Systematic Reviews: Overview & History

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Presenter Disclosures

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(1) The following personal, professional, or financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

No Relationships to disclose
Acknowledgement

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Goal: Provide context for following sessions through an overview of the history and production methods of systematic reviews and their role in evidence based practice.
Objectives

- Discuss the differences between a narrative review, systematic review, and meta-analysis
- Explain the importance of systematic reviews
- Describe the steps required to complete a systematic review
Reasons Your Systematic Review was Rejected

- Did not check for existing systematic reviews on the same topic
- Did not register the systematic review protocol
- Did not search enough databases
- Did not clearly define variables for extraction
- Did not report full search strategy for at least one database
- Did not follow PRISMA reporting guidelines
- Did not include all key published and unpublished articles
- Did not include critical appraisal of included articles
Definitions and descriptions
What are the characteristics of systematic reviews?
Systematic Review Definitions 1, 2

- A properly conducted systematic review **faithfully summarizes the evidence from all relevant studies** on the topic of interest, and it does so **concisely and transparently** (Cook, 1997)

- A review of a **clearly formulated question** that uses **systematic and explicit methods** to identify, select and critically appraise relevant research, and to collect and analyse data from the studies that are included in the review. ([http://www.cochrane.org/faq/general](http://www.cochrane.org/faq/general))
Systematic Review Definition 3

- The application of strategies that limit bias in the assembly, critical appraisal, and synthesis of all relevant studies on a specific topic.
- Meta-analysis may be, but is not necessarily, used as part of this process.
- Systematic reviews focus on peer-reviewed publications about a specific health problem and use rigorous, standardized methods for selecting and assessing articles.
- A systematic review differs from a meta-analysis in not including a quantitative summary of the results (Porta, 2008 Dictionary of Epidemiology, 5th ed)
Meta-Analysis Definition

- A way of combining data from many different research studies. A meta-analysis is a **statistical process** that combines the findings from individual studies.

Source: AHRQ Effective Health Care Program Glossary
http://effectivehealthcare.ahrq.gov/index.cfm/options/glossary/
Two Broad Categories of Systematic Reviews

- **Qualitative systematic review**
  - primary studies summarized
  - without meta-analysis

- **Quantitative systematic review**
  - Meta analysis included
SR Compared to Narrative Reviews

- Narratives useful for obtaining a broad perspective on a topic
  - Ex: textbook chapter on a disease including sections on the physiology, epidemiology, etc…

- Narrative reviews are subject to bias
  - Authors pick and choose evidence to support pre-existing views
Selected Systematic Review Characteristics

- Clear question/ hypothesis to be answered
- Exhaustive, reproducible literature search
- Clear study inclusion criteria
- Analyzes quality of each included study, evaluates sources of bias
- Includes only strongest available studies in conclusions
- Prospective publicly accessible protocol
Exercise 1

**INSTRUCTIONS:**

Read the two abstracts that follow and the methods section for the second article. One of these is a systematic review and one is not. Which is the systematic review?

1. How much of the information given did you have to read before you were sure that one of the citations used systematic search methods?
Variations on Systematic Review Methods

- Scoping Reviews (Arksey 2005; Levac 2010; Armstrong 2011)
- Umbrella Reviews (Ioannidis 2009)
- Rapid Reviews (Hartling et al 2015)
- Realist Reviews (Pawson 2005; Wong 2013)

....and more
History, Importance of Systematic Reviews
Selected Historic Moments

- 1972 – Archie Cochrane calls for use of evidence in medical decision making (Cochrane 1972)
- 1978 – WHO, UK funded database of perinatal clinical trials
- 1992 – Evidence Based Medicine defined by Guyatt (Kohatsu 2004)
- 1993 – Cochrane Collaboration starts. International scope
- 1996 Cochrane Health Promotion and Public Health Field registered; Community Preventive Services Task Force started by CDC
- 1997 Evidence Based Public Health defined by Jenicek (Kohatsu 2004)
- 2009 PRISMA Standards for publishing systematic reviews (Liberati 2009)
- 2013 RAMESES standards for publishing meta-narrative reviews (Wong 2013)
Growth of Published SRs

Figure: Growth in published systematic reviews
Number of records (per year) retrieved from Medline, with search for “meta-analysis” as MeSH index term and “systematic review” as text word. Result for 2009 was retrieved in April 2010, and might be underestimated because of lag before records are indexed in Medline.

(Booth, 2010)
SRs are key to evidence based processes

SRs Mid Level of Evidence Based Practice Pyramid

6S Pyramid

- SYSTEMS: are electronic systems which can be sophisticated enough to link to patient records and to prompt practitioners about guidelines for care.
- SUMMARIES: provide an outline of management options for a given health issue. Summaries incorporate the highest quality and most synthesized sources of research evidence.
- SYNOPSIS OF SYNTHESSES: summarize the findings and implications of high quality systematic reviews.
- SYNTHESSES: are systematic reviews that provide rigorous summary of all primary research evidence that could be found relevant to a particular focused question.
- SYNOPSIS OF SINGLE STUDIES: provide brief summaries of results and implications of single high-quality studies.
- STUDIES: are related to a particular focused question.

Start here to answer public health practice questions

Source: http://www.nccmt.ca/eiph/search-eng.html
SRs in Health Policy

“Reading a good [systematic] review can be one of the most efficient ways to become familiar with state-of-the-art research and practice for many specific topics in public health, as well as a way to inform health policy.”

(Brownson, RC. et al. 2011)
Guidance on Producing Systematic Reviews
Manuals, Guidance Documents for Creating SRs

- **Centre for Reviews and Dissemination** – 2009 book
  [www.york.ac.uk/inst/crd/index_guidance.htm](http://www.york.ac.uk/inst/crd/index_guidance.htm)

- **Cochrane Handbook**
  [http://handbook.cochrane.org/](http://handbook.cochrane.org/)

- **Cochrane Methods Supplement** (annual report of developments in methods)
  [http://methods.cochrane.org/how-access-our-resources](http://methods.cochrane.org/how-access-our-resources)

- **Methods Guide for Effectiveness and Comparative Effectiveness Reviews.**

- **Institute of Medicine**: Finding What Works in Health Care: Standards for Systematic Reviews
  [www.iom.edu/srstandards](http://www.iom.edu/srstandards)

- **Process of information retrieval for systematic reviews and health technology assessments on clinical effectiveness**
Comparing Guidance

- IOM, *Finding What Works…*

Appendix D-G

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<tr>
<th>Standards and Elements</th>
<th>Agency for Healthcare Research and Quality (AHRQ) Effective Health Care Program</th>
<th>Centre for Reviews and Dissemination (CRD)</th>
<th>The Cochrane Collaboration</th>
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<tr>
<td>3.1 Conduct a comprehensive, systematic search for evidence</td>
<td>Provides guidance on searching for evidence (see below).</td>
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<td>3.1.1 Work with a librarian or other information specialist trained in performing systematic reviews to plan the search strategy</td>
<td>A person with library expertise is part of the review team whose responsibility is to plan the search. The person conducting the search should be involved in the development of key questions, PICOTS (population, intervention, comparator, outcome, timing, and setting), analytic frameworks, and inclusion/exclusion criteria.</td>
<td>An information specialist should ideally be included as part of the project team. Review authors should work closely with the Trials Search Coordinator for assistance in searching for studies to include in their reviews.</td>
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Guidance on Reporting SRs

- PLOS Reporting Guidelines Collection
  - [http://www.ploscollections.org/article/browse/issue/info:doi/10.1371/issue.pcol.v01.i18](http://www.ploscollections.org/article/browse/issue/info:doi/10.1371/issue.pcol.v01.i18)

- EQUATOR
  - Collects guidance documents on reporting SRs and other types of health research

- PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)

- PRISMA-E (PRISMA plus health equity reporting)
  - [http://equity.cochrane.org/equity-extension-prisma](http://equity.cochrane.org/equity-extension-prisma)

- MOOSE (Meta-analysis of Observational Studies in Epidemiology)
  - [http://www.emgo.nl/kc/analysis/statements/MOOSE.pdf](http://www.emgo.nl/kc/analysis/statements/MOOSE.pdf)

- RAMESES publication standards: meta-narrative reviews
  - [http://www.biomedcentral.com/1741-7015/11/20](http://www.biomedcentral.com/1741-7015/11/20)
Steps in a Systematic Review
Steps in Conducting a SR (*From IOM Finding What Works*)

1. Planning, assembling team, develop process
2. Create protocol
3. Search, screen, select studies to review
4. Appraise studies for bias, extract data from them
5. Synthesize findings, assess evidence quality
6. Write report, peer review

Step One Tasks

Assess Need

Is the question of interest to practice or research?
Are their existing reviews?
Do they meet quality criteria?
Do they need an update?

Assemble Team With Needed Expertise

SR Methods
Info Retrieval
Subject Expertise
Statistics

Take steps to minimize team bias, conflicts of interest
Where to find existing protocols

- PubMed, other literature databases
- Cochrane Library
  - PubMed does not contain Cochrane protocols
- PROSPERO
  - Reviews can register any time prior to data extraction
- Journals
  - BMC Systematic Reviews
  - BMJ Open
Step One Tasks: Develop a Research Question

- Logic model of interventions, outcomes useful
- PICO / PICOS / PICO(TS) formats
  - Patient population
  - Intervention (or Exposure)
  - Comparison
  - Outcomes
  - Timing (duration) (AHRQ)
  - Study design (CRD) / Setting (AHRQ)

- Some parts of question will become part of search
- Some parts of question will become inclusion criteria
Step Two: Create Protocol, Register or Submit for Peer Review

- Research question
- Search strategy
- Inclusion criteria
- Condition or domain of study
- Population / participants
- Intervention/ exposure
- Comparator(s) / control
- Outcomes
- Data extraction
- Risk of bias (quality assessment)
- Data synthesis strategy
- Subgroup, subset analysis
- Dissemination plan
- Review team information
- Funding sources
Step Two: Preliminary Search Strategy

- For protocol, will evolve later

- CRD suggests including:
  - Databases, other sources to be searched
  - Likely search terms (textwords, indexing terms) for each concept to be searched
  - Limit decisions – language, publication status
  - Plan for update search near end of review
  - Software for managing references
Step Two: Register or Submit Protocol for Peer Review

- Check with funder or publisher for requirements

- No requirements? Consider

  - PROSPERO
  - Publishing protocol as an article
    - See *BMC Systematic Reviews* for examples
Step Three: Search, screen, select studies to review

- **Who does the literature searches?**
  - Best: Librarian does search
  - Second best: Librarian advises searcher
  - Not so good: no librarian on team

- **Use multiple databases**

- **Include other sources of studies**
  - Grey literature
    - Conference papers, trial registries, etc
  - Handsearching
  - Citation Searching
SR Searches: High Sensitivity, Low Precision
Some search tasks

- Revision of protocol search strategy as needed
- Decide which research question components to search and which are evaluation criteria
- Clarify definitions of concepts in search
  - Ex: Elderly
- Find synonyms for concepts, test for inclusion
- Thorough documentation of all search processes
- Long term storage of search strategies, citations retrieved
Documentation of Search Strategy

- Databases
- Database providers
- Line by line search copied directly from at least one of the databases searched
  - Appendix or online supplement to article
- Dates of searches
Step Three: Screening

- Done in two passes by two or more trained screeners
  - Title/Abstract
    - Meets inclusion criteria?
    - Maybe/No decision
    - Reason doesn’t need to be documented
  - Full Text Screening of remaining studies
    - Document reasons for exclusion, number in each
Out of scope studies are removed in three steps

- Studies found: 498
- Studies included: 5

(Paton, 2009)
Step Four: Appraise studies for bias, extract data

- Evaluate potential bias by looking at measures such as:
  - Selection, allocation of subjects
  - Attrition
  - Performance bias
  - Intervention variability – deviation from planned
  - Validity, reliability of outcome measures
  - Reporting bias – selective reporting of results
Step Four: Extract Data

- Data extraction forms should be created in advance, pilot tested
- Use 2 extractors to reduce errors
- Possible data to include:
  - Who extracted the data, when
  - Citation info for study
  - Study aims, design, methods
  - Participant characteristics
  - Intervention, setting
  - Outcomes
  - Type of analysis
  - Number of participants
  - Results of analysis
  - Subgroup analysis
  - Other outcomes reported
  - Costs
  - Resources used
  - Adverse events
Step Five: Data Synthesis, Overall Quality Assessment

- Planned analysis of included studies
  - Meta-analysis and/or narrative analysis?
  - Measures of heterogeneity
  - Outcomes of interest
  - Effect measures to be used
  - Subgroup analysis plans
  - Publication bias analysis

Forest plot
Step Six: Write report, Disseminate Results

- Don’t wait to the end, write parts of report when possible
  - Ex: Write search methods as soon as possible
“Systematic reviews can indeed be carried out without proper information or library support, though researchers are not typically experienced in information retrieval and their searches are likely to be less sensitive, less specific, and slower than those done by information professionals”

Petticrew M 2001
Librarians as collaborators

- Cochrane, IOM, and AHRQ standards all recommend librarian involvement in the SR search
- Can write up search methods for publication
- Are eligible for authorship
- In addition to the search, can help with
  - Identifying reference and review management software
  - Finding examples of forms for review management
  - Assist in acquisition of full text articles
  - Document search info for future updates
Beyond Initial Report: Update the Review

- New research findings can quickly make SRs out of date
  - “…over half (53/103) of organizational respondents estimated that more than 50% of their respective SRs were likely out of date (Garrity, 2010)

- The Cochrane Collaboration policy: update within two years or justify non-compliance in commentary (Higgins, 2011)

Exercise 2 – On your own to reinforce knowledge of the review process

**Instructions:**

1. Read the PubMed citation and abstract for this Cochrane systematic review.
2. Highlight or underline all the parts of the record related to the steps for doing a systematic review. Use this exercise as an opportunity to reinforce your knowledge of the steps.
3. Compare the systematic review abstract in this activity to the systematic review abstract in Exercise 1. Note the differences in what they report and how much detail they provide.
Summary

- Systematic reviews are key to evidence based decision making in public health and policy.

- Standards for conduct and reporting of systematic reviews should be used in planning and implementing all systematic reviews.

- Librarians have a key role as information seeking and management experts in systematic reviews.
References

References cont.

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References cont.