

# Overview of Systematic Review and Research Synthesis

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Center on  
**KNOWLEDGE TRANSLATION FOR  
DISABILITY & REHABILITATION RESEARCH**

at American Institutes for Research ■



# Goals for the Presentation

- Discuss the rationale for systematic review and meta-analysis.
- Describe the different types of reviews encountered in the literature.
- Provide an overview of the stages of a systematic review and meta-analysis.

# Why Use Systematic Review and Meta-Analysis?

# What Is a Systematic Review?

From Petticrew, M., & Roberts H. (2006). *Systematic reviews in the social sciences: A practical guide*. Malden, MA: Blackwell Publishing.

- “A systematic review is a review that strives to comprehensively identify, appraise, and synthesize all the relevant studies on a given topic.” (p. 19)
- “Systematic reviews are a method of making sense of large bodies of information and a means of contributing to the answers to questions about what works and what does not – and many other types of questions, too.” (p. 2)

# Essential Goals of Systematic Review

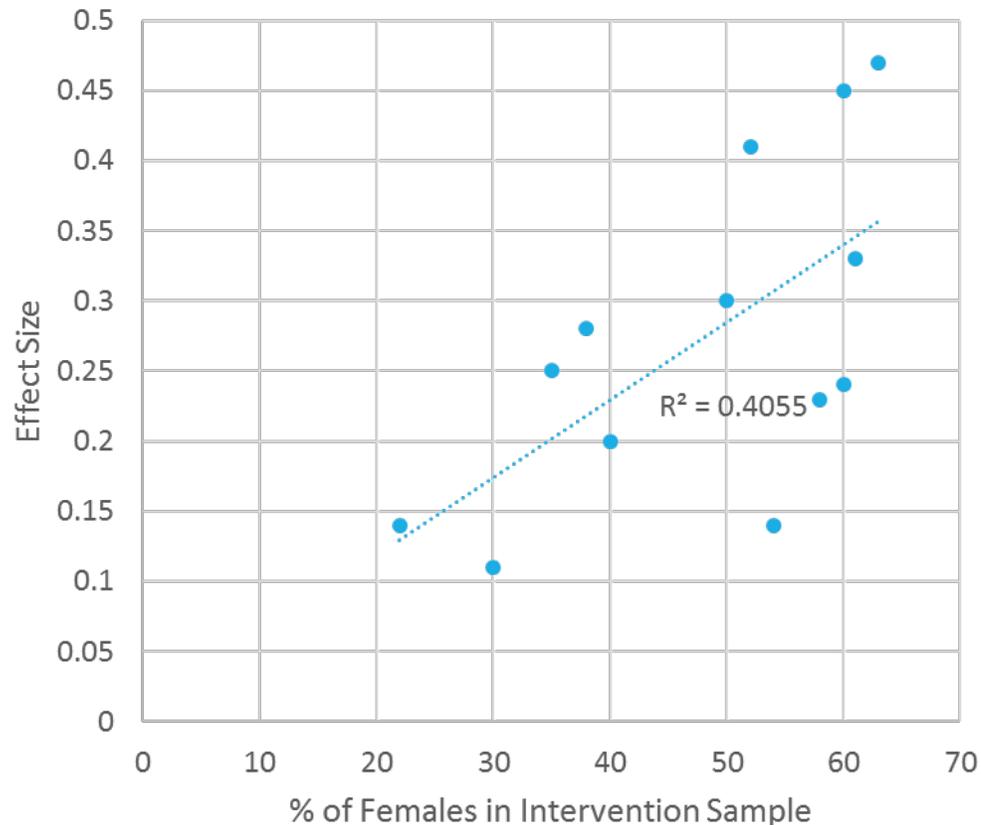
- Summarize existing empirical research to inform policy and practice.
- Provide directions for future research. (Williams et al., 2017)
- Use replicable and transparent methods to summarize existing research.

# Rationale for the Use of Systematic Reviews

- Examining the results of multiple studies provides stronger evidence than results of any single study.
- Single studies can have undue influence on practice and policy.
- Single studies can have limitations in design, generalizability, etc.
- We don't use single-subject (N=1) designs to assess public opinion (or at least we shouldn't...).

# Rationale for Systematic Reviews (cont.)

Illustrative Example



- Systematic reviews provide opportunities to examine variation across studies not possible in a single study.
- Multiple studies allow the exploration of why research results may vary due to differences in research design, sample characteristics, implementation of intervention, context, measures, etc.
- Meta-analysis can examine associations between study results and variation in methods across studies.

# Littell (2008)

- This paper examined the quality of narrative reviews studying the effectiveness of Multi-Systemic Therapy (MST) for treating youth with a range of behavioral challenges.
- One part of the study examined how each review characterized the results of a single study on MST.
- Let's look first at the results of one study and then examine how narrative reviews using that study characterize the results.
- Reference: Littell, J. H. (2008). Evidence-based or biased? The quality of published reviews of evidence-based practices. *Child and Youth Services Review, 30*, 1299-1317.

# Study Example: Brunk et al., 1987

Brunk, M., Henggeler, S. W., & Whealan, J. P. (1987). Comparison of multisystemic therapy and parent training in the brief treatment of child abuse and neglect. *Journal of Consulting and Clinical Psychology, 55*(2),171-178.

- 43 families of abused/neglected children randomly assigned to:
  - Parent training (PT) groups or Multi-Systemic Therapy (MST)
- 33/43 families completed treatment and provided data on outcomes immediately after treatment.
- 30 outcomes (scales and subscales).

# Results Obtained by Brunk et al., 1987



# How Did Brunk et al. Interpret These Results?

- Data provided on all (7) statistically significant results
- 12/22 non-significant results
- Used a series of MANOVAs with groups of measures
- **Outcome reporting bias**



# Brunk et al. Interpretation (cont.)

- Both groups showed decreased psychiatric symptoms, reduced stress, and reduced severity of identified problems.
- MST was more effective than PT at restructuring parent-child relations.
- PT was more effective than MST at reducing identified social problems.

Abstract



Data provided

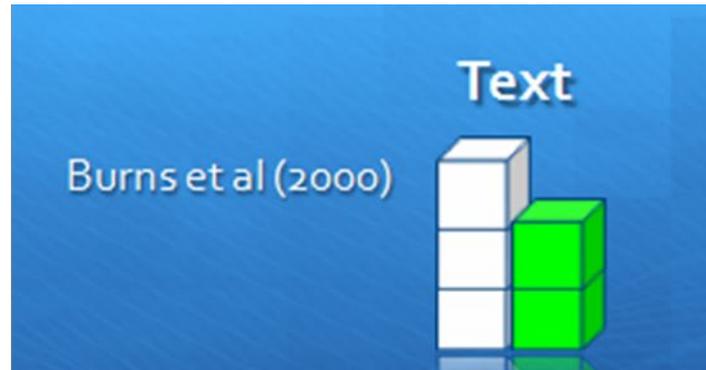


Outcome data



# One Review's Description of Brunk et al.

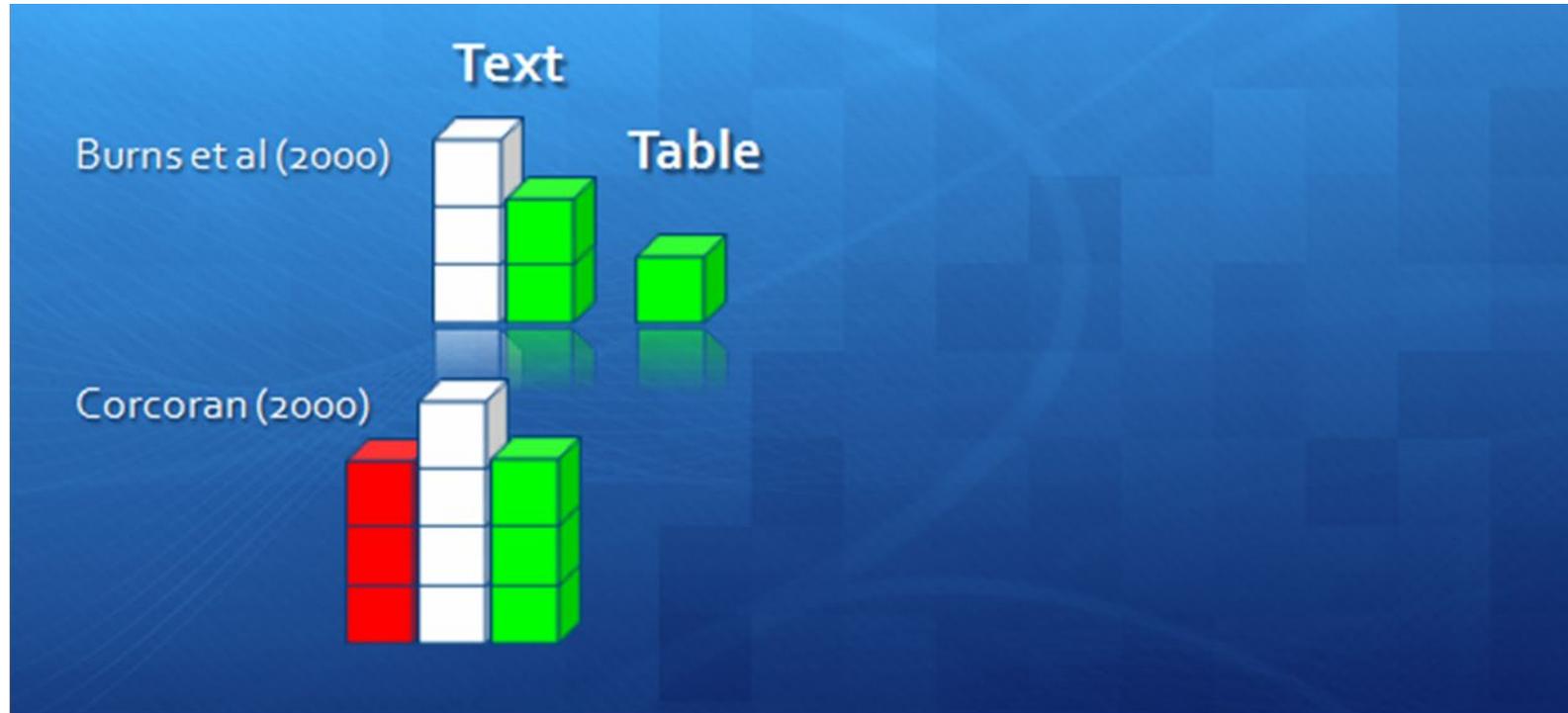
“Parents in both groups reported decreases in psychiatric [symptoms] and reduced overall stress....both groups demonstrated decreases in the severity of the identified problems ....[MST] improved [parent-child] interactions, implying a decreased risk for maltreatment of children in the MST condition” (p. 293).



Outcome data



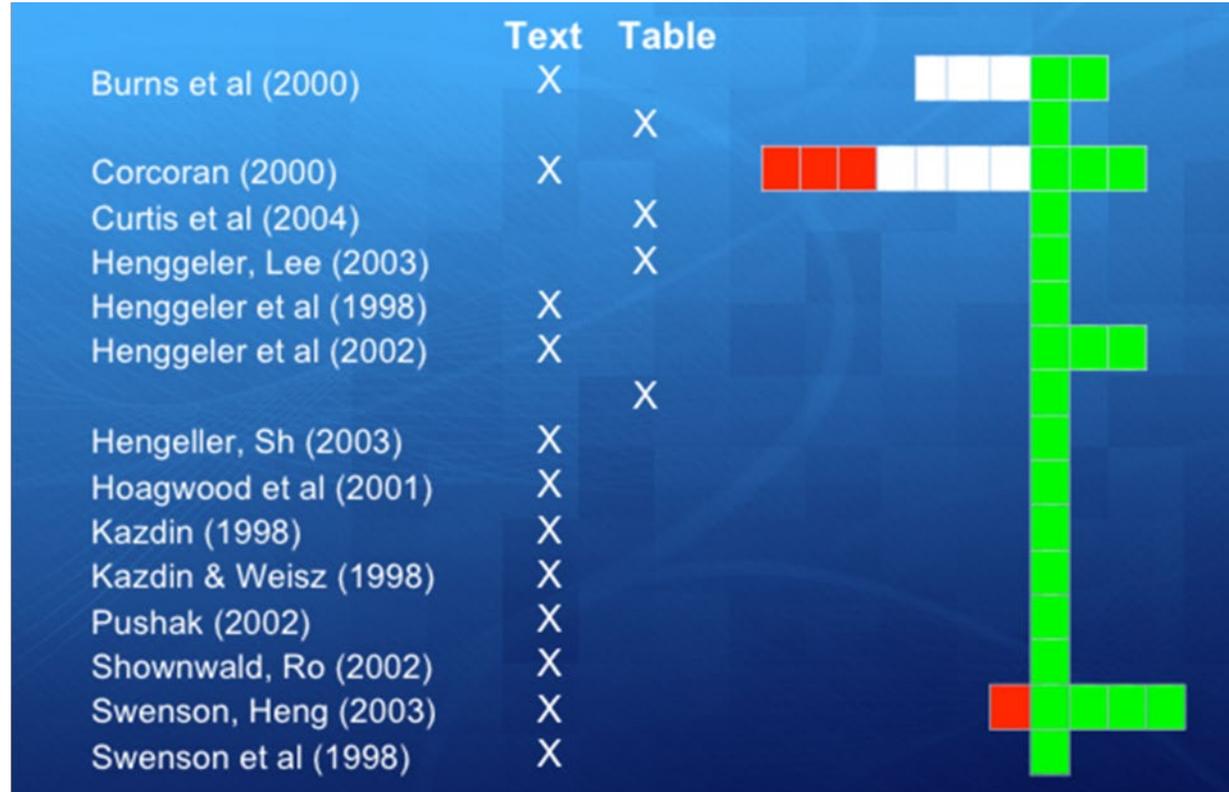
# Comparison of Two Reviews' Discussion of Brunk et al.



Outcome data



# Summary of All Published Reviews' Discussion of Brunk et al.



## Outcome data



# Summary of All Published Reviews' Discussion of Brunk et al. (cont.)

- Most reviews used a single phrase to characterize results of this study, highlighting advantages of one approach (MST).
- Most reviews ignored valuable information on relative advantages, disadvantages, and equivalent results of different approaches.

Outcome data



# All Reviews Included Multiple Studies

How did the reviewers synthesize the results of studies of MST?

# What Methods Did the Reviewers Use?

Analysis of reviews of research on effects of MST published after 1996:

- 86+ reviews
- More reviews than studies
- Assessed 66 reviews
- Many “light” reviews (rely on other reviews)
- 37 reviews cited one or more primary studies (Littell, 2008)

# Methods Reviewers Used (cont.)

37 reviews cited one or more primary studies:

- Most were traditional, narrative summaries of convenience samples of published reports (Littell, 2008).
- Most conclude that MST “works” (i.e., is consistently more effective than alternatives).
- Some conclude that MST is effective across problems, populations, and settings:
  - Citing Brunk et al. (1987) [only] as the evidence for effects in cases of child abuse and neglect

# What Did a Systematic Review of MST Find? (Littell, 2005)

Effects are not consistent across studies:

- Few studies, most conducted by program developers in USA
- All studies have mixed results across outcomes, except those that have null results on all outcomes

Contrary to conclusions of most published reviews, which suggest that the effectiveness of MST is well established, consistent across studies

**Campbell Systematic Reviews**

2005:1

First published: 23 August, 2005

Last updated: 21 September, 2005

## **Multisystemic Therapy for Social, Emotional, and Behavioral Problems in Youth Aged 10-17**

Julia H. Littell, Melanie Popa, Burnee Forsythe

# Potential Bias in Traditional Narrative Reviews

- Selection bias (i.e., lack of transparency for study inclusion)
  - Publication bias
  - Dissemination bias
  - Confirmation and allegiance bias
- Outcome reporting bias
- Use of “cognitive algebra” to synthesize results

# Selection Bias: Publication Bias

## Published studies

- Are three times more likely to be published than similar studies with null or negative results (Song et al., 2009, inception cohort)
- Have effect sizes about .19 standard deviations larger than unpublished studies (Polanin, Tanner-Smith, & Hennessey, 2016)

## Sources of publication bias are complex:

- Investigators less likely to submit null results for conference presentations (Song et al., 2009) & publication (Dickersin, 2005)
- Peer reviewers and editors less likely to accept/publish null results (Song et al., 2009)

# Selection Bias: Dissemination Bias

Relying on published results can also lead to dissemination bias.

Studies with significant results are

- Published faster (Hopewell et al., 2001)
- Cited and reprinted more often
- More likely to be published in English than other languages
- Easier to locate (esp. in English)

# Selection Bias: Confirmation & Allegiance Bias

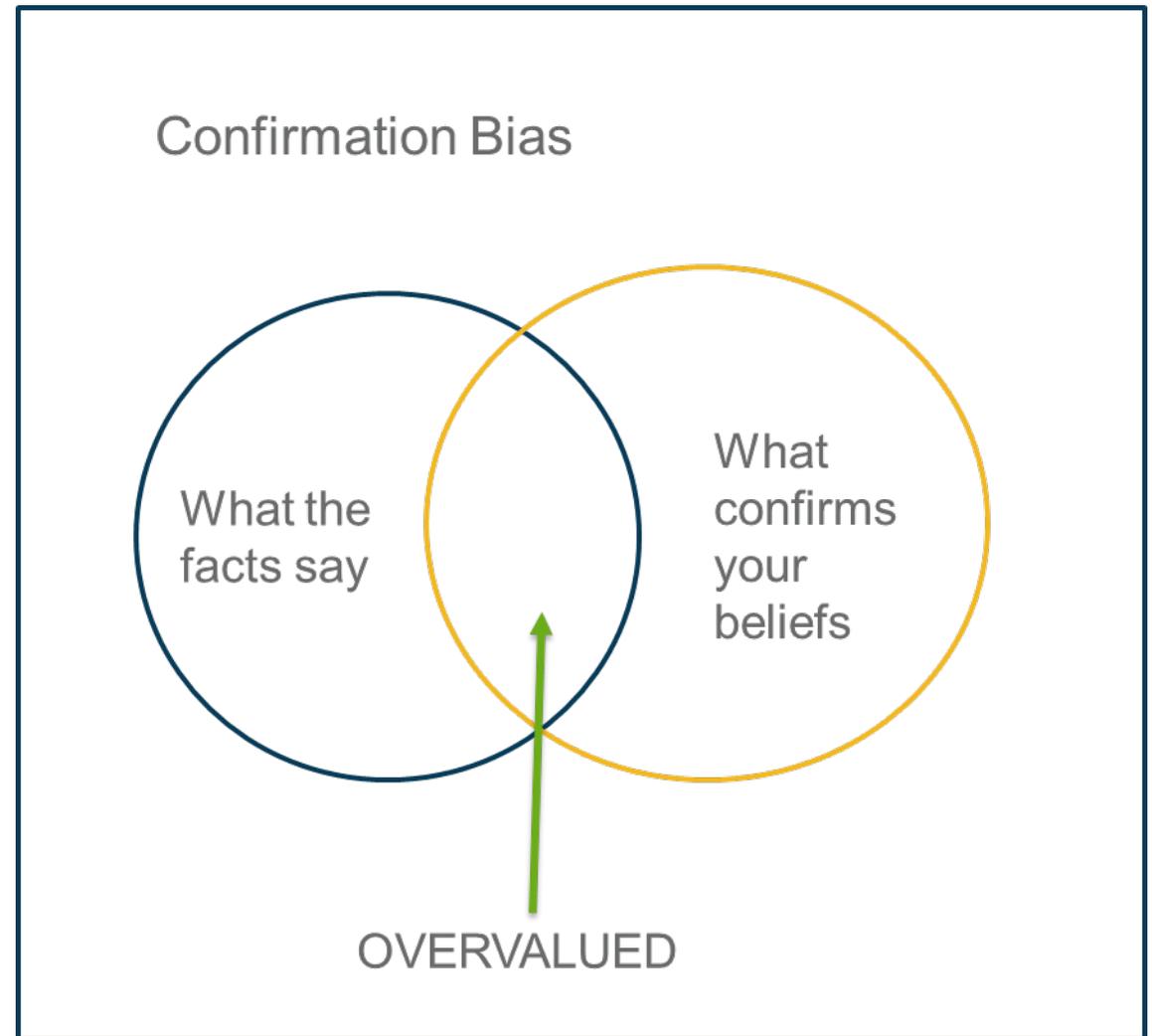
Without clear selection criteria for studies in a review, reviews are also subject to

## Confirmation bias

- Tendency to seek and accept information that confirms prior expectations (hypotheses) and ignore evidence to the contrary (Rabin & Schrag, 1999)

## Allegiance bias

- Researchers' preferences predict results (Luborsky et al., 1999)



# Outcome Reporting Bias

- Traditional, narrative reviews tend to report on the statistically significant results from a primary study.
- Within studies with mixed results, significant results are also more likely to be
  - Reported (mentioned at all)
  - Fully reported (i.e., data provided)
- There is active research on outcome reporting bias in medicine (Vedula et al., 2009) and in education (Pigott et al., 2013).

# Use of “Cognitive Algebra” to Synthesize Results

- Primary studies include many measures and statistical analyses, making a narrative summary difficult.
- There is a tendency to count up the numbers of results supporting or not supporting a given hypothesis – a procedure termed “vote counting.”
- Vote counting does not provide statistically defensible results given ubiquitous power issues in primary studies.

# Use of “Cognitive Algebra” to Summarize Results (cont.)

Kahneman, D. (2011). *Thinking, fast and slow*. New York, NY: Farrar, Straus and Giroux, p. 118.

“The exaggerated faith in small samples is only one example of a more general illusion – we pay more attention to the content of messages than to information about their reliability, and as a result end up with a view of the world around us that is simpler and more coherent than the data justify.”

# Systematic Reviews as an Alternative

Systematic reviews:

- Aim to minimize bias and error in the review process
- Develop and follow a predetermined plan (protocol)
- Use transparent, well-documented, and replicable procedures to locate, analyze, and synthesize results of previous studies

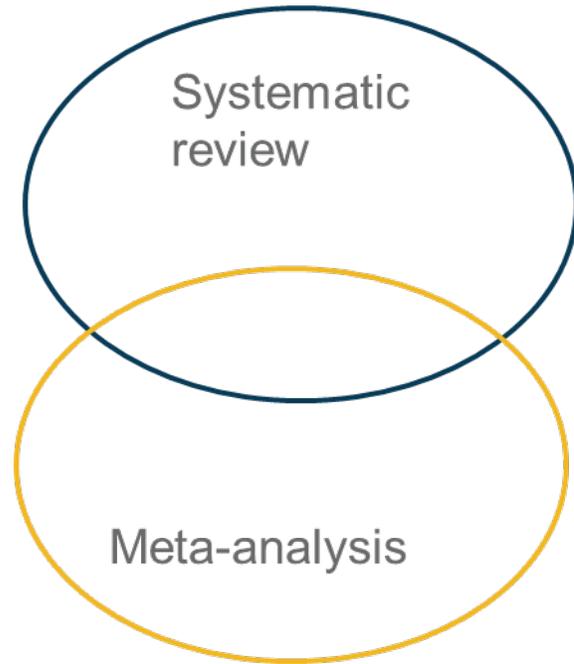
# Steps Used in Systematic Reviews to Reduce Bias and Error

- Set explicit inclusion/exclusion criteria
- Develop and document strategies for locating all relevant studies (regardless of publication status)
- Interrater agreement (reliability) on key decisions, data extraction, coding
- Formal study quality assessment (risk of bias)
- Meta-analysis (when possible) to synthesize results across studies

# What Is Meta-Analysis?

- Meta-analysis is a set of statistical techniques to synthesize the quantitative results from a set of studies.
  - Meta-analysis techniques include methods for estimating an average effect and the variance of that average effect from a set of studies.
  - Meta-analysis techniques also provide methods for exploring the variation across study results.
  - Meta-analysis techniques exist to examine potential risk of bias.

# Systematic Reviews and Meta-Analysis



- Systematic reviews don't always include meta-analysis:
  - Might include narrative synthesis (or no synthesis)
  - Can include multiple meta-analyses
- Meta-analyses are not always based on systematic reviews
  - Many use convenience sample of published studies
  - Vulnerable to publication and dissemination biases

# Purpose for a Systematic Review: Configuration vs. Aggregation

- Gough, Oliver, & Thomas (2017) discuss the difference between systematic reviews aimed at **configuration** versus **aggregation**.
- Configurative synthesis involves interpretive conceptual analysis where the concepts are the data for analysis. Example: Reviews in *Review of Research in Education*.
- Aggregative synthesis involves summarizing the data from a set of studies and when possible, using meta-analysis.

# “Mapping” the Literature

- Researchers interested in understanding the evidence base for an issue might use **Evidence and Gap Maps**.
- Evidence and Gap Maps use systematic methods to identify studies in the literature and then organize them into a “map.”
- Typically the rows of the map are interventions, and the columns are outcomes.
- 3ie and the Campbell Collaboration have produced a number of these maps.
- 3ie: <http://www.3ieimpact.org/evidence-hub/evidence-gap-maps>
- Campbell Collaboration: <https://www.campbellcollaboration.org/explore/making-an-evidence-and-gap-map-egm.html>

# Example: Youth and Transferable Skills

Outcomes

Interventions	Learning and behaviour						Academics, employment, livelihoods and demography					
	Individual knowledge	Individual beliefs and attitudes	Observed transferable skills	Social participation and interaction	Health and safety behaviours	Livelihoods and employment behaviours	Criminality	Demography and health	Academic and schooling outcomes	Employment	Wages, income and assets	Other livelihoods measures
Teacher training programmes and curriculum reform	●	●	●		●		●	●	●	●	N/A	N/A
Teacher networking and support										N/A	N/A	N/A
Teacher incentives										N/A	N/A	N/A
Skills courses at school	●●	●●	●●	●	●●			●				
Institutional management and capacity building	N/A	N/A								N/A	N/A	N/A

Source: <http://gapmaps.3ieimpact.org/evidence-maps/youth-transferable-skills-evidence-gap-map>

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# Other Review Strategies

- **Scoping Reviews:** Scoping reviews are typically used to understand how many studies may exist in a literature. They can use either systematic or unsystematic ways to search the literature.
- **Rapid Evidence Assessment:** Rapid Evidence Assessments are reviews that are conducted on a short timeline, usually in direct response to a time-sensitive policy question. Typically, they involve a limited literature search (limited to published literature, for example) and a limited coding and analysis strategy.

# Conclusions

Different review methods produce different results.

- Traditional methods are “haphazard” (Petticrew & Roberts, 2005) and can lead to the wrong conclusions.
- Scientific methods are needed to minimize bias and error.

“Science is cumulative but scientists rarely cumulate evidence scientifically.” (Chalmers, Hedges, & Cooper, 2002. Abstract)

- We can use scientific principles and methods to synthesize evidence.

# Another Potential Contribution of Systematic Review

Systematic review and meta-analysis can make a contribution to the current debate about replication in the social sciences.

- Research on power in meta-analysis has direct application to replication studies:
  - Power to detect variation across study effects
  - Power to examine the association between study effects and study methods (treatment heterogeneity)
- Debates in systematic review about what studies should be included (i.e., definitions of replications)

# Organizations Supporting Systematic Reviews

- **Campbell Collaboration**
- **Cochrane Collaboration**
- **American Academy of Neurology**
- **Centre for Evidence and Implementation**
- **Centre for Evidence-Based Medicine**
- **Centre for Reviews and Dissemination**
- **Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre)**
- **Joanna Briggs Institute**
- **National Academy of Sciences**

# The Campbell Collaboration

**Website:** <https://www.campbellcollaboration.org/>

**Contact the Disability Coordinating Group:**

<https://www.campbellcollaboration.org/about-campbell/coordinating-groups/disability.html>

The Campbell Collaboration is a voluntary, nonprofit, international research network. That produces and disseminates systematic reviews of the effects of interventions in the social and behavioral sciences.

**Campbell Library:** <https://www.campbellcollaboration.org/library.html>

**Resources for researchers conducting reviews:**

<https://www.campbellcollaboration.org/research-resources.html>

# The Cochrane Collaboration

**Website:** <https://www.cochrane.org/>

The Cochrane Collaboration's mission is to promote evidence-informed health decision-making by producing high-quality, relevant, accessible systematic reviews and other synthesized research evidence.

The *Cochrane Handbook for Systematic Reviews of Interventions* is the official guide that described in detail the process of preparing and maintaining Cochrane systematic reviews on the effects of healthcare interventions. The current version of the Handbook (5.1) is freely available online at

<https://training.cochrane.org/handbook>

Cochrane Library: <https://www.cochranelibrary.com/>

# American Academy of Neurology (AAN)

**Website:** <https://www.aan.com/>

**Contact:** <https://www.aan.com/AAN-Resources/Details/contact-aan/>

The AAN uses a strict evidence-based methodology that follows the Institute of Medicine's (IOM) standards for developing systematic reviews and clinical practice guidelines (CPGs). The AAN process is designed to rigorously evaluate the strength of the evidence and formulate explicit practice recommendations to improve patient outcomes.

- Access the AAN Guidelines Process Summary, 2011 Manual, and approved amendments:
  - [AAN Systematic Review and Guideline Development Process Summary](#)
  - [2011 Manual](#)
  - [Amendments to the 2011 Manual](#)
- [Guidelines](#)
- [Systematic Reviews](#)

# Centre for Evidence and Implementation (CEI)

**Website:** <https://www.ceiglobal.org/>

**Contact:** <https://www.ceiglobal.org/contact>

CEI focuses its work on three areas: making sense of the evidence; effectively implementing evidence in practice; and trialing, testing, and evaluating. CEI applies its expertise in accessing, synthesizing, and analyzing high-quality research to provide insight into what the evidence says is effective. Evidence products include:

- Systematic reviews (including synthesis of findings from systematic reviews)
- “Evidence and Gap Maps” (a visual overview of areas that have — and have not yet — been the subject of rigorous research studies)
- Hybrids which constitute components of systematic reviews and Evidence and Gap Maps

# Centre for Evidence Based Medicine (CEBM)

**Website:** <https://www.cebm.net/>

**Contact:** <https://www.cebm.net/contact/>

CEBM develops, promotes, and disseminates better evidence for health care. CEBM research generates and synthesizes high-quality evidence that benefits patients and society. Examples of resources that support systematic reviews:

- Courses/training: <https://www.conted.ox.ac.uk/about/modules-and-short-courses-in-the-evidence-based-health-care-programme>
- EBM Library: <https://www.cebm.net/ebm-library/>
- Tools: <https://www.cebm.net/category/ebm-resources/tools/>
- Oxford University Systematic Reviews: <https://libguides.bodleian.ox.ac.uk/systematic-reviews>

# Centre for Reviews and Dissemination (CRD)

**Website:** <https://www.york.ac.uk/crd/>

**Contact:** <https://www.york.ac.uk/crd/about/>

CRD is a research department that specializes in evidence synthesis, assembling and analyzing data from multiple research studies. CRD has completed over 200 high-quality systematic reviews covering a wide range of health care topics to facilitate the use of research evidence in decision making. Systematic reviews are supported through the following:

- Courses/training
- Publications
- Databases (Database of Abstracts of Reviews of Effects [DARE] and NHS Economic Evaluation Database [NHS EED])
- [PROSPERO](#) (international prospective register of systematic reviews)

# Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre)

Website: <https://eppi.ioe.ac.uk/>

Contact: <https://eppi.ioe.ac.uk/cms/Default.aspx?tabid=718>

The EPPI-Centre has more than 25 years of experience conducting and supporting systematic reviews in areas including education, health, and social care. In support of systematic reviews, the EPPI-Centre provides:

- Courses and seminars
- Publications on research synthesis
- Online software tool for research synthesis (EPPI-Reviewer 4)
- Guidance tools that support coding, data management, and learning about meta-analysis
- Guideline tools for keywording, data extraction including standardized strategies and examples for coding in education and health fields
- MetaLight software for teaching and learning meta-analysis
- Databases containing full references for primary research studies and evidence reviews

# Joanna Briggs Institute (JBI)

Website: <http://joannabriggs.org>

Contact: <http://joannabriggs.org/contact.html>

The Joanna Briggs Institute is the international not-for-profit, research and development center within the Faculty of Health Sciences at the University of Adelaide in South Australia and is named after the first matron of the Royal Adelaide Hospital. JBI conducts systematic reviews and supports systematic reviews with the following resources:

- Training/courses: [Education](#)
- The System for the Unified Management, Assessment and Review of Information ([SUMARI](#)) is JBI's premier software for the systematic review of literature.
- Critical appraisal tools: [Appraisal Tools](#)
- JBI Database of Systematic Reviews and Implementation Reports ([JBISRIR](#))
- JBI Reviewer's Manual: [Reviewer's Manual](#)

# National Academy of Sciences (NAS)

**Website:** <http://www.nasonline.org/>

**Contact:** <http://www.nasonline.org/about-nas/contact-theNAS/>

The National Academy of Sciences is a private, nonprofit society of distinguished scholars and scientists charged with providing independent, objective advice to the nation on matters related to science and technology. The NAS was established by an Act of Congress and signed by President Abraham Lincoln in 1863. Members are elected by their peers for outstanding contributions to research.

- *Finding What Works in Health Care: Standards for Systematic Reviews* (Institute of Medicine, 2011): <https://www.nap.edu/catalog/13059/finding-what-works-in-health-care-standards-for-systematic-reviews>
- *Clinical Practice Guidelines We Can Trust* (Institute of Medicine, 2011): <https://www.nap.edu/catalog/13058/clinical-practice-guidelines-we-can-trust>

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# Thank you!

*Please take a few minutes to respond to the brief Evaluation Survey:*

<http://www.surveymoz.com/s3/4841349/Evaluation-Webcast-Overview-of-SR-RS>

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