

**CME Article**

# Finding the evidence: resources and skills for locating information on clinical effectiveness

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**Limited time and lack of knowledge about where and how to search for information often present barriers to practitioners who want to locate current best evidence for treating their patients. There is as yet no single place they can go to get an answer to all their questions. High quality clinical studies are difficult to filter out from the mass of information on large databases, and secondary resources of evaluated information are dispersed over hundreds of Internet sites worldwide. This overview presents a practical guide for the busy practitioner who searches only occasionally and needs to maximise the time spent. Major collections of secondary resources are identified and their individual features described briefly. Following this, several services using PubMed are outlined that automatically apply filters for studies with high quality research design. Further sources of information and assistance are listed for those who wish to learn more.**

**Keywords:** evidence-based medicine, databases, information storage and retrieval, technology assessment

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**INTRODUCTION**

In the first article in this series on Evidence-based Medicine and Healthcare<sup>(1)</sup>, a comprehensive overview of the background to the practice of evidence-based medicine (EBM) was given. The article then outlined the five-step approach for practising EBM<sup>(2)</sup> in which clinicians first carefully define their question, then track down the best evidence, critically appraise its validity, apply the results in their practice, and evaluate their performance. This second article in the series expands on step two of the process, namely: finding the information.

While not disputing the wisdom of the five-step approach, clearly it has time and resource implications which may make individual practitioners feel that

the whole thing is just too hard to go through every time they have a clinical question to answer. However, it is seldom necessary to start from first principles and carry out the entire process on one's own. Not only are there systems which assist in locating clinical studies as primary sources of evidence, but there are also now many secondary resources which have gathered primary information, evaluated it systematically, and made the results freely available.

No discussion of finding the evidence would be complete without noting the revolutionary changes that have taken place over the past decade in the way medical information is produced and disseminated. It is hard to believe that little more than ten years ago, searching for medical information was still almost exclusively print-based in text books, print indexes and print journals. Access to electronic formats such as CD-ROM databases was usually available only in medical libraries. Starting from the mid-1990s, however, electronic formats began to take over and eventually to dominate. Today, most practitioners access information at their desk through the Internet, limited only by the speed of the connection, and the ability of the individual to pay for it. What is more, it is not just the traditional large publishers that have become the providers of information, but small research groups and even private individuals can and do put their publications online for immediate access by an international audience.

These changes have made it both easier and at the same time more difficult to access medical information. On the positive side, the many excellent groups that are publishing evidence-based work on their own websites are able to distribute it far more widely and more quickly than they would be able to do in print. Changes in file formats have become available which allow greater flexibility of size and design, so that long reports with extensive evidence tables, reference lists, appendices and other useful resources can be made available as easily and economically as possible, with the end-user bearing the cost of downloading and printing them. On

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the other hand, the proliferation of sources of information, the huge size of some resources, and the ever-changing nature of the location and design of Internet sites can make searching for information time-consuming and frustrating. Lack of good searching skills; multiple sources to search in too little time; overwhelming results from large databases; disappearance or changes in the Internet location; undated information; and information that may be convincingly presented but which may be of questionable quality, are all barriers to finding the right information at the right time.

This article then, aims to present a practical and time-saving guide to some of the major sources of reliable evaluated information or *secondary resources* as well as some of the useful services available to assist in filtering out the best quality original research or *primary studies* from large databases like MEDLINE.

### **FINDING EVALUATED INFORMATION: HAS SOMEONE ELSE ANSWERED THIS QUESTION?**

When an information need arises, it certainly makes sense as a first step to find out whether someone else has already asked the same question and produced a systematic and reliable evaluation of the evidence about it. Over the last decade, evidence-based research groups working in a wide range of countries have tackled a huge variety of topics. The reviews produced have usually been conducted rigorously according to recommended guidelines<sup>(3)</sup>, by expert teams using extensive information resources and search strategies which an individual practitioner could not hope to replicate. While coverage is strongest in the area of effectiveness and safety of diagnostic tests and therapies for common medical conditions, reviews on effective methods and settings for the delivery of health care are also slowly increasing. Many of these evaluated (secondary) resources – systematic reviews, meta-analyses, health technology assessments, evidence-based guidelines, query answering services, and critically-appraised topics – are either completely or partially free. Even if documents need updating or expanding, the findings of the review and the list of included studies will be useful and may reduce subsequent work. But where are these documents? The problem is that there is as yet no one convenient place to locate them. Many are published as stand-alone reports on Internet websites rather than as journal articles and so searching major databases like MEDLINE/PubMed will miss most of them. It would be impossible to provide a comprehensive list of the many sites over which they are dispersed. There are, however, several major sources that

give access to large collections of high quality secondary sources.

Probably the best known of these is the Cochrane Database of Systematic Reviews (CDSR), a section of the Cochrane Library. Cochrane reviews systematically review the evidence for and against the effectiveness and appropriateness of treatments or other interventions for specific conditions. The database comes out once a quarter; new reviews are added and existing reviews are regularly updated to provide a reliable and current source of evidence to practitioners. The Cochrane Library is a subscription database, but the abstracts of all reviews – which include the findings of the review – are free at <http://www.cochrane.org/reviews/index.htm> Because of its importance, many hospitals and other healthcare institutions now subscribe to the Cochrane Library and some health systems make it available nationally to all medical practitioners. More information about the CDSR and the other sections of the Cochrane Library is available at <http://www.cochrane.org>

A second major source of evaluated information is the Health Technology Assessment (HTA) database, created and maintained by the Centre for Reviews and Dissemination (CRD) at the University of York in collaboration with the International Network of Agencies for Health Technology Assessment (INAHTA <http://www.inahta.org>). The 42 members of INAHTA are an important group of contributors to the database, particularly as they tend to give open-access to the full text of the assessments, report their ongoing research, and add their records on a regular basis. However, the database is by no means limited to INAHTA agencies. There are many other contributors, and the number is increasing all the time, owing to the proactive work done by the database managers. The HTA database is probably the single best source of freely-available full text reviews. It is available as a section of the Cochrane Library, but unlike the Cochrane, it is also able to be accessed through a free version at <http://www.york.ac.uk/inst/crd/crddatabases.htm>. It contains records of completed assessments and reviews in progress and information about how to obtain them.

The majority of records have a link to the full text; where this is not possible for any reason (for example those from for-profit organisations), the summary is provided, or contact details for the agency that produced the report. Full reports, brief publications, and new and emerging technology summaries are all included. Do not be put off by the word “technology” – the database covers outcomes for many kinds of health interventions, from new devices and diagnostic tests right through to population-based interventions such as, for example, diet, exercise, or screening

interventions. Note that this service does not evaluate the *quality* of the individual publications – that is up to the user. Its primary aim is to encourage communication and sharing of resources and reduce duplication of cost and effort by bringing together different types of evaluations in the one place so that users do not have to search far and wide for what has already been completed and is currently ongoing.

In addition to the HTA resources, two other useful databases are freely available through the CRD website. These are the Database of Abstracts of Reviews of Effects (DARE) and the NHS Economic Evaluation Database (NHS EED). DARE is a collection of appraisals (evidence-based commentary) of high quality original studies, with an emphasis, as the name suggests, on outcomes. NHS EED is a collection of economic evaluations and references to other economic studies. It is important to note that DARE and NHS EED give a commentary (appraisal) on individual pieces of research but do not give the full text of the original article or document that they appraise. The three CRD databases may be searched simultaneously or individually using an easy “fill in the boxes” search page.

The TRIP Database Plus at <http://www.tripdatabase.com> is a gateway service to a range of evaluated sources with a general practice focus. TRIP's most useful feature is that it searches a range of evidence-based sites simultaneously, as well as running a parallel PubMed search for original research. All results – evaluated and original information – are shown in a list, sorted into self-explanatory categories, with the number of results in each category given. The user can then scrutinise the results from each category individually, omitting those that are not relevant. PubMed search results are also sorted by diagnosis, therapy, prognosis and aetiology aspects. A recent modification to this service, *TRIPwire* provides the user with a means of refining their search by suggesting closely-related aspects to the original search word from which the user can select. For example if the searcher enters *asthma* in the search box, *TRIPwire* suggests words such as *inhaler devices*, *corticosteroids*, *childhood*, to choose from. This enables the user to find a smaller set of more relevant references very easily. TRIP was free until 2003 when it became a subscription service in order to maintain and develop it. However, at present, non-subscribers are permitted five free searches per week. The simultaneous searching of so many sources of information and the extra assistance given with the search process is a useful time-saver for busy clinicians. Included in the range of resources are patient information leaflets, sections from online

textbooks, and other resources particularly useful to general practitioners.

Guidelines are another rich source of evaluated evidence, particularly if the question is on treatment or diagnosis of a relatively common medical condition. There are now many groups developing guidelines, not only in national or state health systems but also in professional colleges and associations. Rather than searching all the different groups individually, it makes sense to go to one of the large services which have collections of guidelines from many sources such as the UK National Electronic Library for Health Guidelines Finder <http://rms.nelh.nhs.uk/guidelinesfinder>, the US National Guideline Clearing House at <http://www.guidelines.gov>, and the Guidelines International Network (GIN) at <http://www.g-i-n.net>. The majority of the guidelines on these websites are freely available in full. The collections are very easy to search and have a wealth of information. An increasing number of groups in the Asian region are producing secondary resources and making them freely available. Guidelines and health technology assessments from Singapore, Malaysia, and Hong Kong and information about where to obtain them is shown in Table I. Additional guidelines from Singapore, India, Thailand and the Philippines are listed on the GIN site referred to above.

Finally, in the round-up of evaluated resources, mention should be made of the BMJ Publishing Group's *Clinical Evidence*. This is a twice-yearly publication containing a series of evidence-based reviews on the current state of knowledge, and gaps in knowledge, on the treatment and prevention of nearly 200 medical conditions. There is a focus on conditions such as asthma, cardiovascular disease, otitis media, and other topics that general practitioners deal with daily. It is available in print, CD-ROM and online. Like the Cochrane Library, this is a subscription service, but is reasonably priced for the individual user, with substantial reductions for students and nurses. Buying the print or CD-ROM version also entitles the subscriber to access the online version. More information about *Clinical Evidence* can be found at <http://www.clinicalevidence.org/ceweb/conditions/index.jsp>

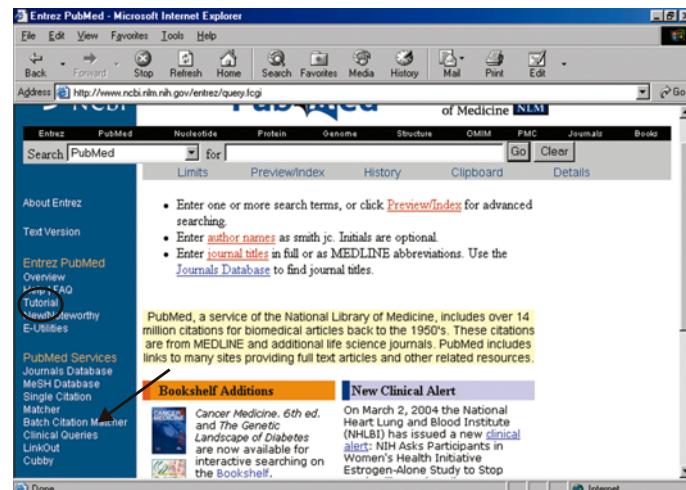
## **FINDING ORIGINAL RESEARCH: HOW TO FILTER FOR HIGH QUALITY STUDIES**

Even with the ever-increasing number of secondary resources available, there are many reasons why most practitioners will also need to search for original (*primary*) studies. Findings from available reviews may not be generalisable to specific regions or

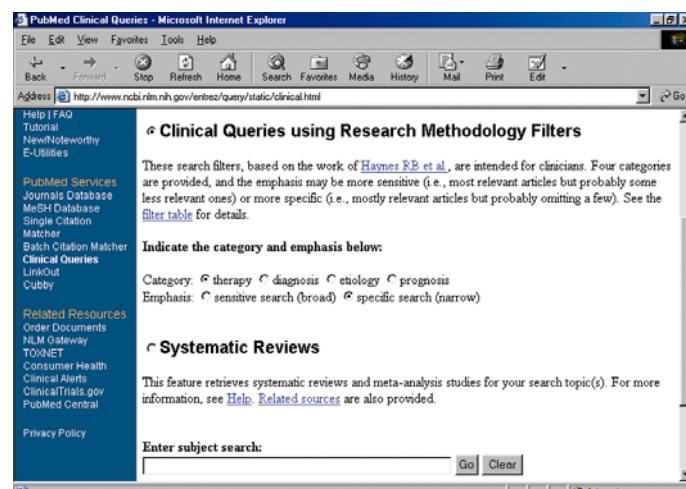
circumstances, the topic may need updating, the question may not yet have been covered, and so on. Whereas the evaluated resources are difficult to find but easy to search, exactly the opposite problem occurs with primary sources; they are easy enough to find, as there are only a few major databases. But once found, the major difficulty is how to search them so as to pick out high quality relevant studies from the millions of other references that make up databases such as MEDLINE. However, thanks to the international emphasis on evidence-based medicine, automated systems have been developed over the past few years to assist with what is often a frustrating barrier to those who would practice EBM. The best known database of original studies in the field of medicine and health is MEDLINE, now very often known by the name of its free format as PubMed (or publicly available MEDLINE). Since the US National Library of Medicine made this resource freely available in the mid-1990s at <http://www.ncbi.nlm.nih.gov/pubmed>, anyone, anywhere, with an Internet connection can log on and use it free of charge. What is more, the information experts at PubMed have developed many features to make searching easier and more rewarding for those who put in even minimal time and effort to learning how to make use of it efficiently and effectively.

Because searching large databases for primary studies is more difficult than searching the relatively small secondary resources, it is particularly important that the question is well defined. The previous article in this series<sup>(1)</sup> outlined the PICO model (the Patient, the Intervention, the Comparator, the Outcome). This is also an excellent approach to deciding how to search, as a clearly defined patient group and intervention are the major concepts in most subject searches. The other concepts, though necessary in the *question* itself, are not always stated in the search. For example, the comparator is often "usual care" or "no treatment" and does not need including in the search statements; the outcome information is often better located by limiting to a particular study design or using filters such as those provided by the *Clinical Queries* option, which will be discussed below.

PubMed has a number of powerful "smart search" or automated features which do away with the need to learn to use the sophisticated and complex hierarchy of subject headings (MeSH), automatically assigning the appropriate subject according to the words that have been entered by the user. Similarly, the automated search overcomes the need for the user to know how to use the operators AND/OR; an unseen "AND" is inserted automatically between each word that is keyed



**Fig. 1** Main search screen of PubMed showing the entry point to the *Clinical Queries* mode (arrowed) and the tutorial (circled) on the sidebar.



**Fig. 2** The *Clinical Queries* mode of PubMed showing the available options and instructions for searching for clinical research or systematic reviews.

into the search box. The system is not entirely foolproof but once mastered, enables good subject searching to be done with a minimum of experience. Though the results are often very large, the volume of the results can be reduced by language, study design, date and other useful restrictions using the *limits* function.

A special feature of PubMed, the *Clinical Queries* mode, has been developed to assist in locating original studies with high quality designs (such as randomised trials) suitable for EBM enquiries. The entry point for this mode can be found on the side-bar of the main page (Fig. 1). After entering this mode the user types a simple subject statement in the search box and selects what aspect of the question applies (diagnosis, therapy, prognosis, or aetiology). There is also space to specify whether the search should aim for *precision* (fewer, more specific results), or *sensitivity*, (a wider search with a

larger set of results). Clear instructions are given on the screen (Fig. 2). When the search is performed, an automatic expert strategy or *filter* for articles with the appropriate research design is combined with the subject statement to retrieve high quality articles. This is very useful in reducing the volume of references retrieved, which may often be overwhelmingly large because of the immense size of the database. The filters are reviewed and updated regularly. *Clinical Queries* searches work best with straightforward, simple subject searches. Elaborate, multi-line searches cannot be done this way. An alternative method, if the *Clinical Queries* option is unsuitable for any reason, is to conduct a simple subject search using the main search screen and apply one of the useful *publication type* limits such as *randomised controlled trial*, *practice guideline*, or *meta-analysis*. Other limits such as that for date of publication can also be useful, for example, to restrict to more recent research, or the human limit to remove experimental studies on animals.

It should be noted that the *Clinical Queries* mode can also be used to find secondary research that has been published in journal article form. Some of these will be a shorter form of longer evidence-base reports that have been produced by research agencies. Synthesising them and having them published as journal articles so that they are indexed by MEDLINE/PubMed means that the findings are disseminated to a wider audience. For an example of this see the article on screening for colorectal cancer by Towler et al<sup>(4)</sup> and the corresponding Cochrane review<sup>(5)</sup>. To use this function of the *Clinical Queries* mode the user should select the *Systematic Reviews* option, taking note of the instructions on the screen and paying particular attention to the cautions given. Remember that MEDLINE/ PubMed does not cover formats other than journal articles so that stand-alone reports, meeting abstracts and other non-journal documents are not covered. As mentioned above, the subject search entered by the user should be kept as simple as possible and the *Limits* function used to reduce the results if necessary.

Another service that provides assistance in searching PubMed for original research is SUMsearch (<http://sumsearch.uthscsa.edu/>), from the University of Texas Health Science Center. Automatic prompts on this service guide the searcher through the process step by step, selecting the best words for the subject search, then applying automatic filters. This service searches PubMed, the National Guidelines Clearing House, and the CRD databases simultaneously so that the results are a mixture of systematic reviews, guidelines, and original research. Results are grouped

into useful clusters according to the type of document. SUMsearch provides the same automated search options as the PubMed *Clinical Queries* mode with the addition of *adverse effects* and *screening/prevention* filters. As mentioned above, the TRIP database carries out a similar function using the *Clinical Queries* automated searches via PubMed but does not assist with the expression of the subject in the same way as SUMsearch does.

The features and services described above give valuable assistance in filtering the huge body of medical literature so that research with high quality study design is found more easily. However, unless the subject search is well stated in the first place, no amount of filtering will give a satisfactory result. A grasp of the basic principles of database searching is crucial. Anyone who searches PubMed can benefit from the excellent online tutorial accessed through the PubMed home page (Fig. 1) that has many animated demonstrations to assist the learner, as well as self-test review questions at the end of each section. Subject searching of large bibliographical databases is not something for which hard and fast rules can be made; it is an art rather than a science, and every search has its own difficulties. Familiarity with the features of a particular service and regular practice brings better results. It is worth remembering that PubMed has been designed to allow medical practitioners to find the answers to clinical questions using simple search statements with a minimum of knowledge about the way the database works.

For complex topics, training and practice are needed to search large databases; there comes a point when an expert should be consulted. If possible face-to-face instructional sessions with a medical librarian or health information specialist should be sought. Glanville et al<sup>(6)</sup> have drawn attention to the value that these highly trained professionals offer in helping to locate information and keeping practitioners up to date. Others have documented the contribution to patient care that is made when the skills of an information professional are added to the practitioner's own<sup>(7-9)</sup>. Those without access to a local or distance medical or academic library service, could seek help from an evidence-based group operating in their region, take advantage of workshops at conferences they might attend, or contact the customer service department at the National Library of Medicine at [custserv@nlm.nih.gov](mailto:custserv@nlm.nih.gov) for advice.

It should be noted that PubMed is not the only large database of health-related information. It has been emphasised here because of its universal accessibility and relevance for medical practitioners.

**Table I. Some of the evaluated resources from the Asian region.**

Country	Producer	URL
Hong Kong	Hong Kong Hospital Authority	<a href="http://www.ha.org.hk/hesd/nsapi">http://www.ha.org.hk/hesd/nsapi</a> (Professional Knowledge link)
Malaysia	Ministry of Health – clinical practice guidelines	<a href="http://www.moh.gov.my/Medical/HTA/Clinical%20Practice%20Guidelines.htm">http://www.moh.gov.my/Medical/HTA/Clinical%20Practice%20Guidelines.htm</a>
	Ministry of Health – health technology assessments	<a href="http://www.moh.gov.my/Medical/HTA/Project.htm">http://www.moh.gov.my/Medical/HTA/Project.htm</a>
Singapore	Ministry of Health – medical and nursing clinical practice guidelines	<a href="http://www.moh.gov.sg/corp/publications/index.do">http://www.moh.gov.sg/corp/publications/index.do</a>

**Table II. Further sources of information on resources and searching skills.**

Title	Producer	URL
Health Technology Assessment on the Net a guide to Internet sources of information.	Alberta Heritage Foundation for Medical Research	<a href="http://www.ahfmr.ab.ca/hta/hta-publications/infopapers/Internet_sources_of_information.pdf">http://www.ahfmr.ab.ca/hta/hta-publications/infopapers/Internet_sources_of_information.pdf</a>
Etext on Health Technology Assessment (HTA) information	National Information Center for Health Services Research, National Library of Medicine	<a href="http://www.nlm.nih.gov/nichsr/ehta/ehta.html">http://www.nlm.nih.gov/nichsr/ehta/ehta.html</a>
Review methods and resources	Centre for Evidence-based Medicine Oxford	<a href="http://www.cebm.net/searching.asp">http://www.cebm.net/searching.asp</a>
Web resources: literature searching	University of Sheffield School of Health & Related Research	<a href="http://www.shef.ac.uk/scharr/links.htm#evidence">http://www.shef.ac.uk/scharr/links.htm#evidence</a>
Review methods and resources. Finding studies for systematic reviews	Centre for Reviews and Dissemination, University of York	<a href="http://www.york.ac.uk/inst/crd/crdreview.htm">http://www.york.ac.uk/inst/crd/crdreview.htm</a>

Others that would be useful in addition are EMBASE (medical, with a more European focus), CINAHL (nursing literature), PsychINFO (psychology and psychiatry), and Current Contents (all subjects). However, these are all subscription databases unlikely to be available to anyone working outside well-resourced institutions, and none have the special features developed for PubMed to assist the person searching for evidence-based information.

## CONCLUSION

This overview has described some major secondary resources for evaluated information, and highlighted services that assist in locating high quality primary studies. All resources are reliable, well-established, and will give good value for time spent. As most information on the Internet dates rapidly, it makes sense to keep up with a few good sources, use them as gateways to the others, and let them do the work keeping up-to-date with changes in location information. The resources outlined, are not of course, a comprehensive list of everything available – there are a great many more. For those with the time and inclination to explore further, several more comprehensive guides to further sources of information and searching skills are given in Table II.

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