

Education and debate

How to read a paper

The Medline database

Trisha Greenhalgh

This is the first of 11 articles introducing non-experts to finding medical articles and assessing their value

Unit for Evidence-Based Practice and Policy, Department of Primary Care and Population Sciences, University College London Medical School/ Royal Free Hospital School of Medicine, Whittington Hospital, London N19 5NF
Trisha Greenhalgh, senior lecturer
p.greenhalgh@ucl.ac.uk

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In 1928, in his introduction to *Sceptical Essays*, Bertrand Russell wrote: "The extent to which beliefs are based on evidence is very much less than believers suppose." Medical beliefs, and the clinical practices that are based on them, are a case in point. Debate continues as to whether scientific evidence alone is sufficient to guide medical decision making, but few doctors would dispute that finding and understanding relevant research based evidence is increasingly necessary in clinical practice. This article is the first in a series that introduces the non-expert to searching the medical literature and assessing the value of medical articles.

The Medline database

Over 10 million medical articles exist on library shelves. About a third are indexed in the huge Medline database, compiled by the National Library of Medicine of the United States. The Medline database is exactly the same, whichever company is selling it, but the commands differ according to the software. Vendors of Medline online and on CD ROM include Ovid Technologies (ovid) and Silver Platter Information (WinSPIRS).

Articles can be traced in two ways: by any word listed on the database, including words in the title, abstract, authors' names, and the institution where the research was done; and by a restricted thesaurus of medical titles, known as medical subject heading (MeSH) terms.

To illustrate how Medline works, I have worked through some common problems in searching. The scenarios have been drawn up using ovid software.

Summary points

Not all medical articles are indexed on Medline, and many that are have been misclassified

Searching by textword can supplement a search by MeSH headings

To increase the sensitivity of a search, use the "explode" command and avoid using subheadings

Scan titles on screen rather than relying on the software to find the most valid or relevant ones

Problem 1: You are trying to find a known paper

Solution: Search the database by field suffix (title, author, journal, institution, etc) or by textwords.

First, get into the part of the database which covers the approximate year of the paper's publication. If you are already in the main Medline menu, select "database" (Alt-B). If you know the approximate title of the paper and perhaps the journal where it was published, you can use the title and journal search keys or (this is quicker) the .ti and .jn field suffixes. The box shows some other useful field suffixes.

Thus, to find a paper called something like "Confidentiality and patients' casenotes," which you remember seeing in the *British Journal of General Practice* a couple of years ago,¹ type the following sequence:

- 1 confidentiality.ti
- 2 british journal of general practice.jn
- 3 1 and 2

You could do all this in one step:

- 1 confidentiality.ti and british journal of general practice.jn

This step illustrates the use of the boolean operator "and"; it will give you articles common to both sets. Using "or" will simply add the two sets together.

Note that since 1988 the *British Medical Journal* is abbreviated BMJ in ovid software, and *Journal of the American Medical Association* is JAMA. Other useful field suffixes to try when searching for a known article are author (using the syntax haines-ap.au), institution (for example, manchester.in), or title (for example, evidence-based medicine.ti).

Useful search field suffixes (ovid)

Syntax	Meaning	Example
.ab	Word in abstract	epilepsy.ab
.au	Author	smith-r.au
.jn	Journal	lancet.jn
.me	Single word, wherever it may appear as a MeSH term	ulcer.me
.ti	Word in title	epilepy.ti
.tw	Word in title or abstract	epilepsy.tw
.ui	Unique identifier	91574637.ui
.yr	Year of publication	87.yr

Problem 2: You want to answer a specific question

Solution: Construct a focused (specific) search by combining two or more broad (sensitive) searches.

I was recently asked by the mother of a young girl with anorexia nervosa whose periods had ceased to prescribe oral contraceptives for her so as to stop her bones thinning. This seemed a reasonable request, though there were ethical problems to consider. But is there any evidence that taking oral contraceptives in these circumstances really prevents long term bone loss? I decided to explore the subject using Medline. To answer this question, you need to search very broadly under "anorexia nervosa," "osteoporosis," and "oral contraceptives." The search described below involves articles from 1992; when replicating it, make sure the database you are searching goes back that far. Type:

1 anorexia nervosa

You have not typed a field suffix (such as .tw), so the OVID system will automatically try to "map" your request to one of its standard medical subject headings (abbreviated MeSH and colloquially known as "mesh terms"). (Note that not all Medline software packages will automatically map your suggestion to MeSH terms. With Silver Platter search software, for example, you need to enter your heading and click the "suggest" button.) For this example, the screen offers you either "eating disorders" or "anorexia nervosa" and asks you to pick the closest one. Choose "anorexia nervosa" (space bar to highlight the text, then press "return").

The screen then asks you whether you want to "restrict to focus." Do you only want articles which are actually about anorexia nervosa, or do you want any article that mentions anorexia nervosa in passing? Let's say we do want to restrict to focus. Next, the screen offers us a choice of subheadings, but we'll ignore these for a moment. Select "Include all subheadings." We could have got this far using a single line command:

2 *anorexia nervosa/

The * shows that the term is a major focus of the article, and the / represents a MeSH term. You should have about 750 articles in this set.

Similarly, to get articles on osteoporosis (which is also a MeSH term), use the following single line command:

3 osteoporosis/

You should get about 2200 articles. Note that in OVID, if you know that the subject you want is an official MeSH term, you can shortcut the mapping process by typing a slash (/) after the word. Note also that we have not used an asterisk here, because osteoporosis may not be the focus of the article we are looking for.

Finally, put in the term "oral contraceptives" (without an asterisk and without a slash) to see what the MeSH term here is. You will be offered "contraceptives, oral," and if you had known this you could have used the following command:

4 contraceptives, oral/

This set should contain around 1200 articles. You can combine these three sets, either by using their set numbers 1 and 2 and 3 or by typing the single line command:

5 *anorexia nervosa/ and osteoporosis/ and contraceptives, oral/

With this you will have searched over 4000 articles and struck a single bull's eye.² (If you don't find it, check the syntax of your search carefully, then try running the

Useful subheadings (OVID)

Syntax	Meaning	Example
/ae	Adverse effects	thalidomide/ae
/co	Complications	measles/co
/ct	Contraindications (of drug)	propranolol/ct
/di	Diagnosis	glioma/di
/dt	Drug therapy	depression/dt
/ed	Education	asthma/ed
/ep	Epidemiology	poliomyelitis/ep
/hi	History	mastectomy/hi
/nu	Nursing	cerebral palsy/nu
/og	Organisation/administration	health service/og
/pc	Prevention and control	influenza/pc
/px	Psychology	diabetes/px
/th	Therapy	hypertension/th
/tu	Therapeutic use (of drug)	aspirin/tu

same search through the previous five year database using the Alt-B command.)

Problem 3: You want to get general information quickly about a well defined topic

Solution: Use subheadings and/or the "limit set" options.

Subheadings are the fine tuning of the Medline indexing system; they classify articles on a particular MeSH topic into aetiology, prevention, therapy, and so on. The most useful ones are listed in the box. I try not to use subheadings unless I have unearthed an unmanageable set of articles, since an estimated 50% of articles in Medline are inadequately or incorrectly classified by subheading. It actually doesn't take long to browse through 50 or so articles on the screen. It is better to do this than to rely on the "limit set" command (see box) to give you the best of the bunch.

The option "AIM journals" denotes all journals listed in the Abridged Index Medicus—that is, the "mainstream" medical journals. Alternatively, if you want articles relating to nursing, rather than medical care, you could limit the set to "Nursing journals." This is often a better way of limiting a large set than asking for local holdings. If you are not interested in seeing anything in a foreign language (even though the abstract may be in English), select this option, again bearing in mind that it is a non-systematic (indeed, a very biased) way of excluding articles from your set.³

Note that instead of using the "limit set" function key you can use direct single line commands such as:

9 limit 4 to local holdings

10 limit 5 to human



PETER BROWN

Useful “limit set” options

AIM journals	Abstracts
Nursing journals	Local holdings
Dental journals	English language
Cancer journals	Male
Review articles	Human
Editorials	Publication year

Problem 4: Your search gives irrelevant articles

Solution: Refine your search as you go along in the light of interim results.

Often, a search uncovers dozens of articles which are irrelevant to your question. The boolean operator “not” can help here. I recently undertook a search to identify articles on surrogate endpoints in clinical pharmacology research. My search revealed hundreds of articles I didn’t want—all on surrogate motherhood. The syntax to exclude the unwanted articles is:

```
1 (surrogate not mother$.)tw
```

Deciding to use the “not” operator is a good example of how you can (and should) refine your search as you go along—much easier than producing the perfect search off the top of your head. I used the truncation symbol \$ to find all words from a single stem, such as mother, mothers, motherhood, and so on.

Another way of getting rid of irrelevant articles is to narrow your textword search to adjacent words using the “adj” operator. For example, the term “home help” includes two very common words linked in a specific context. Link them as follows:

```
1 home adj help.tw
```

Problem 5: The search gives no articles, or too few

Solution: Firstly, don’t overuse subheadings or the “limit set” options. Secondly, search under textwords as well as MeSH terms. Thirdly, learn about the “explode” command, and use it routinely.

Many important articles are missed not because we constructed a flawed search strategy but because we relied too heavily on a flawed indexing system. For this reason, you should adopt a “belt and braces” approach and search under textwords as well as by MeSH terms. After all, it is difficult to write an article on the psychology of diabetes without mentioning the words “diabetes,” “diabetic,” “psychology,” or “psychological,” so the truncation stems “diabet\$.tw.” and “psychol\$.tw.” would supplement a search under the MeSH term “diabetes mellitus” and the subheading “/px” (psychology).

Another important strategy for preventing incomplete searches is to use the powerful “explode” command. The MeSH terms are like the branches of a tree with, for example, “asthma” subdividing into “asthma in children,” “occupational asthma,” and so on. Medline indexers are instructed to index items by using the most specific MeSH terms they can. If you just ask for articles on “asthma” you will miss all the articles indexed under “asthma in children” unless you “explode” the term using the following syntax:

```
1 exp asthma/
```

Problem 6: You don’t know where to start searching

Solution: Use the “permuted index” option.

Let’s take the term “stress.” It comes up often, but searching for particular types of stress would be labori-

ous and searching “stress” as a textword would be too unfocused. We need to know where in the MeSH index the various types of stress lie, and when we see that, we can choose the sort of stress we want to look at. For this, we use the command ptx (“permuted index”):

```
1 ptx stress
```

The screen shows many options, including post-traumatic stress disorders, stress fracture, oxidative stress, stress incontinence, and so on.

The command “ptx” is useful when the term might be found in several subject areas. If your subject is a discrete MeSH term, use the tree command. For example:

```
2 tree epilepsy
```

will show where epilepsy is placed in the MeSH index—as a branch of “brain diseases,” which itself branches into generalised epilepsy, partial epilepsy, post-traumatic epilepsy, and so on.

Problem 7: Limiting a set loses important articles but does not exclude those of low methodological quality

Solution: Apply an EBQF (evidence based quality filter).

If your closely focused search still gives you several hundred articles, and if applying subheadings or limit set functions seems to lose valuable (and valid) papers, you should insert a quality string designed to limit your set to therapeutic interventions, aetiology, diagnostic procedures, or epidemiology. Alternatively, you could apply search strings to identify the publication type, such as randomised controlled trial, systematic review, or meta-analysis.

These EBQFs (evidence based quality filters), which are listed in Appendix 1, are complex search strategies developed by some of the world’s most experienced medical information experts. You can copy them into your personal computer and save them as strategies to be added to your subject searches. Other search strategies that will identify cohort studies, case-control studies, and so on will soon be available from the UK Cochrane Centre, Summertown Pavillion, Middle Way, Oxford OX2 7LG (general@cochrane.co.uk).

Problem 8: Medline hasn’t helped

Solution: Explore other medical and paramedical databases.

Entry of articles onto the Medline database is open to human error, both from authors and editors who select key words for indexing, and from the librarians who group articles under subheadings and type in the abstracts. In addition, some sections of indexed journals are not available on Medline (for example, the News section of the *BMJ*). According to one estimate, 40% of material which should be listed on Medline can, in reality, only be accessed by looking through all the journals again, by hand. Furthermore, a number of important medical and paramedical journals are not covered by Medline at all. It is said that Medline lacks comprehensive references in the fields of psychology, medical sociology, and non-clinical pharmacology.

If you wish to broaden your search to other electronic databases, ask your local librarian where you could access the following:

- *AIDSLINE*—Covers AIDS and HIV back to 1980.
- *Allied and Alternative Medicine*—Covers complementary and alternative medicine.
- *American Medical Association Journals*—Provides the full text of *JAMA* plus 10 specialty journals produced by the American Medical Association; from 1982.

Appendix 1: Evidence based quality filters for everyday use

- (a) Therapeutic interventions (What works?)
 1 exp clinical trials 2 exp research design
 3 randomized controlled trial.pt.
 4 clinical trial.pt.
 5 (single or double or treble or triple).tw.
 6 (mask\$ or blind\$).tw.
 7 5 and 6
 8 placebos/ or placebo.tw.
 9 1 or 2 or 3 or 4 or 7 or 8
- (b) Aetiology (What causes it? What are the risk factors?)
 1 exp causality
 2 exp cohort studies
- 3 exp risk
 4 1 or 2 or 3
- (c) Diagnostic procedures
 1 exp "sensitivity and specificity"
 2 exp diagnostic errors
 3 exp mass screening
 4 1 or 2 or 3
- (d) Epidemiology
 1 sn.xs
- (This would find all articles indexed under any MeSH term with any of "statistics," "epidemiology," "ethnology," or "mortality" as subheadings.)

Appendix 2: Maximally sensitive search strings (to be used mainly for research)

- (a) Maximally sensitive qualifying string for randomised controlled trials
- 1 RANDOMIZED CONTROLLED TRIAL.pt.
 - 2 CONTROLLED CLINICAL TRIAL.pt.
 - 3 RANDOMIZED CONTROLLED TRIALS.sh.
 - 4 RANDOM ALLOCATION.sh.
 - 5 DOUBLE-BLIND METHOD.sh.
 - 6 SINGLE-BLIND METHOD.sh.
 - 7 or/1-6
 - 8 ANIMAL.sh. not HUMAN.sh.
 - 9 7 not 8
 - 10 CLINICAL TRIAL.pt.
 - 11 exp CLINICAL TRIALS
 - 12 (clin\$ adj25 trial\$).ti.ab.
 - 13 ((single or double or treble or triple) adj25 (blind\$ or mas\$)).ti.ab.
 - 14 PLACEBOS.sh.
 - 15 placebo\$.ti.ab.
 - 16 random\$.ti.ab.
 - 17 RESEARCH DESIGN.sh.
 - 18 or/10-17
 - 19 18 not 8
 - 20 19 not 9
 - 21 COMPARATIVE STUDY.sh.
- 22 exp EVALUATION STUDIES/
 23 FOLLOW UP STUDIES.sh.
 24 PROSPECTIVE STUDIES.sh.
 25 (control\$ or prospectiv\$ or volunteer\$).ti.ab.
 26 or/21-25
 27 26 not 8
 28 26 not (9 or 20)
 29 9 or 20 or 28
- In these examples, upper case denotes controlled vocabulary and lower case denotes free text terms. Search statements 8, 9, 19, and 27 could be omitted if your search takes too long a time to run.
- (b) Maximally sensitive qualifying string for identifying systematic reviews
- 1 REVIEW, ACADEMIC.pt.
 - 2 REVIEW, TUTORIAL.pt.
 - 3 META-ANALYSIS.pt.
 - 4 META-ANALYSIS.sh.
 - 5 systematic\$ adj25 review\$
 - 6 systematic\$ adj25 overview\$
 - 7 meta-analy\$ or metaanaly\$ or (meta analy\$)
 - 8 or/1-7
 - 9 ANIMAL.sh. not HUMAN.sh.
 - 10 8 not 9
- Search statements 9 and 10 could be omitted if your search seems to be taking a long time to run.

- *ASSIA*—An applied social sciences database covering psychology, sociology, politics, and economics since 1987. All documents have abstracts.
- *Cancer-CD*—A compilation by Silver Platter of CANCERLIT and Embase cancer related records from 1984. The CD ROM version is updated quarterly.
- *CINAHL*—The nursing and allied health database covering all aspects of nursing, health education, occupational therapy, social services in health care, and other related disciplines from 1983. The CD ROM version is updated monthly.
- *Cochrane Library*—The Cochrane Controlled Trials Register (CCTR), Cochrane Database of Systematic Reviews (CDSR), Database of Abstracts of Reviews of Effectiveness (DARE), and Cochrane Review Methodology Database (CRMD) are updated quarterly; authors of systematic reviews on CDSR undertake to update their own contributions periodically.⁴
- *Current Contents Search*—Indexes journal issues on or before their publication date. It is useful when checking for the very latest output on a subject. Updated weekly; from 1990.
- *Current Research in Britain*—The British national research database of trials in progress.
- *DHData* (formerly DHSS-Data)—The database of the UK's Department of Health indexes articles covering health service and hospital administration; from 1983.
- *Embase*—Focuses on drugs and pharmacology but also includes other biomedical specialties. It is more up to date than Medline and has better European coverage. The CD ROM version is updated monthly.

- *HELMIS*—The Health Management Information Service at the Nuffield Institute of Health, Leeds, UK, indexes articles on health service management.
- *Psychlit*—Produced by the American Psychological Association as the computer searchable version of Psychological Abstracts; covers psychology, psychiatry, and related subjects; journals are included from 1974 and books from 1987 (English language only).
- *Science Citation Index*—Indexes references cited in articles as well as the usual author, title, abstract, and citation of articles themselves. Useful for finding follow up work done on a key article and for tracking down addresses of authors.
- *SHARE*—Based at the King's Fund library in London; published and ongoing research into the health of, and health services for, black and minority ethnic groups.
- *Toxline*—Information on toxicological effects of chemicals and drugs on living systems; from 1981.
- *UNICORN*—The main database of the King's Fund, London. Covers health, health management, health economics, and social sciences. Particularly strong on primary health care and the health of Londoners.

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- 1 Caman D, Britten N. Confidentiality and medical records: the patient's perspective. *Br J Gen Pract* 1995;45:485-8.
- 2 Seeman E, Szmukler GI, Formica C, Tsalamandris C, Mestrovic R. Osteoporosis in anorexia nervosa: the influence of peak bone density, bone loss, oral contraceptive use, and exercise. *J Bone Mineral Res* 1992;7:1467-74.
- 3 Moher D, Fortin P, Jadad AR, Juni P, Klassen T, Le Lorier J, et al. Completeness of reporting of trials published in languages other than English: implications for conduct and reporting of systematic reviews. *Lancet* 1996;347:363-6.
- 4 Bero L, Rennie D. The Cochrane Collaboration: preparing, maintaining, and disseminating systematic reviews of the effects of health care. *JAMA* 1995;274:1935-8.

The articles in this series are excerpts from *How to read a paper: the basics of evidence based medicine*. The book can be ordered from the BMJ Bookshop: tel 0171 383 6185/6245; fax 0171 383 6662. Price £13.95 UK members, £14.95 non-members.