2 Very serious</div>	<div>Dose response of a gradient</div> <div>+1 Evidence</div>	Moderate (three plus: ⊕ ⊕ ⊕ ○)
Observational studies	Low		<div>Indirectness</div> <div>-1 Serious</div> <div>-2 Very serious</div>	<div>All plausible residual confounding</div> <div>+1 Would reduce a demonstrated effect</div>	Low (two plus: ⊕ ⊕ ○ ○)
			<div>Imprecision</div> <div>-1 Serious</div> <div>-2 Very serious</div>	<div>+1 Would suggest a spurious effect if no effect was observed</div>	Very low (one plus: ⊕ ○ ○ ○)
			<div>Publication bias</div> <div>-1 Likely</div> <div>-2 Very likely</div>		

# More specific

- Study design (RCT vs Observational)
- Risk of bias (RoB tool)
- Inconsistency (heterogeneity,  $I^2$ )
- Indirectness (differences in PICO questions)
- Imprecision (sample size, few events, 95% CI of the summary effect)
- Publication Bias (Funnel Plot)





Psychological therapy compared to any comparator for anxiety and depression in children and adolescents with long-term physical conditions

**Patient or population:** anxiety and depression in children and adolescents with long-term physical conditions

**Setting:**

**Intervention:** psychological therapy

**Comparison:** any comparator

Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)	comments
	Risk with any comparator	Risk with Psychological therapy				
Treatment efficacy: depression short-term	The mean depression short-term was 0	SMD 0.31 lower (0.59 lower to 0.03 lower)	-	1121 (16 RCTs)	⊕⊕⊕⊖ LOW 1 2 3	A SMD of 0.31 is a small effect size
Treatment efficacy: anxiety short-term	The mean anxiety short-term was 0	SMD 0.26 lower (0.59 lower to 0.07 higher)	-	578 (13 RCTs)	⊕⊕⊕⊖ MODERATE 1 2	The confidence interval crosses the line of no effect
Quality of life short-term	The mean quality of life short-term was 0	SMD 1.13 higher (0.44 higher to 1.82 higher)	-	464 (7 RCTs)	⊕⊕⊕⊖ LOW 1 2 3	A SMD of 1.13 is a large effect size
Functioning short-term	The mean functioning short-term was 0	SMD 0.49 higher (0.3 lower to 1.29 higher)	-	483 (7 RCTs)	⊕⊕⊕⊖ LOW 1 2 3	The confidence interval crosses the line of no effect

- 1

High degree of inconsistency between results
- 2

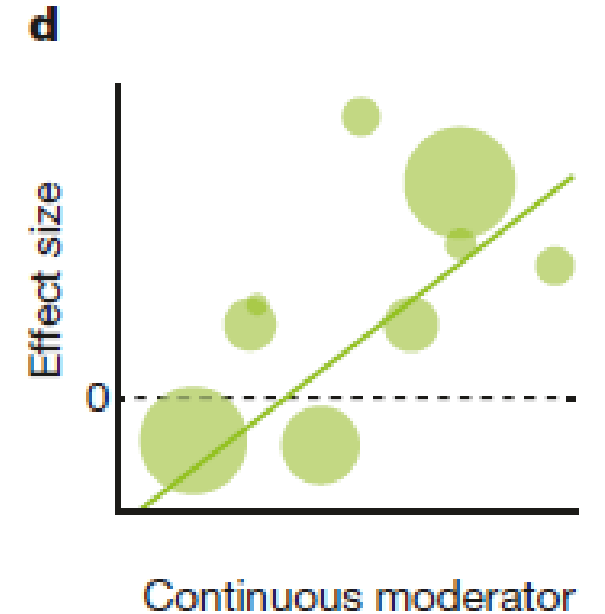
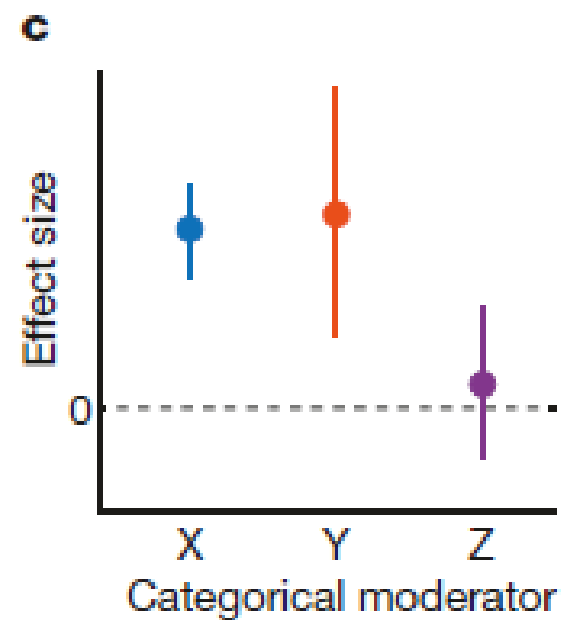
Substantial heterogeneity
- 3

Upper/lower CI crosses the effect size (SMD) of 0.5 in either direction



# Exploration of data

- Subgroup analysis and investigation of heterogeneity, Meta-regression
- Sensitivity analysis



# Reporting the review

The methods and results of systematic reviews should be reported in sufficient detail to allow users to assess the trustworthiness and applicability of the review findings.



Enhancing the **QUALity** and  
**Transparency Of health Research**



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- Causal inference
- Sample size calculation

<https://lights.science/>

# Reporting tools for systematic reviews

- PRISMA 2020 (<https://www.bmj.com/content/372/bmj.n160>)  
(<https://www.prisma-statement.org/extensions>)



- Synthesis without meta-analysis (SWiM) in systematic reviews: reporting guideline  
(<https://www.bmj.com/content/368/bmj.l6890>)

- COSMIN  
(<https://www.cosmin.nl/tools/cosmin-taxonomy-measurement-properties/>)





## PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
<b>TITLE</b>			
Title	1	Identify the report as a systematic review.	
<b>ABSTRACT</b>			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	
<b>METHODS</b>			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	

# Concise guide to best practices for evidence syntheses

Resources	Intervention	Diagnostic	Prognostic	Qualitative or mixed methods	Prevalence and incidence	Etiology and risk	Measurement properties	Overviews (umbrella reviews)	Scoping reviews
Methodological guidance	Cochrane <sup>b</sup> , JBI	Cochrane, JBI	Cochrane	Cochrane, JBI	JBI	JBI	JBI	Cochrane, JBI	JBI
Reporting <sup>c</sup> Protocol	PRISMA-P <sup>116</sup>	PRISMA-P	PRISMA-P	PRISMA-P	PRISMA-P	PRISMA-P	PRISMA-P	PRISMA-P	PRISMA-P
Systematic review	PRISMA 2020 <sup>112</sup>	PRISMA-DTA <sup>120</sup>	PRISMA 2020	eMERGe <sup>213,d</sup> ENTREQ <sup>214,d</sup>	PRISMA 2020	PRISMA 2020	PRISMA 2020	PRIOR <sup>215</sup>	PRISMA-ScR <sup>121</sup>
Synthesis without meta-analysis	SWiM <sup>180</sup>		SWiM <sup>e</sup>		SWiM <sup>e</sup>	SWiM <sup>e</sup>	SWiM <sup>e</sup>		
RoB assessment of included studies <sup>f</sup>	For RCTs: Cochrane RoB2 <sup>157</sup> For NRSI: ROBINS-I <sup>158</sup> Other primary research <sup>g</sup>	QUADAS-2 <sup>216</sup>	Factor review QUIPS <sup>217</sup> Model review PROBAST <sup>65</sup>	CASP qualitative checklist <sup>218</sup> JBI critical appraisal checklist <sup>219,h</sup>	JBI checklist for studies reporting prevalence data <sup>220</sup>	For NRSI: ROBINS-I <sup>158</sup> Other primary research <sup>g</sup>	COSMIN RoB Checklist <sup>67</sup>	AMSTAR-2 <sup>6</sup> or ROBIS <sup>4</sup>	Not required <sup>i</sup>
Overall level of evidence certainty	GRADE <sup>27</sup>	GRADE adaptation <sup>j</sup>	GRADE adaptation <sup>k</sup>	CERQual <sup>221</sup> ConQual <sup>222,l</sup>	GRADE adaptation <sup>m</sup>	Risk factors <sup>n</sup>	GRADE adaptation <sup>o</sup>	GRADE (for intervention reviews) Risk factors <sup>n</sup>	Not applicable