Centre for Cognitive Ageing and Cognitive Epidemiology

Data Extraction, Quality Assessment and Narrative Synthesis

Dominika Dykiert

Lifelong Health & Wellbeing
Research for Healthy Ageing

How to do a systematic review?

1. Define a question
2. Search the literature: Sheila
3. Extract the data
4. Assess study quality
5. Combine the results
   a) Narrative synthesis
   b) Meta-analysis: Geoff
6. Present the results (writing up)

So you've done your search…

- It is common to start with thousands of "hits"
- Most papers excluded after scanning titles/abstracts
- Usually, a small proportion retained for the review/meta-analysis

	Shenkin et al (2004)	Calvin et al (2011)	Dykiert et al (2012)	Cox et al (2014)
"Hits" (titles/abstracts read)	3 207	19 236	13 961	1 544
Potentially relevant (Full texts evaluated)	91	90	1 126	232
Included in review	6	27	33	208
Included in meta-analysis		16	29	

Data Extraction

- Selecting and recording relevant data from the studies to be reviewed

- Prone to error, so…
  - Use a data extraction form
  - Record data exactly as reported (e.g. "58% female" rather than calculating the actual number of females in the sample)
  - Have more than one person extract the data and check for mis-matches

Data Extraction Form

- Design according to the needs of your research
- Pilot and refine (possibly more than once)
  - Extracting too much = waste of effort and time
  - Extracting too little = waste of effort and time (if you need to revisit papers for more data)

Data Extraction Form: Content

1. General information
   - Authors, title, source and year of publication
   - Publication type (e.g. journal article/book chapter)
   - Reviewer ID (if more than one)

JBI Data Extraction Form for Experimental/Observational Studies

Reviewer _____ Date _____
Author _____ Year _____
Journal _____ Record number _____

Study method RCT Quasi-RCT Longitudinal
Retrospective Observational Other _____

Participants
Setting _____
Population _____
Sample size
Intervention 1 _____ Intervention 2 _____ Intervention 3 _____

Interventions
Intervention 1 _____

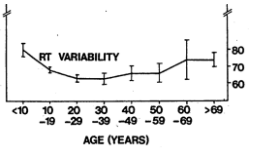
Pearson et al(2009) Evidence-Based Clinical Practice in Nursing and Health Care: Assimilating research, experience and expertise

Data Extraction Form: Content

2. Study characteristics
   - Study design
   - Participant characteristics (demographics, sample size)
   - Outcomes (and interventions, if applicable)
   - Information needed for quality assessment (comparability of groups, exclusions made, length of follow-up, etc)
   - Your comments on methodology, limitations, generalisability that you have after reading the paper

Data Extraction Form: Content

3. Outcome measures
   - Effect sizes (if reported)
     - Cohen's d, odds ratio, hazard ratio
   - Or data allowing to estimate effect sizes
     - e.g. mean + SD + n in each group, results of a statistical test
   - Or… whatever is available *& relevant*
     - graphs
     - authors' descriptions



Wilkinson & Allison (1989). Journals of Gerontology, 44, 29-35.

Assessing Study Quality

- Evidence from a systematic review (and/or meta-analysis) is only as good as studies in it
- "Garbage in, garbage out"
- Need to ascertain sufficient quality of included studies

Things to Consider

- Risk of bias
  - Bias is "a systematic error, or deviation from the truth, in results or inferences" [Cochrane Handbook]
  - E.g. selection bias, attrition bias, reporting bias
  - Can lead to under- or overestimation of the true effects
  - Affects the extent to which the results can be trusted
- Generalisability
  - Do findings apply to the wider population?
- Statistical issues
  - Sufficient power?
- Issues specific to your field/research question
  - Comparability of groups, length of follow-up, etc.

Assessing Studies: Tools

- Different tools for different study designs
- No gold standard; all have issues
- Many focus on reporting
  - e.g. whether the criteria for excluding participants from the sample are clearly stated
  - What is **done** is more important than what is **reported**
  - Confusing study quality with the quality of the paper/report
- Many provide an overall quality score
  - Different aspects combined into a single score
  - Serious doubts over their usefulness

Assessing Studies: Tools

Study 1

Ethics approval obtained	1 Yes	0 No
Sufficient length of follow-up	1 Yes	0 No

Total score: 1

Study 2

Ethics approval obtained	1 Yes	0 No
Sufficient length of follow-up	1 Yes	0 No

Total score: 1

Intervention Studies

Appendix

Checklist for measuring study quality

Reporting

1. *Is the hypothesis/aim/objective of the study clearly* [redacted]

yes	1
no	0

2. *Are the main outcomes to be measured clearly* [redacted] *in the Introduction or Methods section?*
If the main outcomes are first mentioned in the Results section, the question should be answered no.

yes	1
no	0

3. *Are the characteristics of the patients included in the study clearly* [redacted]
In cohort studies and trials, inclusion and/or exclusion criteria should be given. In case-control studies, a case-definition and the source for controls should be given.

yes	1
no	0

7. *Does the study* [redacted] *of the random variability in the data for the main outcomes?*
In non normally distributed data the inter-quartile range of results should be reported. In normally distributed data the standard error, standard deviation or confidence intervals should be reported. If the distribution of the data is not described, it must be assumed that the estimates used were appropriate and the question should be answered yes.

yes	1
no	0

8. *Have all important adverse events that may be a consequence of the intervention been* [redacted]
This should be answered yes if the study demonstrates that there was a comprehensive attempt to measure adverse events. (A list of possible adverse events is provided).

yes	1
no	0

9. *Have the characteristics of patients lost to follow-up been* [redacted]
This should be answered yes where there were no losses to follow-up or where losses to follow-up were so small that findings would be unaffected by their inclusion. This should be answered no where a study does not report the number of patients lost to follow-up.

Downs & Black (1998) J Epidemiol Community Health, 52, 377–384

Diagnostic Studies

Table 2

The QUADAS tool

Item		Yes	No	Unclear
1.	Was the spectrum of patients representative of the patients who will receive the test in practice?	( )	( )	( )
2.	Were selection criteria clearly described?	( )	( )	( )
3.	Is the reference standard likely to correctly classify the target condition?	( )	( )	( )
4.	Is the time period between reference standard and index test short enough to be reasonably sure that the target condition did not change between the two tests?	( )	( )	( )
5.	Did the whole sample or a random selection of the sample, receive verification using a reference standard of diagnosis?	( )	( )	( )
6.	Did patients receive the same reference standard regardless of the index test result?	( )	( )	( )

Whiting et al. (2003). BMC Medical Research Methodology, 3, 25

Cohort/ case-control Studies

	Yes	Can't tell	No
3. Is the choice of study method appropriate?			
4. Is the population studied appropriate? • (cohort study) Was an appropriate control group used – ie were groups comparable on important confounding factors? • (case-control study) Were the controls randomly selected from the same population as the cases?			
5. Is confounding and bias considered? • [redacted] • (cohort study) Were the assessors blind to the different groups? • (cohort study) Could selective drop out explain the effect? • [redacted] • (case-control study) Were interventions and other exposures assessed in the same way for cases and controls? • (case-control study) Is it possible that overmatching has occurred in that cases and controls were matched on factors related to exposure?			

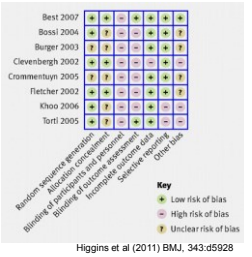
Weightman AL (2004) Evidence Bulletins Wales

Assessing Studies

- You may need to create your own tool
- Focus on:
  - the risk of bias (to what extent can you trust the results to reflect true effects?)
  - what was done rather than what was reported
  - data to be used in the review rather than those originally reported
    - additional data received from the authors
    - additional exclusions/ re-inclusions of cases originally excluded
- Do use the available scales and checklists for ideas but also think of potential sources of bias specific to your field

Using Quality Information

- Demonstrate the risk of bias in the included studies
  - Provide frequencies and/or percentages of studies with high and low risk of bias
- Perform sensitivity analysis (low vs. high risk of bias)



Higgins et al (2011) BMJ, 343:d5928

Data Synthesis

Narrative — Descriptive account, few numbers

Quantitative — Meta-analysis (statistical)

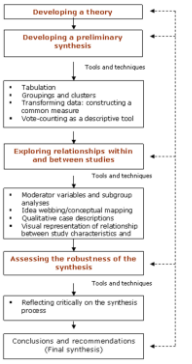
Narrative synthesis can be in addition to or instead of meta-analysis

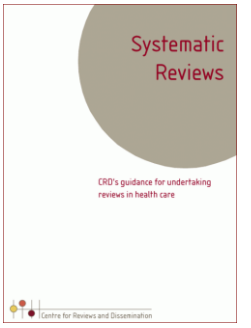
- Narrative summary alone may be best when the studies are very heterogeneous
- When meta-analysis can be performed, a narrative synthesis provides background information

Narrative synthesis

- Usually includes:
  - Study type (e.g. intervention, observational)
  - Number and characteristics of participants
  - Description of interventions and/or outcome measures
  - Study quality
- In addition, especially if meta-analysis is not going to be performed
  - Discussion of heterogeneity (differences across studies)
  - Description of patterns in the data, for example, trends of findings for studies with different characteristics (e.g. different types of studies, participant groups, etc.)

Narrative synthesis





http://www.york.ac.uk/inst/crd/pdf/Systematic_Reviews.pdf

Meta-analysis

- Combines results of different studies
- Not always possible
  - e.g. too few studies, too different
- A separate session on meta-analysis to follow (Geoff Der)

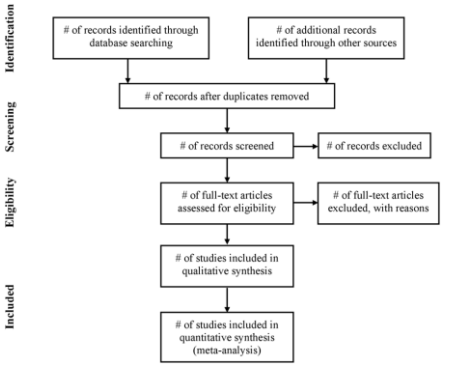
Thank you

Email: d.dykiert@ed.ac.uk

Centre for Cognitive Ageing and Cognitive Epidemiology

Lifelong Health & Wellbeing

PRISMA flowchart



Moher et al. (2009) PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed.1000097

PRISMA checklist [1]

Section/Topic	#	Checklist Item	Reported on Page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	

PRISMA checklist [2]

Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.
RESULTS		
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome-level assessment (see Item 12).
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group and (b) effect estimates and confidence intervals, ideally with a forest plot.
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).
DISCUSSION		
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., health care providers, users, and policy makers).
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review level (e.g., incomplete retrieval of identified research, reporting bias).
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.
FUNDING		
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.

MOOSE checklist

Reporting of background should include

- Problem definition
- Hypothesis statement
- Description of study outcome(s)
- Type of exposure or intervention used
- Type of study designs used
- Study population

Reporting of search strategy should include

- Qualifications of searchers (eg, librarians and investigators)
- Search strategy, including time period included in the synthesis and keywords
- Effort to include all available studies, including contact with authors
- Databases and registries searched
- Search software used, name and version, including special features used (eg, explosion)
- Use of hand searching (eg, reference lists of obtained articles)
- List of citations located and those excluded, including justification
- Method of addressing articles published in languages other than English
- Method of handling abstracts and unpublished studies
- Description of any contact with authors

(…)

Stroup et al. (2000). JAMA, 283:2008-12.