HOW TO GUIDE #8 #DryLabsRealScience

TOPIC: Systematic Review Projects

TAGS: Research, Non lab projects, Systematic review, Meta-analysis

BRIEF DESCRIPTION

Systematic review is a process where pre-existing data is collected using systematic methods and subsequently critically appraised. The findings are then synthesised either qualitatively or quantitatively, depending upon the specific focus of the research question, to try to answer a specific research question or to derive a consensus conclusion. Systematic reviews are often conducted using clinical trials data, and that will be the focus of this guide, but can be a applied to any collection of compatible research studies.

DEFINING YOUR RESEARCH QUESTION

Defining the research question you are attempting to answer through systematic review is the single most important step in the process. Many people who attempt a systematic review for the first time come up with a very complex, multi-variate question (for example – Is the use of sumatriptan to relieve migraine pain more effective than acetaminophen and dihydroergotamine when given orally, intranasally or intramuscularly?). This poses two potential issues. The first is that the data to answer such a question may not exist in the literature. The second issue is that, even if the data does exist, the number of assumptions made by the author will increase, which potentially decreases the statistical power of the conclusions drawn and will also increase the degree of bias in the study (for a really good guide of study bias see Pannucci *et al.*, Plast Reconstr Surg. 2010 126(2): 619–625). In the first instance a simple question with a binary output (only two possible answers) is recommended (for example – Is the use of oral sumatriptan superior to oral acetaminophen in relieving migraine pain?).

PICO

PICO is a tool used by many scientists conducting systematic review, it stands for Population, Intervention, Comparison, Outcome. For example, using our sumatriptan question from the previous section:

Population	Intervention	Comparison	Outcome
Adult migraine sufferers	100 mg oral sumatriptan	500 mg oral acetaminophen	Severe migraine to mild or none in 2 hours

The use of PICO allows you to define many of the terms of your initial literature search, for example by specifying dosages and defining the patient groups. Probably the most difficult aspect of using PICO is defining your outcome. In many cases once you start to survey the literature you will find a wide variety of outcomes examined and choices will have to be made on limiting or expanding the scope of your study. After your initial search, if your PICO is too restrictive or produces too large a data set you can revise the terms and reset your search (this will save time in the long run!).

FINDING THE DATA

Using the terms of your PICO conduct a literature search using the widest number of databases possible. Many scientists will preferentially use one search engine over another. This is often a sensible time saving device based on experience within the field (for example, biomedical scientists often use PubMed but this would be a less useful search engine for physicists) but in a systematic review the broadest base of studies is required, so numerous search engines should be used (e.g. PubMed, Web of Science, Scopus, Google Scholar etc..) as they all use different algorithms. Once you have your long list of articles you will need to refine this data set to make sure you are using the best evidence and that you are working with data that can be compared. An important step in this process is the use of **inclusion and exclusion criteria**.

These criteria can be related to the individual characteristics of patient groups (age, sex, underlying conditions etc..), to technical elements of the study (blinding, methodological approach, statistical analysis of the outputs etc..) or to the publication itself (peer review, published in English etc..). Again, if your criteria are too stringent and leave you very few sources to work with or are too loose and leave you with too much data then amend your terms and search again.

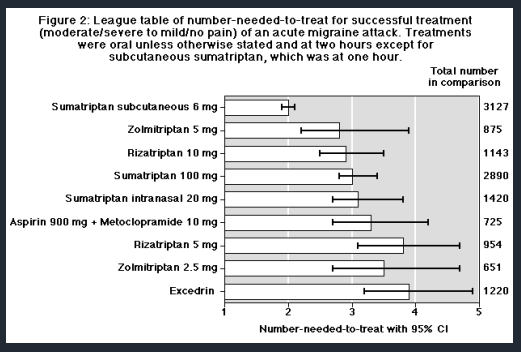
The type of study is also important, to the right you will see the hierarchy of evidence. This is a generalised tool for comparing studies of different types. The higher up on the triangle the study is, the "higher level" the evidence is. Be cautious though, as this is a blunt tool and other evidence appraisal approaches should also be used.

RANKING YOUR EVIDENCE

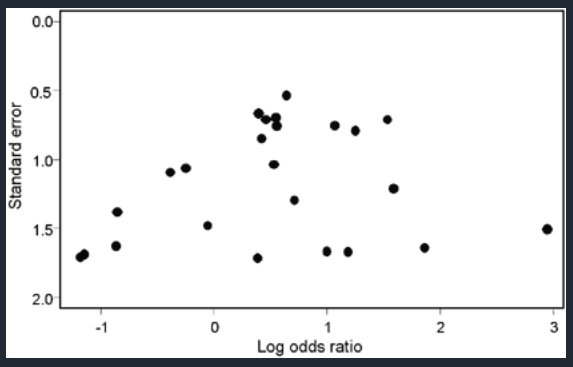
At this stage you must make critical decisions about the quality of your evidence. There are third party tools that are appropriate for some types of evidence (Jadad scoring for clinical trials is an excellent example) and while these tools offer a degree of objectivity to the analysis they are not appropriate for all types of data. When looking at your evidence ask the following questions: Is the study question relevant, does the study add anything new, what type of question is being asked, is the study design appropriate to the question, did the study methods address potential sources of bias, are the statistics appropriate, does the data justify the conclusion, are there any conflicts of interest.

COMPARING STUDIES

The mechanisms you use to compare findings from different studies will differ depending on your research question and the data sets you are working with. For drug trials calculating the number needed to treat value (NNT) (http://www.ebm.med.ualberta.ca/TherapyCalc.html), Odds Ratios and Funnel Plots (see example plot below) (https://www.medcalc.org/calc/odds_ratio.php) and the use of Forest Plots (see example below) (https://www.medcalc.org/manual/forestplot.php) are recommended.



Funnel Plot - OR=1 Exposure does not affect odds of outcome
OR>1 Exposure associated with higher odds of outcome
OR<1 Exposure associated with lower odds of outcome



Forest Plot

ADDITIONAL ONLINE RESOURCES FOR CONDUCTING SYSTEMATIC REVIEWS

http://www.cebm.net/ http://www.cochrane.org/ http://www.bandolier.org.uk/
http://www.nice.org.uk/ http://www.evidence.nhs.uk/ http://www.casp-uk.net/

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