

Accessing the Literature: Using Bibliographic Databases to Find Journal Articles. Part 1

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Research in primary dental care, recertification, continuing professional development, lifelong learning, peer review and quality healthcare are all informed by the published literature. Dental practitioners can find out about reliable and up-to-date information available in the published literature by searching bibliographic databases.

Published in two parts, this article describes the databases relevant to clinical dental practice and explains the generic skills required to search them effectively, focusing on MEDLINE, the database most relevant for the majority of dental practitioners, which is freely available via the World Wide Web (WWW). The article differentiates be-

tween sensitivity (maximum recall) and specificity (relevance of recall), and suggests how to identify a manageable number of relevant citations, how to save the citations, and how to obtain the full text. In part 2, the article concludes by alerting readers to some of the limitations and pitfalls of database-searching.

KEY WORDS: EDUCATION, PROFESSIONAL; EDUCATION, DENTAL, CONTINUING; EDUCATION, DENTAL, GRADUATE; MEDLINE; DATABASES, BIBLIOGRAPHIC; INFORMATION STORAGE AND RETRIEVAL; ABSTRACTING AND INDEXING; EVIDENCE-BASED MEDICINE; DATABASE SEARCH TECHNIQUE; SENSITIVITY AND SPECIFICITY; COMPUTER USER TRAINING; KEYWORDS; SUBJECT HEADINGS; TRUNCATION; CITATION SEARCH © PRIMARY DENTAL CARE 2001;8(3):117-121

Introduction

Practitioners need to be able to evaluate the available evidence in order to achieve balanced conclusions when addressing clinical or research questions. To do this they need to know where to find relevant information that might help to answer the question.¹ Bibliographic databases that index the contents of journals within specialised subject areas help to identify relevant publications. Some databases contain the full text of some publications, but generally a database search will produce a list of citations (information *about* the articles, rather than the publications themselves) that identify relevant publications. The full text can be obtained from a library. The databases are available as compact discs (CD-ROM) or online, via networks.² The interface (what you see on the screen) and the search software can vary, but certain generic search skills apply to most databases. This article

will focus on MEDLINE which covers the international literature of medicine, dentistry and the allied sciences.

The effectiveness of databases as a source of information depends on the ability of the searcher to retrieve the most important relevant references.³ Techniques that increase the precision of the search and reduce the number of references can eliminate relevant citations. The challenge is to strike a balance between poor recall (too few) and poor precision (too many) to achieve a manageable number of relevant high-quality references, without missing important references.⁴ Search skills that focus the search to retrieve relevant information can also be used when searching the Internet.⁵⁻⁷

Before you Begin

Before commencing research it is wise to check that the research has not already been carried out and to seek out related but unpublished research findings that may complement one's own research. *Dissertation Abstracts*, a database

produced by University Microfilms Inc covering the period from 1861 onwards, provides comprehensive coverage of dissertations submitted at North American universities, with abstracts of their content. *Index to Theses*, produced by the Association for Information Managers in the UK, lists and abstracts theses accepted in UK universities from 1970 onwards. Both databases are provided by university libraries.

Choosing a Database

You may need to search more than one database to find all the relevant references in your subject. This section will describe the databases most relevant to clinical dental practice.

MEDLINE, compiled by the National Library of Medicine (NLM) in the United States, indexes approximately 4000 journals in the fields of clinical medicine, healthcare, dentistry, veterinary medicine, pharmacology, nursing, and the biosciences (such as genetics, immunology, microbiology and physiology) from 1966 onwards. Although international in scope, MEDLINE's indexing

policy (journals indexed and speed of indexing) favours mainstream medical and North American titles, hence indexing of British and European dental journals can be rather slow. Prior to 1997, MEDLINE could only be searched at a medical or dental library or by subscribing to a fee-based service. Several commercial services are still available, for instance OVID and Silverplatter, but a number of services provide access to versions of MEDLINE free of charge, via the WWW using Internet browsers such as Netscape Navigator or Internet Explorer.⁸ The best free versions of MEDLINE, eg *PubMed* (<http://www4.ncbi.nlm.nih.gov/PubMed/>), *Grateful Med* (<http://igm.nlm.nih.gov/>) and *Medlineplus* (<http://medlineplus.nlm.nih.gov/medlineplus/>) are provided by National Library of Medicine in the United States. The OMNI and Dr Felix MEDLINE pages provide access to the different versions (<http://omni.ac.uk/medline/> and <http://www.docnet.org.uk/dr Felix/>).

PubMed has some advantages over other versions of MEDLINE. For instance, 'Pre-Medline' material (recently published and not yet fully indexed) is added daily, the 'Related Articles' search function enables you to use one relevant reference to gather other similar references and the 'Clinical Queries' search identifies 'evidence-based' literature. One disadvantage is that PubMed is provided by a USA host and is slow to search after midday. An excellent introduction to PubMed, the 'Cheat Sheet For Moving Toward PubMed', prepared by staff at the William H Welch Medical Library, Johns Hopkins University, is available at (<http://www.welch.jhu.edu/help/guides/dbs/pubtable.html>).

Embase, compiled by the pharmaceutical Excerpta Medica Foundation in Amsterdam, indexes approximately 4000 mainstream biomedical and clinical journals in the period 1980 onwards. Although international in scope, Embase favours European titles, drugs and toxicology, and complements MEDLINE, with which there is approximately 50% overlap.

HealthSTAR, produced jointly by

the NLM's National Information Center on Health Services Research and Healthcare Technology (NICHSR) and the American Hospital Association (AHA), covers the published literature of health services technology, administration, and research, from 1975 onwards. MEDLINE citations account for 95% of the database, the remaining 5% being derived from journal articles on healthcare administration, technical and government reports, meeting papers and abstracts, books and book chapters on health services research, clinical practice guidelines, and healthcare technology. Articles unique to HealthSTAR have been added to the PubMed database, and PubMed is updated monthly with HealthSTAR citations.

Science Citation Index (SCI), compiled by the Institute for Scientific Information (ISI) in the United States, is international in scope and indexes approximately 4000 journals in all scientific disciplines (including medicine, dentistry and life sciences) from 1981 onwards. SCI is excellent for interdisciplinary research in the biosciences (inflammation, microbiology, pathology, bacteriology) that underpin dental practice.⁹ A unique feature of the citation indexes, the 'Cited Reference' search, searches for articles that cite earlier publications, thus searching forward from a known citation to identify related, more recently published literature.

Social sciences databases are useful for the behavioural, social or economic aspects of healthcare provision. For instance:

- *Applied Social Science Index and Abstracts* (ASSIA) published by The Library Association in the UK.
- *Social Sciences Citation Index* (SSCI), published by ISI.
- *International Bibliography of the Social Sciences* (IBSS), published by The British Library of Political and Economic Science.
- *Sociological Abstracts*, published by Sociological Abstracts Inc, USA.
- *Social Sciences Index*, published by Wilson Co, USA.
- *PsycLIT*, published by The Ameri-

can Psychological Association.

Faced with a plethora of journal articles on a particular topic, clinicians often rely on review articles. However, these can be open to bias and may not be based on a systematic review of the literature. Evidence-based reviews are less likely to be biased since they are based on the rigorous application of scientific principles to the search and review process, the 'evidence' being rigorously conducted meta-analyses, randomised controlled trials, systematic reviews or overviews and, where these do not exist, well conducted clinical studies employing random allocation, triple-, double- or single-blind trials.¹⁰ *The Cochrane Library*, (<http://www.update-software.com/cochrane/cochrane-frame.html>), produced by the Cochrane Foundation, includes:

- *The Cochrane Database of Systematic Reviews* (CDSR).
- *The Cochrane Controlled Trials Register* (CCTR).
- *The Database of Abstracts of Reviews of Effectiveness* (DARE).
- *The Cochrane Review Methodology Database*.

CDSR provides full text systematic reviews of the effects of healthcare, often involving meta-analysis of the findings of numerous studies, each too small to produce reliable results individually. Evidence is included or excluded on the basis of explicit quality criteria, to minimise bias. Cochrane reviews are regularly updated as new evidence emerges, and in response to comments and criticisms. Abstracts of Cochrane Reviews can be browsed or searched, without charge, via the Cochrane Library Website (<http://www.update-software.com/cochrane/cochrane-frame.html>).

CCTR, a bibliography of controlled trials identified by contributors to the Cochrane Collaboration, is part of the international effort to search the world's journals to create an unbiased source of data for systematic reviews. CCTR includes reports published in sources not currently indexed in MEDLINE or other bibliographic databases.

DARE contains abstracts of high

quality, systematic research reviews of the effectiveness of healthcare interventions, that have been critically appraised by reviewers at the NHS Centre for Reviews and Dissemination (CRD) at the University of York, England. DARE can be searched free of charge via the CRD Website (<http://www.york.ac.uk/inst/crd/welcome.htm>).

The Cochrane Review Methodology Database contains a bibliography of articles and books on the science of research synthesis, a handbook on critical appraisal and the science of reviewing research, a glossary of methodological terms, contact details for Collaborative Review Groups and other entities in the Cochrane Collaboration, and 'Netting the Evidence', a guide to where to find information on the Internet on using evidence in practice (<http://www.shef.ac.uk/~scharr/ir/netting>).

In the United Kingdom, The Centre for Evidence Based Dentistry is based at The Institute of Health Sciences, Oxford. More information on evidence-based dentistry can be found on their website (<http://www.ihs.ox.ac.uk/cebd/index.htm>).

Information on how to identify evidence-based literature when searching bibliographic databases such as MEDLINE is given in the section headed 'Techniques to focus the search'.

Accessing the Databases

Generally databases are licensed to libraries and similar institutions on subscription, rather than to individual users. Some commercial providers, for instance Dialog (<http://www.dialog.com/>), provide a commercial service to individuals paying by credit card. However, MEDLINE, COCHRANE and DARE are available free of charge via the Internet. You can search these databases, view and download the search results, including the complete citation and abstracts. To access these databases use the URLs given in the previous section.

Database Search Techniques

Different databases and different providers of the same database use different search software. The generic principles of database searching apply to all databases but the operation may vary from database to database and from format to format. Once you have selected an appropriate, accessible database it is worthwhile spending time at the outset in familiarising yourself with the search instructions or online 'Help' embedded in the database software. These will help you to perform an effective search. PubMed's online 'Help' is comprehensive and regularly updated.

Formulating the search strategy

A good search is based on a carefully formulated research or clinical question setting out clear inclusion and exclusion criteria.¹¹ When formulating the search strategy you need to package the search topic so that the database can match your search terms to relevant articles on that subject. If you search for 'consumer satisfaction in dental practice', the database search engine will only match your search to citations that mention that exact phrase. To translate the search topic into a database search strategy you need to dismantle the topic into its component themes, consider the terms used to describe each theme and link these using the appropriate Boolean operators.

Keywords

Keywords are the building blocks of a search strategy. Once you have considered the different aspects of the subject, consider how each aspect might be described in the literature. This will enable you to identify the relevant 'keywords', the words or phrases used in the literature to describe the subject. The 'keywords' should include related terms, synonyms, variant terminology and spellings (US or UK).

Truncation

Keywords may have variant endings—singular, plural, adjectives. A keyword search for one will only retrieve citations with that form of the word. To avoid missing relevant citations (and reduce the amount of typing) most databases use the technique of truncation whereby a symbol is used to retrieve variant forms derived from the same word stem. PubMed's truncation symbol is '*'. Here are some examples:

dent* **child*** **periodont***

would retrieve the following variants:

dentists	childhood	periodontal
dentistry	children	periodontitis
dental	child	periodontology
dentist		periodontally

Be careful to place the truncation symbol correctly, following the word stem or word root common to all variants, as show above. When using truncation consider the consequences: inappropriate use will retrieve irrelevant citations known as 'false hits', eg 'child\$' would also find childbirth and dent\$ would also find dentition, denture, dentures or denturists.

Boolean operators

To retrieve relevant information you need to be able to contextualise keywords. If keywords are the building blocks, Boolean operators are the cement that binds the search strategy. Boolean operators are used to link the keywords. There are three. In PubMed they must be typed in upper case.

Use Boolean **OR** to link synonyms, variant terminology, alternative terms or spellings. Use OR when either one term or another should occur, eg 'consumer satisfaction OR patient satisfaction'. OR is used to broaden the scope of the search, increase the number of references and the sensitivity of the search.

Use Boolean **AND** when the keywords must both or all be mentioned in the same article, eg 'consumer satisfaction AND dental practice'. AND narrows the focus of the search, reduces the number of references and increases the precision of the search. Misuse of this operator

is the most common cause of search failure. OR should be used to link synonymous terms: AND should only be used to link different concepts. It is easy to get this wrong. Do not use AND when you mean OR. For instance, if you typed 'dentist* AND dental practice*' the search would only find articles that mentioned both dentists and dental practices in the same article. To find references that mention either dentists or dental practices your search would be 'dentist* OR dental practice*'.

In PubMed a space between words defaults to Boolean AND. Phrases should be enclosed in quotation marks ' ' to ensure that the database search system reads the phrase as a phrase. Otherwise, the search system will look for citations mentioning each word, but not necessarily adjacent to each other.

Use Boolean **NOT** to exclude terms, eg 'periodontitis NOT juvenile periodontitis'. NOT reduces the number of citations, increases the specificity of the search and should be used with caution, as it may eliminate relevant citations. For instance, the example given above would eliminate citations mentioning adult periodontitis, if they also mention juvenile periodontitis.

Using parentheses (nesting)

When you need to use more than one Boolean operator you must 'nest' the terms linked by Boolean OR in parenthesis, for example 'dental practice AND (satisfaction OR quality)'. Otherwise the search would find citations that mention dental practice and satisfaction or citations that mention quality, in any context.

Techniques to Focus the Search

When a search yields too many citations, some more relevant than others, you need to narrow the focus of the search to eliminate unwanted citations. There are several ways of doing this.

Boolean operators

The Boolean operators AND or NOT can be used to narrow the focus of the search. Use AND to link keywords that must both, or all, occur in the same article. Use NOT to specifically exclude unwanted terms.

Searching by field

References in a database are indexed in sections called fields, eg 'Author', 'Title' or 'Abstract' fields. By searching for keywords in specific fields you increase the precision (specificity) of the search. For example, you can search for words appearing in the title or abstract fields. The way to express a field search varies. In PubMed several fields can be searched or specified, eg title '[ti]', abstract '[ab]', MeSH terms '[mh]' (MeSH terms will be described in more detail in part 2). When restricting a search to keywords appearing in the article's title, bear in mind that titles do not always reflect the content. To find PubMed citations with abstracts (as distinct from keywords in abstracts) express the search as, eg 'lasers AND hasabstract' [sic].

Adjacency or proximity

The adjacency or proximity operators 'SAME', or 'WITH' can be used instead of the Boolean operators 'OR', 'AND', 'NOT' to retrieve terms occurring together in the same sentence or paragraph, or within a specified number of words. Rather like field searching, adjacency or proximity assumes that terms occurring together in the same sentence or paragraph, or within a specified number of words, are likely to be used in the same context. Adjacency or proximity operators vary from database to database.

Snowballing

One relevant citation can be used to identify other similar citations. To 'snowball' from one key citation to gather similar, related citations: check the article's bibliography or check the thesaurus terms used to describe the article and construct a search using the most relevant thesaurus terms or, using a Citation

Index (SCI or SSCI), run a 'cited reference' search for more recently published articles that cite a key reference. In PubMed, once you have run a search and have identified a relevant reference, click 'Related Articles' to find similar references.

Limit search results

Some databases include software to 'Limit' (restrict the scope of) the search to specific languages, age groups, human or animal, gender or specific types of publication, eg practice guidelines, meta-analyses, randomised controlled clinical trials (RCTs), or reviews. This can help to focus the search and reduce the number of references. In PubMed the 'Limits' also enable you to limit the search to references added in recent months.

To identify evidence-based studies relating to diagnosis, treatment or risk factors, use the database's 'limit' function to identify specific types of publication such as cohort studies or RCTs or, use PubMed's 'Clinical Queries' search to identify articles that report research conducted using specific evidence-based methodologies.¹² Specific search strategies or 'search filters' to identify high quality studies are available on the WWW. Here are some examples:

- Searching for the Best Evidence in Clinical Journals (<http://cebml.jr2.ox.ac.uk/docs/searching.html>).
- ihs search filters (<http://www.ihs.ox.ac.uk/library/filters.html#LINKS>).
- World Wide Web-Based EBM Hedges (<http://www.mssm.edu/library/ebm/ebmhedges.htm>).

Journal subsets (MEDLINE)

To contextualise a search it can be useful to search only in dental journals for subjects that have other applications, eg lasers. To do this you can restrict your search to MEDLINE's dental subset. In PubMed type the search as, eg 'lasers AND jsubsetd'. However, you may miss some key references published in prestigious mainstream medical journals.

PubMed's Pre-Medline subset

includes recently added articles that are not yet fully indexed. To limit the search to the Pre-Medline subset, type the keyword followed by 'premedline [sb]'.

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Letter to the Editor

An Evaluation of Attitudes of Midlands Female Dentists to General Dental Practice: Will it Impact upon the Future Delivery of Primary Dental Care?

Sir,—I read the paper by David Thomas on the attitudes of Midlands female dentists with interest (*Primary Dent Care* 2001;**8**:71-5) and noticed within the author's short résumé some information on patient numbers in his previous practice that made me look again.

We read of a patient list of 42,000 served by a principal (the author) and 10 other dentists who included some VDPs. Assuming that a trainee dentist such as a VDP at the appropriate skill level would be pressed to service a list of 1000 patients to any quality, what then was the patient load of the other dentists?

With perhaps three VDPs (possibly more?) among the dentist numbers the other dentists would be undertaking to provide care for a list of 5700 patients or thereabouts.

This begs the following questions:

1. How many of these patients are active?
2. How many hours would be worked in the average week by the dentists on the team?
3. How many patients are seen each day?

These issues do not even address the time needed to be spent with junior colleagues in the stewardship of their early career development and first professional year.

I would welcome some enlightenment from Professor Thomas and an insight into the quality assurance systems in place, as this seems a phenomenal workload.

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The author replies:

Thank you for giving me the opportunity to respond to Dr Marshall's comments on my paper. I am disappointed that his comments should be based upon his inaccurate quotation from my résumé because this leads directly to his equally inaccurate projections. Nowhere does he read of a 'patient list of 42,000' and clarification of his error is called for because my résumé refers only to a patient database (collected from 1990 when the new contract was introduced) and that is very different.

Medicolegally requirements mean keeping records of all practice patients and therefore the database includes the following:

- Patients who only attend for emergency treatments.
- Patients who fail appointments.
- Patients who move away from the area.
- Patients, who for whatever reason, discontinue to attend the practice.
- Large numbers of elderly patients who attend for full dentures.
- Others minor treatments such as denture repairs.

The practice served a low socio-economic group with many patients on income support. Some local areas had patient to dentist ratios in excess of 6000:1 and a very mobile workforce. Perhaps Dr Marshall is committed to the private sector and does not understand the registration system of the NHS but of relevance to his assumptions is that both our practices had a combined list of registered patients of about 26,000. This means an average list of treated patients per dentist of about 2600 which is both undesirable and higher than average, but in dentally deprived areas it not out of the ordinary. Many of these patients were longstanding, motivated with good oral hygiene and as a consequence required minimal maintenance.

My paper was not related to any of the above issues but to answer further points that Dr Marshall is concerned about:

- The principal had only one VDP at any given time and that is what the VT Scheme allows. Dr Marshall's inference that there were perhaps three VDPs (possibly more) is a flawed assumption and this, combined with his inaccurate registered patient list, means his deduction of 5700 patients per dentist is slightly inaccurate.
- The dentists in the team would work an average four-and-a-half days or 36 hours per week. Clearly the numbers of patients treated per day depended greatly on the requirements of individual patients.

Dr Marshall makes no reference to my actual paper and I thank the editor for allowing me a few lines to explain where any confusion might have arisen. This statistic from our database was included in my paper because I felt it helped illustrate the acute dental manpower shortages that are developing in the West Midlands. This problem make it even more important that the needs of the working patterns of female dentists are better understood if we are to give our patients the best care in a time of inadequate resourcing.

I hope that my paper has contributed in some small way and that it serves to highlight an urgent need to understand some of our future problems.

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