



Introduction to systematic literature searching

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Structuring your literature search

1. Formulate the search question

Before using any database, it is a good idea to think about your search in terms of a question that you are trying to answer. Here are some sample questions:

Is lithium effective in treating bipolar disorder when compared to placebo?

Does mammographic screening improve the survival of patients with breast cancer compared with those in control groups?

What evidence is there that aspirin is effective in the prevention of secondary myocardial infarction?

You can use the PICO check list to structure your question:

- Patient population or problem
- Intervention or exposure
- Comparison
- Outcome

2. Pick out the major subjects

Look at your question carefully and underline the essential words or phrases that make up the essential subject components of your question. Here are the samples from above:

Is lithium effective in treating bipolar disorder when compared to placebo?

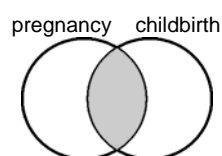
Does mammographic screening improve the survival of patients with breast cancer compared with those in control groups?

What evidence is there that aspirin is effective in the prevention of secondary myocardial infarction?

3. Expand the major subjects (brainstorming for keywords)

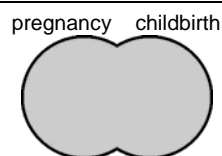
Examine each major subject and make a list of any synonyms, alternative spellings, and related terms which you would like included in your results. To do this, it helps to think of formal terms (like myocardial infarction) as well as less formal terms (like heart attack). Be as specific as possible, and where you are interested in a largish area (like heart disease) list **all** the more specific topics (like types of heart disease) that you want to cover. See below for a diagram showing how you may organise your major subjects and keywords.

At this point you should also think about how you will be combining your keywords when you search the databases:



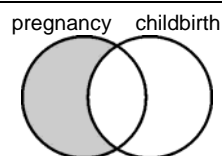
AND

AND retrieves only the records containing all of the combined terms: this example has retrieved records about both pregnancy and childbirth.



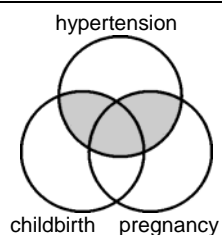
OR

OR retrieves records containing any of the combined terms: this example has retrieved records about either pregnancy or childbirth or both. Records are not duplicated in the results.



NOT

NOT retrieves records containing one term but excludes records containing an unwanted term: this example has retrieved records about pregnancy, but has left out anything about childbirth. Use NOT with caution, as it can exclude records which may be useful.



**AND
&
OR**

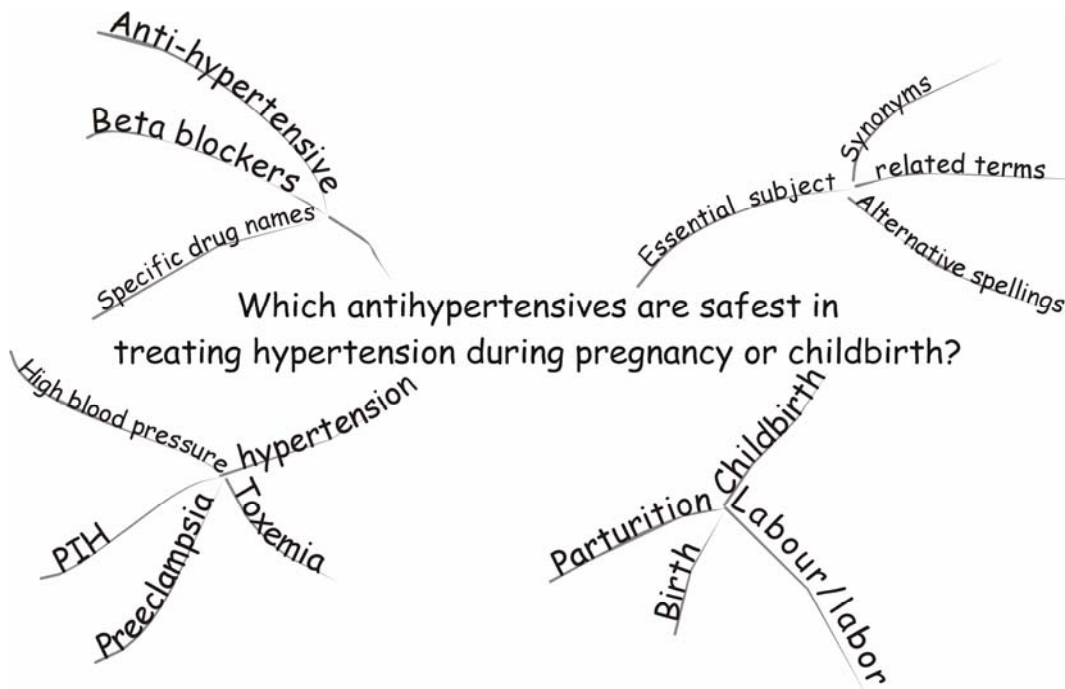
Use more than one Boolean operator to make more complex refinements: this example has retrieved records about hypertension and either childbirth or pregnancy.

4. Set criteria

To make it so that you have fewer irrelevant results to look through, and to make it easier to identify relevant results, think about criteria that would address your question: Are you interested in articles about humans only? Male or female or both? Do you want to limit to a certain age group? What about year of publication – do you need only the very latest, or do you want to cover 10, 15, 20 or more years into the past? What type(s) of research methods would yield the right kind of data for your question (e.g. randomised controlled trial, cohort study, meta-analysis etc.).

You should now have a very clear definition of what you are looking for in the database. This will save you a lot of time in the long run.

1. Expanding the major subjects using a mind-map or spider diagram:



2. Expanding the keywords using columns:

Which <u>antihypertensives</u> are safest in treating <u>hypertension</u> during <u>pregnancy</u> or <u>childbirth</u> ?				
anti-hypertensive(s) beta blockers specific drug names	Alternative spellings related terms synonyms	high blood pressure toxemia preeclampsia PIH	Alternative spellings related terms synonyms	Parturition Birth Labour/ labor

Troubleshooting for database searches

If you have too many hits

- **Focus:** Many databases have a focus option for Subject Heading terms, restricting the search to articles with your term as a main subject.
- **Limit:** Reduce the parameters of your search by selecting publication year, age group, language, publication type, etc. There is a full range of limits, but use some with caution: restricting your search to articles in English, for example, is an arbitrary measure, probably excluding excellent research.
- **Filters:** Apply 'ready made' search filters to your subject. You can use methodological filters for systematic reviews, diagnosis, and more from http://www.phru.nhs.uk/casp/learning_resources.htm
- **Boolean operators:** Use the powerful AND or NOT operators to shed articles not solely on your search topic(s). Use NOT with caution!
- **Subheadings:** Some databases have subheadings - shortcuts to popular facets of research, varying by Subject Heading. Be cautious with Subheadings – they are not watertight.

If you have many irrelevant hits

- **Subject Headings:** You will retrieve a higher proportion of relevant articles if you search with Subject Headings than with free-text alternatives.
- **Permuted Index** (Ovid interface – in the Tools menu): Search for all Subject Headings containing your word: you will be able to select the most appropriate Subject Headings from a list.
- **Tree Display:** (Ovid) Use the subject tree to find more precise Subject Headings.
- **Limit:** see above
- **Boolean operator NOT:** A search on 'pregnancy' will retrieve a fair number of articles also about childbirth. Searching for 'pregnancy not childbirth' will exclude the articles including childbirth. Beware! You may exclude many useful articles.

If you have too few hits

- **Explode:** use the explode option to include a broad Subject Heading and all the narrower terms branching off from it (this is easier to visualise if you look at the Tree Display).
- **Avoid subheadings:** select All Subheadings when you are presented with the option, because the subheading system is not entirely reliable.
- **Synonyms:** Most database content is international, so if your search terms do not map to any appropriate Subject Headings, think of North American or other equivalents.
- **Lateral searching:** look at the Subject Headings tagged onto a relevant article. Use those terms to expand the scope of your search.
- **Free-text searching:** an alternative for terms that are too new or are not sufficiently widely used to be Subject Headings.
- **Related terms:** use the truncation symbol, (the symbol varies between databases – check the help section if in doubt), in your textword / keyword search to retrieve words with a common root. 'Pancreat*' will bring up pancreatectomy, pancreatic, pancreatin, etc.
- **Spelling:** beware of alternative spellings during textword / keyword searches – e.g. paediatrics / pediatrics; immunisation / immunisation)
- **Search other databases,** too. No database is complete.

If you want to be very thorough

- **Avoid limits** – especially ones that don't influence the quality or relevance of search results – e.g. abstract only.
- **Avoid subheadings:** Select All Subheadings when you are presented with the option.
- **Explode:** See above.
- **Search multiple databases:** In addition to Embase and Medline, try PsycINFO, CINAHL, etc

Searching the literature – systematically!

What makes a literature review systematic?

- Aims to include all comparable data
- Methods and inclusion criteria are explicit
- Aims to avoid or eliminate any bias
- Should be reproducible (like an experiment)
-

What's the difference between a systematic review and meta-analysis?

- Meta-analysis is the statistical summary of two or more studies weighted for study size, precision or quality. The data must be comparable (i.e. same study design). A systematic review may contain a meta-analysis, but systematic reviews may also be undertaken on subjects that do not lend themselves to statistical information.

How do you avoid bias?

- Publication bias – There is a tendency for small negative studies to remain unpublished which may cause the meta-analysis to overestimate the size of the overall effect: publication bias may be overcome by a number of strategies which include writing to researchers in the field, contacting pharmaceutical companies and obtaining so-called grey literature. Publication bias can only be truly overcome by the prospective register of all studies in advance of their completion.
- Database bias – databases like Medline tend to index well-known, English-language journals, and neglect journals published in the 'developing world': search alternative databases like the Global Health Library (incorporating LILACS and other WHO regional databases)¹ and IndMed²
- Language bias – excellent research is published in many languages, but reviews are often limited to English: use methodology filters or other, rational limiting tools
- Multiple publication bias – results, especially positive results, may be published many times. Be aware of the possibility by noting studies with common authors, equal numbers of participants and common grant numbers.
- Reviewer bias – the reviewer may exclude reports that don't agree with his/her conclusions: stick to your clearly stated question and your inclusion/exclusion criteria.

Where do you start – and when do you stop?

- Make sure you have a well-developed research question including, for example, the patient population, the intervention, the comparison, and the desired outcome (that would be a question about therapeutic effectiveness).
- Check to see if a review has already been done on your topic (see below).
- To get started on your search terms, search for your topic (use a broad term) in the Cochrane Library. Each review should have a section where they list their tried and tested searches for databases – Medline at least.
- Systematic reviews are very time-consuming... how much time do you have? Decide how thorough you want to be, or if you should concentrate only on one aspect of the review process.
- Because no database is comprehensive, you should probably search at least three. See the Which database? section to decide which ones.
- If you need to find randomised controlled trials, start by looking in the Cochrane Controlled Trials Register in the Cochrane Library.³ The Cochrane Collaboration also have a randomised controlled trial search filter that you can use in Medline and adapt to other databases⁴.

How do you find out if one has already been done on your topic, and how do you assess it for quality?

- Ask your colleagues or other experts if they are aware of any systematic reviews.
- If your question is about the therapeutic effectiveness of an intervention, it's worth checking the Cochrane Library first. If you don't find one in the Cochrane, or you want to check for others, you could use the systematic reviews search filter in Medline⁴, or an adaptation of it in another database.
- To quality assess a systematic review, you could start by having a close look at the methods (they must be reproducible) and other details like the aims and objectives of the review, and the inclusion and exclusion criteria. For more assessment criteria, see chapter 8 in Greenhalgh's *How to read a paper*, or *Critical Appraisal for Psychiatry* by Lawrie, McIntosh & Rao, or other titles in the *Further reading* section of this course handbook.

How do you describe your search methods?

- Basically, describe exactly what you did, in enough detail for someone else to reproduce your methods and results. State your research question/hypothesis, and be clear about your criteria for including or excluding publications or reports. For each database searched, list your search history, and indicate the span of years searched in each database, too. It is worth indicating any databases searched that yielded no results. Moher D et al 1999, and Stroup et al 2000 (see references at the end of this handout) give good guidance on presentation of methods and results.

How do you summarise each of the studies used in the review

- Sometimes it is helpful to use a table to provide an at-a-glance tool for all the studies selected for the review – and a separate one also for those rejected after careful consideration. The tables would look something like this:

References	Criterion 1	Criterion 2	Criterion 3	Criterion 4
Author-Date 1	how criterion is met or not met	how criterion is met or not met	how criterion is met or not met	how criterion is met or not met
Author-Date 2	how criterion is met or not met	how criterion is met or not met	how criterion is met or not met	how criterion is met or not met
Author-Date 3	how criterion is met or not met	how criterion is met or not met	how criterion is met or not met	how criterion is met or not met
Author-Date 4	how criterion is met or not met	how criterion is met or not met	how criterion is met or not met	how criterion is met or not met

¹ Global Health Library – <http://search.bvsalud.org/ghl/> is an initiative of the World Health Organisation, to bring together in one search interface various literature databases (including LILACS) created in regional offices and by the Pan American Health Organization (PAHO) – with the aim of “radically increasing access to information and scientific evidence on health, particularly in developing regions”.

² IndMED – <http://indmed.nic.in/> a bibliographic database of 75 Indian biomedical journals from 1985 onwards. Its creators aim to index the significant contribution of India to health care and biomedical research. Though much of this contribution is now considered to conform to international standards, international bibliographic databases reference only a fraction. IndMED aims to redress this situation.

³ The Cochrane Library – a collection of databases, including the Cochrane Database of Systematic Reviews and the Cochrane Controlled Trials Register. See Which Database for more information. Available from <http://www.nelh.nhs.uk/cochrane.asp>.

⁴ Medline (Ovid interface) search filters:

For Systematic Reviews

1. meta-analysis/
2. exp review literature/
3. (meta-analy\$ or meta analy\$ or metaanaly\$).mp.
4. meta analysis.pt.
5. review academic.pt.
6. review literature.pt.
7. letter.pt.
8. review of reported cases.pt.
9. historical article.pt.
10. review multicase.pt.
11. or/1-6
12. or/7-10
13. 11 not 12
14. animal/
15. human/
16. 14 and 15
17. 14 not 16
18. 13 not 17

For Randomised Controlled Trials

1. randomized controlled trial.pt.
2. controlled clinical trial.pt.
3. randomized controlled trials/
4. random allocation/
5. double-blind method/
6. single-blind method/
7. clinical trial.pt.
8. exp clinical trials/
9. (clin\$ adj25 trial\$).mp.
10. ((singl\$ or doubl\$ or treb\$ or tripl\$) adj25 (blind\$ or mask\$)).mp.
11. placebos/
12. placebo\$.mp.
13. random\$.mp.
14. research design/
15. comparative study/
16. exp evaluation studies/
17. follow up studies/
18. prospective studies/
19. (control\$ or prospectiv\$ or volunteer\$).mp.
20. (ANIMAL not HUMAN).sh.
21. (or/1-6) not 20
22. (or/7-14) not 20
23. (or/15-19) not 20
24. 21 or 22 or 23

Which database?

This is just a selection of literature databases – these are the most popular for health and biomedical subjects. See www.lib.ed.ac.uk for a full list of literature databases available from UoE Library.

AMED (Allied and Alternative Medicine)

Why use it?

- Subjects covered include acupuncture, homeopathy, palliative care, Chinese medicine, hospice care, physiotherapy, chiropractic, hypnosis, podiatry, herbalism, occupational therapy, rehabilitation, holistic treatments and osteopathy.
- Controlled thesaurus terms (based on MeSH) are used

Bear in mind...

- Updated quarterly
- Not all subjects have been covered since 1985: palliative care is since 1997, speech and language therapy since 1999.
- Coverage: 1985 to present
- Number of journals indexed: nearly 600 (mostly European journals)

ASSIA (Applied Social Sciences Index and Abstracts)

Why use it?

- International coverage of journals for health and social science professionals

Bear in mind...

- Coverage: 1987 to present
- Number of journals indexed: over 650 (40% UK, 45% North American, 15% other).

BIOSIS Previews (Biological Abstracts)

Why use it?

- Biological and medical literature (with approx. 30% journal overlap with Medline and Embase)
- Good for preclinical research in biology and biomedicine, pharmacology, reports of new organisms
- Indexes more than journal articles: includes books, patents and meeting and conference reports
- Has long and full abstracts
- Marginally stronger than Medline for psychiatry
- Coverage back to 1969

Bear in mind...

- Indexing protocols have been changed from time to time – current headings and descriptors may not retrieve older records on the same subject

CAB Abstracts

Why use it?

- Covers the significant research and development literature in the areas of agriculture and related topics, such as veterinary medicine
- Coverage is from 1910
- Veterinary sciences, animal sciences and human health make up 37% of the database
- Currently indexes around 30,000 serial titles
- Indexes books, conference proceedings, monograph theses and report, as well as journals
- Global coverage – over 30% of the records are from Africa, Asia, Australasia, Eastern Europe and Central and South America

Bear in mind...

- Journals are only abstracted cover-to-cover when all articles in them meet the selection criteria pertaining to subject relevance and scientific merit
- Grey literature is covered in some areas (e.g. veterinary medicine), but not in others (e.g. animal breeding and genetics)
- Around 5% of the records do not have abstracts
- CAB Abstracts uses British spelling, therefore the thesaurus should be used for specific searches

CINAHL (Cumulative Index of Nursing and Allied Health Literature)

Why use it?

- Comprehensive coverage of English-lang. publications in nursing and allied health professions
- Covers more than just journal articles: includes book chapters, theses, conference proceedings, audiovisual, practice standards etc.

- Contains many full-text resources
- Well-structured controlled thesaurus (70% of which also appear as MeSH in Medline)

Bear in mind...

- Coverage: 1983 to present
- Number of journals indexed: over 500

Cochrane Library (CL)

Why use it?

- Focussed resource for finding systematic reviews of the effectiveness of clinical interventions (Cochrane Database of Systematic Reviews and Database of Reviews of Effectiveness)
- First stop resource for finding controlled trials (Cochrane Controlled Trials Register)
- Contains helpful information for researchers performing reviews.

Bear in mind...

- If its narrow in scope can be considered a limitation, then it's worth pointing out that the systematic reviews are of controlled trials, and although it is possible to perform sound systematic literature reviews of other types of research / publications, those types of reviews are not included in the CL.

Embase

Why use it?

- Good coverage of wide range of clinical medical topics, but particularly strong in pharmacology and psychiatry when compared with Medline.
- Good European journal coverage
- Well structured controlled thesaurus (Emtree) for good relevancy of results
- In addition to journal articles, covers meetings, conferences and symposia
- Shorter Indexing delay than Medline: 4 to 8 weeks

Bear in mind...

- Coverage: 1980 to present

Global Health

Why use it?

- International coverage of medicine and public health topics; strong in nutrition and vector control
- Coverage: 1910 to present
- Indexes more than just journal articles: theses, patents, books, book chapters, etc.
- Publisher claims 40% of content is unique when compared with other databases
- 95% of records have abstracts in English (non-English ones have been translated).

Bear in mind...

- Subject Heading thesaurus not terribly detailed – requires lots of keyword searching

Google Scholar

Why use it?

- Great first source for getting started on a literature search – simple and quick.
- Searches the web for academic literature, e.g. peer-reviewed journals, theses, books etc.
- Searches key biomedicine sources, e.g. PubMed, and full-text journal databases from Blackwell, Ingenta, Nature, Springer, Wiley etc.
- Seamless linking to many full-text articles (sometimes the route does not recognise university subscriptions: before paying, check Library's e-journal list at www.lib.ed.ac.uk)
- Uses WorldCat's *Find a Library* tool to locate books in nearby libraries

Bear in mind...

- Still in beta, and it seems the database has not been updated recently
- Google Scholar will not list the bibliographic and full-text journals databases that are in its database, so it's hard to say exactly what its coverage is.
- Advanced Search features have poor reliability

Medline

Why use it?

- Good coverage of wide range of clinical medical topics, both human and veterinary
- One of the longest periods of coverage: from 1966, with over 11 million records
- Very strong and widely recognised controlled thesaurus of MeSH (Medline Subject Headings) for good relevancy of results
- Transparent navigation of MeSH terms allows you to 'see inside' the organisation of the database
- Probably the best source for dentistry information (though the MeSH can be weak in this subject)

- Ovid interface has excellent refining tools and several save options including auto-alert
- Bear in mind...
- Long indexing delay: 3 to 6 months for complete records (Pre-medline helps to overcome this)
- Very large: over 11 million records, so requires sifting through results
- Of the biomedical, science and social science databases, weaker in psychiatry and psychology
- Journal coverage weighted toward North American titles
- Does not usually index publications other than journal articles

PsycINFO

Why use it?

- Coverage back to 1887
- Well structured controlled thesaurus
- Indexes more than just journal articles: dissertations, books, and book chapters are included.
- Good for all aspects of mental health
- Good for social, behavioural and psychological aspects of health and illness

Bear in mind...

- Comparatively small database: approximately 1.5 million records

PubMed

PubMed is the free version of Medline (see above), direct from the producer, the National Library of Medicine. Almost all the information about Medline applies to PubMed.

Why use it?

- Good interpretation of searches, mapping to both subject headings and doing free-text searches
- Incorporates OLDMedline (pre-1966 articles) automatically
- Time-saving links between other NCBI databases, like the Online Medelian Inheritance in Man, and article records in PubMed
- Use Single Citation Matcher to find references easily: handy when you have incomplete details
- Journals Database helps to find standard abbreviations, or to decipher abbreviations
- Free registration with My NCBI allows you to save search histories on the server

Bear in mind...

- Fewer fields and search limits are available compared to Medline
- Links to full text articles may not take you to the source from which we subscribe – before getting out your credit card, check the library's e-journal list (www.lib.ed.ac.uk)
- The MeSH browser is clumsy compared to Medline
- Fewer tools for saved searches and auto-alerts than Medline

SciFinder Scholar (Chemical Abstracts) see: <http://www.lib.ed.ac.uk/resbsub/scifinder.shtml>

Why use it?

- Coverage of chemistry (organic, inorganic, physical, analytical, theoretical), chemical structures and patents, chemical engineering, biochemistry, biotechnology, genetics
- Bibliographic coverage of 9,000 journals from 1907 to present
- Facility to search by chemical structure
- Chemical reaction searching allows you to specify reaction sites and map atoms in the reactants
- Contains patents data, and information on chemical suppliers and regulations

Beware

- Our subscription has a limit of six simultaneous users – if it's busy do try again!
- It is necessary to download software to be able to use SciFinder

Scirus

Why use it?

- Based on ScienceDirect (Elsevier stable) full-text journals; PubMed; US, EU and Japanese patent offices; open access archives like BioMed Central; as well as WWW sources
- Advanced search allows limits by fields searched, publication type, date, format, original source, or subject area
- Prompts with keywords to refine searches
- Clear links to full-text, which work best if you are on the UoE network or proxy
- Easy export of selected search results by email, text or into EndNote or other reference tools.

Bear in mind...

- Journal article results are heavily based on Elsevier publications
- Publisher catalogues are searched, pointing to buying books instead of finding them in the library.

Web of Science (WoS)

Why use it?

- Indexes over 180 veterinary medicine and animal science journals, and over 2,500 core medical journals
- Science Citation Index covers over 5300 fully indexed journals, and Social Science Citation Index covers over 1700 fully indexed journals, both from a wide range of disciplines
- Cited Reference Search: valuable research tool, allowing you to find articles which have cited a known reference
- Related to the above, you can also see all references cited in articles
- Simultaneous searching of Science Citation Index and Social Science Citation Index is good for public health topics and psychiatry or psychology
- Short indexing delay: 2 to 4 weeks
- Coverage comparatively long: from 1900 for SCI; 1975 for SSCI
- Well-written, context-sensitive help

Bear in mind...

- There is no controlled thesaurus: searches are free-text searches
- Advanced search has a cap of 100,000 results for each search string
- During term-time, very slow service at hours of peak use (10am-5pm)

Further reading

Centre for Reviews and Dissemination. Systematic Reviews: CRD's guidance for undertaking systematic reviews in health care, University of York; 2009. Available from: www.york.ac.uk/inst/crd/pdf/Systematic_Reviews.pdf

Dixon-Woods M, Agarwal S, Jones D, Young B, Sutton A. Synthesising qualitative and quantitative evidence: a review of possible methods. *J Health Serv Res Policy*; 10(1):45-53, 2005.

Egger M, Davey Smith G, Altman DG, editors. Systematic reviews in health care: meta analysis in context. 2nd ed. London : BMJ, 2001.

Glasziou P, Del Mar C, Salisbury J. *Evidence-based practice workbook*. Oxford: Blackwell, 2007.

Greenhalgh T, Dawson B. *How to read a paper : the basics of evidence-based medicine*. 4th ed. Chichester: Wiley-Blackwell, 2010.

Guyatt G et al. Users' guides to the medical literature : essentials of evidence-based clinical practice. Chicago, Ill. : AMA Press, 2002.

Lawrie S, McIntosh A, Rao S. Critical appraisal for psychiatrists. Edinburgh : Churchill Livingstone, 2000.

Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JPA, et al. The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration. *PLoS Med* 2009;6(7):e1000100.

Moher D, Cook DJ, Eastwood S, Olkin I, Rennie D, Stroup DF. Improving the quality of reports of meta-analyses of randomised controlled trials: the QUOROM statement. *Lancet* 1999;354(9193):1896-900.

Moher D, Schulz KF, Altman D. The CONSORT statement: revised recommendations for improving the quality of reports of parallel-group randomized trials. *JAMA* 2001;285(15):1987-91.

Pocock SJ. *Clinical trials : a practical approach*. Chichester : Wiley & Sons, 1983.

Sackett DL. *Evidence-based medicine: how to practice and teach EBM*. 2nd ed. Edinburgh : Churchill Livingstone, 2000.

Stroup DF, Berlin JA, Morton SC, Olkin I, Williamson GD, Rennie D, et al. Meta-analysis of Observational Studies in Epidemiology: A Proposal for Reporting. *JAMA* 2000;283(15):2008-12