

Systematic Reviews & Meta-analyses: Papers that summarize other papers

Evidence-Based Practice in Speech-Language Therapy
(SHSC 2033)

Session 4

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Systematic Reviews
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Meta-Analyses
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Group Discussion
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References

Outline

1. Systematic reviews
2. Meta-analyses
3. Group discussion

Clinical decision making

- Do you really want to base a clinical decision on any one study?
- The more data we have on the efficacy or effectiveness of intervention, the more confidence we can have in using it with our clients.

Systematic Reviews
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Meta-Analyses
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Group Discussion
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References

Systematic Reviews

Systematic reviews

"A systematic review attempts to identify, appraise and synthesize all the empirical evidence that meets pre-specified eligibility criteria to answer a given research question. Researchers conducting systematic reviews use explicit methods aimed at minimizing bias, in order to produce more reliable findings that can be used to inform decision making." ¹

¹ <http://www.cochranelibrary.com/about/about-cochrane-systematic-reviews.html>

Systematic reviews



3-minute video introduction to Cochrane reviews

<https://www.youtube.com/watch?v=egJlW4vkb1Y>

What is a systematic review?

“... a form of structured literature review that addresses one or more evidence questions (or key questions) that are formulated to be answered by analysis of evidence. Broadly, this involves:

- *An objective means of searching the literature*
- *Applying predetermined inclusion and exclusion criteria to this literature*
- *Critically appraising the relevant literature*
- *Extraction and synthesis of data from evidence base to formulate answers to key questions”²*

² <https://www.nlm.nih.gov/nichsr/hta101/ta10106.html>

Simple hierarchy of intervention evidence³

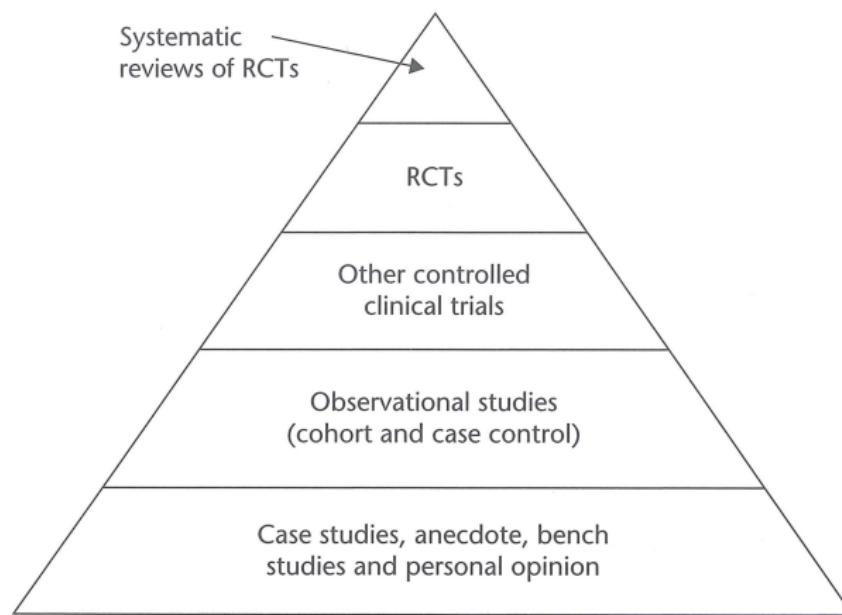


Figure 2.1 A simple hierarchy of evidence for assessing the quality of trial design in therapy studies.

Levels of evidence for intervention studies⁴

- 1a Systematic reviews (SR) & meta-analyses (with homogeneity) of RCTs
- 1b Individual RCT (with narrow confidence interval)
- 2a SR (with homogeneity) of cohort studies
- 2b Individual cohort study (including low quality RCT)
- 3a SR (with homogeneity) of case-control studies
- 3b Individual case-control studies
- 4 Case-series (and poor quality cohort and case-control studies)
- 5 Expert opinion without explicit critical appraisal; bench research

⁴ <https://www.cebm.net/index.aspx?o=1025>

Systematic reviews

Some advantages

- You don't necessarily have to search for, read, or critically appraise (many) primary studies.
- SR results are based on an aggregate of primary studies (accumulated evidence).
- High quality SRs = highest quality evidence

Systematic reviews

Things to be aware of...

- SRs may be susceptible to **publication bias**: significant findings are more likely to be published than non-significant ones.
- If different kinds of interventions or outcome measures are combined, interpretation is difficult.⁵
- SRs still need to be critically appraised, just like any other study you read.
- Check the publication date. If the SR is not recent, search for primary studies (e.g., RCTs) published after that to supplement the SR, so that your conclusions are up-to-date.

⁵ For a lively discussion of this, see Johnston (2005).

Where to find SRs

- Cochrane Library (for health care research)
- Campbell Collaboration (USA; for social, behavioural and educational research)
- speechBITE (Australia; communicative disorders research; supported by SPA, ASHA, RCSLT, CASLPA CPLOL)
- Research journals

Does Vitamin C prevent colds?

- Controversial topic for over 70 years
- Cochrane Library searched using these keywords:
“vitamin C, colds”
- 3 SRs found; study by Hemilä and Chalker (2013) looks most relevant to this question.⁶
- Their question was:
“Do oral doses of 0.2 g or more daily of vitamin C reduce the incidence, duration or severity of the common cold when used either as continuous prophylaxis or after the onset of symptoms?”

⁶Searched on 2018-02-06

Cochrane reviews related to children's speech and language disorders

- Go to Cochrane Library website at <http://www.cochranelibrary.com/>
- Expand Cochrane Reviews on purple menu bar
- Click Browse Reviews
- Click Developmental, psychosocial & learning problems
- Under Filter your results, expand Developmental problems

Search results ⁷

Developmental, Psychosocial and Learning Problems

- Developmental problems (82)
 - Autistic spectrum disorder (21)
 - Cerebral palsy (13)
 - Down syndrome (12)
 - Screening for abnormalities of growth & development (11)
 - General neurodevelopmental problems (8)
 - Including SR on dysphagia in children
 - Speech and language disorders (7)
 - Other (12)

Cochrane search #2⁹

Keyword: “aphasia”; 5 SRs found:

- 1 on speech and language therapy for aphasia (2016)
- 1 on transcranial stimulation for aphasia (2015)
- 1 on pharmacological treatment for aphasia (2001)
- 1 on music interventions for acquired brain injury (2017)
- 1 on interventions for children with primary speech and language delay or disorder (2003)⁸

⁸a false positive; i.e., those with neurological damage were excluded from this review

⁹Searched on 2019-02-12

Cochrane search #3¹⁰

Record title: “dysphagia”; 7 SRs found:

- 1 on patients with progressive muscle disease (2016)
- 1 on patients with oesophageal cancer (2014)
- 1 on children with hereditary ataxia (2015)
- 1 on children with neurological impairment (2012)
- 1 on patients with Parkinson's disease (2001)
- 1 on treatment using acupuncture (2008)
- 1 on patients with acute and subacute stroke (2018)

¹⁰ Searched on 2019-02-12

Caution

- Even though SRs of RCTs are considered to be the strongest form of intervention evidence, **they still need to be critically appraised.**
- Use CASM rather than CATE (Dollaghan, 2007).
- Look at the publication date of the SR. You may need to also search for newer primary studies to make sure your conclusion is up-to-date.

Meta-Analyses

Meta-analyses

- Many SRs contain meta-analyses—a statistical method that summarizes the findings of two or more primary studies.
- “*... a statistical synthesis of the numerical results of several trials which all addressed the same question*” ¹¹
- “*Systematic methods that use statistical techniques for combining results from different studies to obtain a quantitative estimate of the overall effect of a particular intervention or variable on a defined outcome. This combination may produce a stronger conclusion than can be provided by any individual study.*” ¹²
- Think of MAs as quantitative SRs.

¹¹ Greenhalgh (2010, p. 121)

¹² <https://www.nlm.nih.gov/nichsr/hta101/ta101014.html>

Meta-analyses are cool ☺

*"A good meta-analysis is often easier for the non-statistician to understand than the stack of primary research papers from which it was derived.
... the underlying statistical techniques used for meta-analysis are exactly the same as the ones for any other data analysis—it's just that the numbers are bigger."* ¹³

¹³ Greenhalgh (2010, p. 121)

Statistical analyses in MAs

- Most MA results are presented in a standard way.
- Results of **included studies** are graphed using a **forest plot**.
 - Effect size (ES) and 95% CI are plotted for each study.
 - Vertical line represents **no treatment effect**. ES with CI that crosses this is regarded as non-significant.
 - Results are then combined to produce an **overall estimate of effect size** and depicted as a \diamond diamond in the graph.

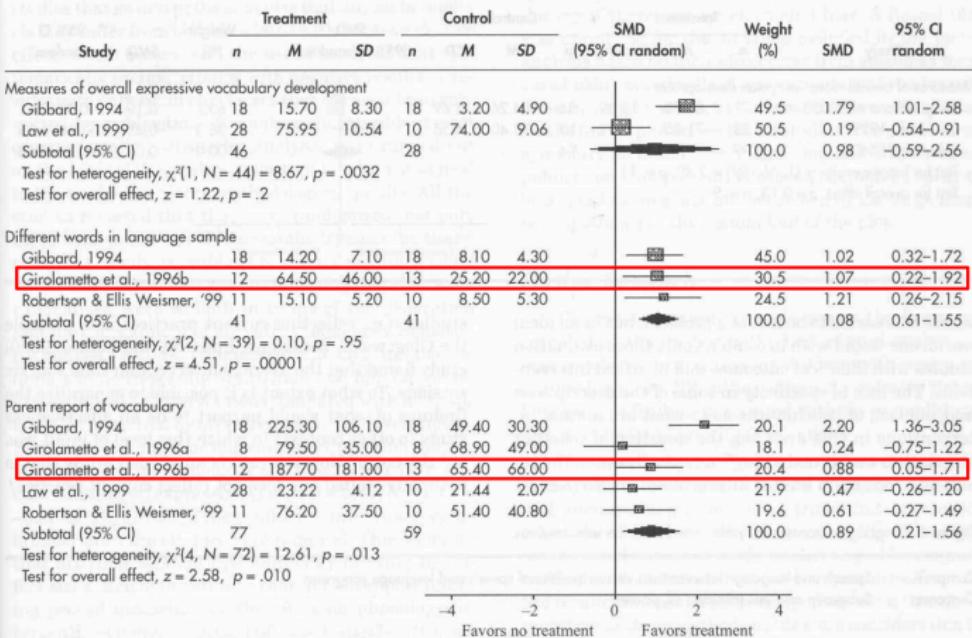
Forest plot

From Law, Garrett, and Nye (2004, p. 3)

Figure 3. Expressive vocabulary outcomes.

Comparison: Speech and language intervention versus delayed or no treatment

Outcome: Expressive vocabulary outcomes



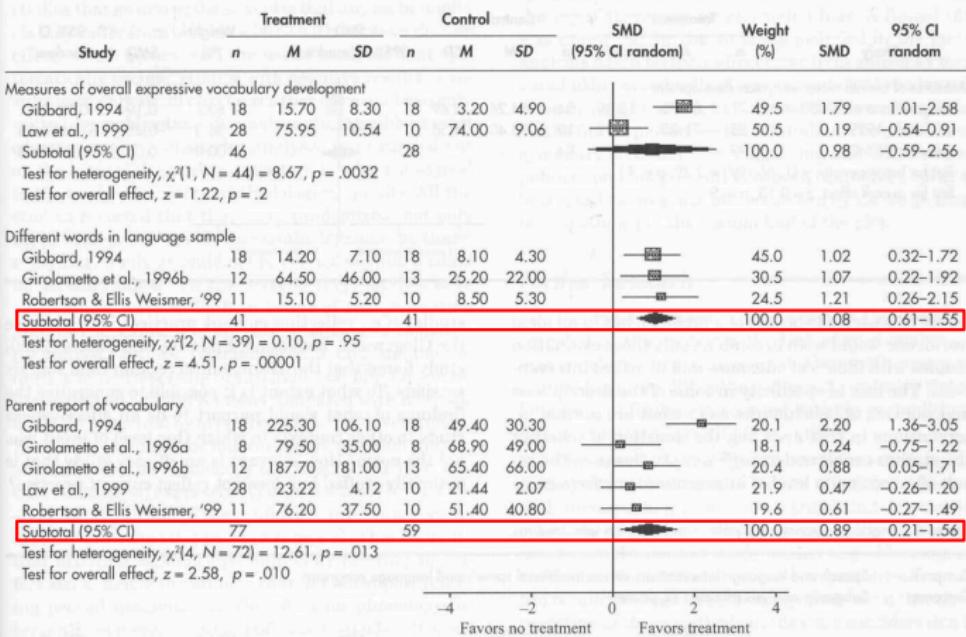
Forest plot

From Law et al. (2004, p. 3)

Figure 3. Expressive vocabulary outcomes.

Comparison: Speech and language intervention versus delayed or no treatment

Outcome: Expressive vocabulary outcomes



Conclusions based on a meta-analysis¹⁴

- Intervention is effective in certain areas.
- Across studies, treated groups had significantly better expressive vocabulary outcomes than control groups.
 - NDW in language sample: $d = 1.08$, 95% CI [.61, 1.55]
 - Parent-reported vocabulary: $d = .89$, 95% CI [.21, 1.56]
 - Notice that **standardized ESs** are reported above.

¹⁴Law et al. (2004)

Useful tools

1. Prospective study registration for authors of SRs and MAs:
PROSPERO (<https://www.crd.york.ac.uk/prospero/>)
2. Reporting standards for authors of SRs and MAs:
PRISMA (www.prisma-statement.org)
3. Critical appraisal checklist for readers of SRs and MAs:
CASM (Dollaghan, 2007, p. 157)

ASHA's evidence maps

- Summaries of clinical research related to assessment and intervention in communication disorders
- Contain published SRs that are not in the Cochrane Library.
- See <http://on.asha.org/evidence-maps>
- Also, see <http://www.asha.org/Research/EBP/EBSRs>

Cherry picking

- Choosing what you want to believe by ignoring some studies or not critically appraising them.
- This can result from believing what you read in the popular press or relaying on information from web sites with an axe to grind.
- Example: Not having your child vaccinated because “*MMR vaccine causes autism.*”
- Searching for, and critically appraising the evidence, should help you avoid this cognitive error.

Group discussion

- Break up into your assigned groups.
- Use CASM (Dollaghan, 2007, p. 157) to critically appraise the research article.
- Document **where** you found information addressing each point.

References

- Dollaghan, C. A. (2007). Appraising diagnostic evidence. In C. A. Dollaghan (Ed.), *The handbook for evidence-based practice in communication disorders* (pp. 81–104). Baltimore, MD: Paul H. Brookes.
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