Principles & rationale for systematic review

Hilary Thomson
Outline

- Rationale for systematic reviews
- What is a systematic review (& what it is not)
- What systematic reviews can contribute
- Key components of a good systematic review
- Why systematic reviews of complex interventions are challenging
What is a systematic review?
Why do we need literature reviews?

- Calls for evidence
  - make use of existing research and knowledge
Why do we need literature reviews?

- Calls for evidence - make use of research and knowledge
- Information overload: an efficient method of dealing with information overload
- Deal with conflicting findings
- Best evidence: studies vary in design, soundness, population studied (etc)
- Single studies are rarely definitive
  - Synthesis of evidence allows greater confidence in findings
    - Repeated findings & consistency across different contexts, populations
    - Greater statistical power in meta-analysis with larger population
Adverse effects of doing a literature review
Non-systematic reviews

- Expert reviews - provides expert opinion on state of the field
- Introductions to papers, thesis
- Scoping reviews - map out an area identifying key literature, range of disciplines/outcomes/interventions/evaluation…
- Rapid reviews

*Not well equipped to provide comprehensive synthesis of best available evidence*
Why do people take Vitamin C when they have a cold?

…Nobel Laureate Linus Pauling’s 1986 book “How to live longer and feel better”, in which he reviews the literature and concludes that

“…we should be getting 200 times the amount of vitamin C that the Food and Nutrition Board recommends”
Testing Pauling’s claims about Vitamin C & colds

- Exhaustive search of databases, and hand searches of journals and special collections,

- Identified 61 trials- 15 methodologically sound

- Even in megadoses Vitamin C cannot prevent a cold, though it might shorten its duration if already infected

- Pauling’s review did not mention 5 of the “top 15” studies, and two others were referred to only in passing

- A haphazard review, even one carried out by an expert, can be very misleading

Why you *should* do a non-systematic review

- Easier
- Quicker/cheaper
- Can do it on your own
- Get the answer you want
Why do we need systematic reviews?

- Limit bias in selection & interpretation of existing evidence
- Focussed approach to managing overwhelming amount of evidence, publications

- Systematic & transparent method for:
  - Identifying relevant evidence
  - Assessing quality-validity of relevant evidence
  - Drawing conclusions based on best available evidence
What is a systematic review?

- Systematic reviews are “hypothesis-testing” – they need to answer a clear, specific question

- Key elements of a systematic review:
  - **Identify**: comprehensive searches within pre-set limits
  - **Appraise**: assess validity of evidence
  - **Synthesis**: may be statistical (meta-analysis) or narrative
What is a systematic review?

- **Hypothesis testing**: addressing clear review question with pre-specified primary outcomes

- **Transparent scientific method**: agreed methods, replicable, transparent, follows a protocol to limit scope for bias

- **Comprehensive** (within defined criteria - not necessary to include everything) - not a partial or biased selection of studies

- **Objective**: formal, using a range of methods to limit reviewer bias - **more than one** reviewer for independent selection & appraisal of evidence

- Conclusions based on the “best evidence”
What is a systematic review?

- **Comparable to primary research**
  - Designed to test hypothesis: needs clearly defined and answerable question which can be addressed given resources/time
  - Review protocol
  - Minimise selection bias- selection of studies using protocol and two reviewers
  - Each included study is a case- data is extracted/collected and assessed for validity
  - Methods need to be transparent- carefully recorded
  - Detailed analysis
  - Examination of explanatory variables- what works for whom and in what circumstances
  - Able to assess validity of final synthesis
  - Dedicated resources and specialist skills
Steps in a systematic review

- Define question
- Write protocol
- Develop & conduct searches
- Screen for eligible studies
- Assess study quality
- Extract findings
- Synthesis
- Prepare summaries for users

Additional steps:

- Define hypothesis
- Plan in advance
- Determine population
- Recruitment
- Ensure data validity
- Data collection
- Analysis
- Disseminate
What do you think about systematic reviews?

- Application & limitations
  - what kind of research can be included?
  - what kind of questions can be addressed?
  - how are the data synthesised?
Some myths about systematic reviews?

- Like non-systematic review only bigger- more comprehensive
- Only include randomised trials
- Most useful for clinical questions about drugs
- Most useful for questions about what works
- Only deal with outcomes- not able to consider what works for who and in what circumstance
- Searches do not need information science expertise
- Conclude with a meta-analysis

Value of a systematic review approach

- Focussed question- developed for application in practice
- Minimises bias in selection & interpretation of evidence
- Transparent & replicable
- Prioritises evidence according to study quality
How data are synthesised

- Data synthesis is part of a systematic review
- Systematic review is not a method of synthesis
- Type of synthesis will depend on type of data being reviewed
What systematic review can contribute

- Establishes what is known (and what is unknown) & how it is known
  - Provide map of knowledge & nature of research on a topic

- Drawing on collection of studies to develop body of evidence allows greater confidence in repeated findings
  - Meta-analysis across studies allows for greater statistical power and precision of final effect estimate

- Systematically examine reasons for variations across studies
  - Positive impacts of housing improvements in New Zealand but not in UK
Approaches to reviews

- **Aggregative**
  - Synthesis of similar data to test hypothesis
  - Deductive
  - Likened to adding stones to build a cairn

- **Configurative**
  - Synthesis of data with some level of commonality but incorporates high level of variation - used to generate hypothesis
  - Inductive
  - Likened to mosaic - contrasts create image

- Most reviews will involve a mix of approaches (especially of complex interventions)
What makes a good systematic review?
All very well in theory

- Not bias free
- Not fully transparent
  - Room for interpretation in assessments
Most “systematic reviews” aren’t systematic

- The validity of 480 systematic review and meta-analyses using a simple scale was assessed
  - Thorough search
  - Appraisal of study quality
  - Assessment of heterogeneity

- 26% met all three the criteria

Marks of a good systematic review

- Essential characteristics - transparent & replicable
  - Clear & focussed review question
  - Search strategy described
  - Comprehensive searching of all included sources
  - Two reviewers to select included studies
  - Two reviewers to assess quality of included studies
  - Justification for method of synthesis - meta-analysis or narrative
  - Synthesis reflects quality of included studies - less weight given to studies with high levels of bias
  - Results & characteristics of individual studies to accompany final conclusions of synthesis - tables, forest plots etc
Markers of a well conducted systematic review


- Reporting standards
Why systematic reviews of complex interventions are challenging
Why systematic reviews of complex interventions are challenging

- Broad questions
  - Not conceptually appropriate to only look at outcomes - complex data extraction
  - Need to include broad range of study designs & data types
    - Issues around assessment of study quality and synthesis

- Difficult to identify grey literature

- Complex interventions
  - Intervention: multi-components, interactions, delivery and components vary within and between studies
  - Potential multiple confounders & interactions

- Heterogeneity limits potential for meta-analysis & appropriate synthesis
Reading