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

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>“Hits” (titles/abstracts read)</td>
<td>3,207</td>
<td>19,236</td>
<td>13,961</td>
<td>1,244</td>
</tr>
<tr>
<td>Potentially relevant (Full texts evaluated)</td>
<td>91</td>
<td>50</td>
<td>1,126</td>
<td>252</td>
</tr>
<tr>
<td>Included in review</td>
<td>6</td>
<td>27</td>
<td>33</td>
<td>23</td>
</tr>
<tr>
<td>Included in meta-analysis</td>
<td>16</td>
<td>29</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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)
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

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

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

<table>
<thead>
<tr>
<th>Study 1</th>
<th>Study 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethics approval obtained</td>
<td>1 Yes</td>
</tr>
<tr>
<td>Sufficient length of follow-up</td>
<td>1 Yes</td>
</tr>
<tr>
<td>Total score: 1</td>
<td></td>
</tr>
</tbody>
</table>
### 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)

### 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

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)

PRISMA flowchart

PRISMA checklist [1]
### PRISMA checklist [2]

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<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title</strong></td>
<td>Describe methods and key findings of individual studies and how they address the research question.</td>
</tr>
<tr>
<td><strong>Introduction</strong></td>
<td>State the main objectives and hypotheses of the study and the main findings.</td>
</tr>
<tr>
<td><strong>Methods</strong></td>
<td>Describe the design and conduct of the study, including the rationale and the selection of participants.</td>
</tr>
<tr>
<td><strong>Participants</strong></td>
<td>Identify the population or the sample, the exclusion criteria, and the size of the study.</td>
</tr>
<tr>
<td><strong>Interventions</strong></td>
<td>Describe the intervention or exposure, including the dose and the duration.</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td>Identify the outcomes measured in the study.</td>
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<tr>
<td><strong>Analysis</strong></td>
<td>Specify the methods used for data analysis, including the choice of statistical tests.</td>
</tr>
<tr>
<td><strong>Results</strong></td>
<td>Summarize the results of the study.</td>
</tr>
<tr>
<td><strong>Discussion</strong></td>
<td>Discuss the implications of the results in the context of previous research.</td>
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<tr>
<td><strong>Conclusion</strong></td>
<td>State the conclusions drawn from the results.</td>
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### MOOSE checklist

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</tr>
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<tbody>
<tr>
<td><strong>Title</strong></td>
<td>Describe the main findings of the study, including the design, the sample, the interventions, and the outcomes.</td>
</tr>
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<td><strong>Introduction</strong></td>
<td>State the main objectives and hypotheses of the study and the main findings.</td>
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