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ONLINE SEARCH FOR MEDICAL LITERATURE

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ABSTRACT

Literature search is one of the important aspect of medical science, required for various aspects like designing a research question, publication in a journal, theses, dissertation and presentations. Background research is a important component of research process. By doing background research, we will be able to locate vital elements of scientific literature, get to know what has been done on the particular topic and what needs to be explored. With medical knowledge growing exponentially in the last decade, it is difficult to keep updated knowledge relying on printed material, moreover it can be costly and time-consuming. But due to internet revolution in the past decade, access to medical literature is at the click of a mouse. The two things which internet offers when compared to print material is, internet is economical most of the times and information can be found out rapidly if searched in a systematic way. This article describes the basics of efficient online medical literature search. One has to realize that internet has its strengths and limitations while searching for a particular type of data.

Key words: Medical literature, bibliographic database, search engine, PubMed

INTRODUCTION

Medical literature search has become more easy as well as complex, easy because availability of information on a click, complex because of the increased amount of published material from all over the world and the availability of multiple bibliographic databases. Literature is defined by Webster's Revised Unabridged Dictionary as “the whole body of literary

productions or writings upon a given subject, or in reference to a particular science or branch of knowledge". [1]

Literature review is a exhaustive, systematic survey of the literature including both published and unpublished material, on a specific topic or stated research problem. It includes selecting and searching in appropriate databases, using relevant medical subject heading keywords, filtering out non-relevant results related to stated research question, getting access to the full-text of the selected article and analyzing the literature critically to understand whether the results found are in context of the research question. If the way we perform a search is not proper, we could well be a victim of the most fundamental computer adage: garbage in, garbage out. [2]

The Internet provides access to a plethora of the medical literature, in full text and/or citation/abstract format, and it offers search capabilities good enough to fulfill most information needs. Journals, dictionaries, textbooks, indexes, e-journals-all can be found on the internet in growing numbers. [3]

Rapid growth of internet has altered continuing education for health professionals by allowing access to more varied, individualized, and systematic educational opportunities. [4] And regarding teaching of literature search, some studies have been conducted [5] which concluded that when students were taught the skills of accessing MEDLINE, they could formulate a question, critically review relevant articles, communicate effectively, and use these skills to contribute to patient care. This article describes the basics of online medical literature search.

TYPES OF LITERATURE

There are various types of literature and knowing the type of literature is essential to performing a efficient literature search. These include

Primary Source Literature

It refers to original source , primary first-hand accounts of events not previously published in any format.

Examples:

• Journal Articles

• Laboratory Notebooks

• Data Sets
• Dissertations and Theses (if original research)
• Information collected by interviews and questionnaires
• Manuscript Letters
• Autobiographies
• Patents
• Letters to journals or brief communications
• Statistics

Secondary Source Literature

Secondary source literature includes materials obtained from interpretations and evaluations of primary source materials.

Examples:

• Books/Monographs
• Citation Indexes/Databases
• Commentaries
• Histories, biographies, Encyclopedias
• Dissertations and Theses
• Popular Press
• Practice Guidelines

Tertiary Sources

Reference materials are used in conducting a review of primary and secondary literature. And often there is overlap between secondary and tertiary materials. These materials are helpful in identifying subject areas and persons affiliated with a particular topic.

Examples:

• Atlases
• Bibliographies
• Directories
• Encyclopedias
• Technical or government reports

Gray Literature

Gray literature refers to materials that are published using unconventional methods, not published in journals and not widely available. While formally published or not, it may serve as an important source of information, because it tends to be original and recent. [6]

Examples:

• Clinical Trial Registries
• Committee Reports
• Conference Abstracts
• Government Documents
• Patents
• Symposia
• Technical Reports
• Working Papers

Clinical Literature

These are used while searching for literature related to a clinical question. These include Randomized Controlled Trials, Non-randomized Controlled Trials, Practice Guidelines, Case Reports, Evidence Summaries etc. The ideal sources are systematic reviews or meta-analysis of randomized controlled trials.

GENERAL SEARCH ENGINES

Google search (www.google.com) and **Yahoo search** (www.yahoo.com)

Google is most popular search engine. Most often simple search is used, by entering a specific term or a small sentence in the search box, in the advanced search options one can specify one or more of the following:

1. The keyword appearing in the title or text of the website
2. Limits like language, country specific, date range
3. The URL should contain any of these words or exact word and so on

Google (www.google.com) and Yahoo search (www.search.yahoo.com) are world's two largest web-based search engines. [7] Google provides a web search engine-a tool that constantly indexes the expanding World Wide Web and allows you to search the index. [8] Learning these features is easy and can save a lot of time. You can also search images or news, also these have advanced features. Most commonly these search engines are used for presentations of seminars or journal clubs rather than for research purpose. The major

disadvantage is they retrieve information from non-peer-reviewed sources, and hence one needs to evaluate the resource carefully.

Bing (www.bing.com)

Developed in 2009 by Microsoft, it is the fastest growing search engine. One can search both Google and Bing, although the results are quite similar, but sometimes Bing offers some results which differ with Google.

Google Scholar (scholar.google.co.in)

Launched in beta version in 2004, it is a Google product, is a subset of the larger Google search index. Google Scholar provides a simple way to broadly search for scholarly literature. The search options vary across many disciplines and sources like articles, peer-reviewed papers, articles from academic publishers, dissertation, theses, books, abstracts and other web sites. Google Scholar helps you find relevant work across the world of scholarly research. Much of Google Scholar's index derives from a crawl of full-text journal content provided by both commercial and open source publishers. [9] Google Scholar is relatively simpler to use and yields more specific results than Google search. One can sort articles by types, time, and citations. Like Google, Google Scholar its limitations too. It does not includes majority of the material the indexed by commercial databases, doesn't provide a list of sources it is indexing. Probably it could be used for citation verification rather than searching.

MEDICAL SEARCH ENGINES

Medical World Search (www.mwsearch.com)

Medical World Search is a special search engine dedicated for searching only medical websites. It includes team of people who select sites based on specific criteria which is mentioned in detail on their website, and then these sites are indexed, but is Subscription based.

WebMD (www.webmd.com)

It was founded in 1996, has information about general healthcare, symptom checklist, drug information and blogs by physicians. It is the leading health portal in the United States.

Practiceupdate (www.practiceupdate.com)

Practiceupdate previously known as MedConnect, provides free MEDLINE as part of its goal

to be the online hub for physicians and other health care professionals. It goes beyond MEDLINE and has published its own medical information on the Web since 1994. Practiceupdate offers literature reviews, articles, journal clubs, board reviews, and teaching files.

MedicineNet (www.medicinenet.com)

MedicineNet offers easily understandable yet in-depth medical information. Produced by a network of U.S. board certified physicians, this site has hundreds of web articles on diseases, treatments, procedures, tests, and drugs. Articles can be accessed by searching alphabetically in pre-arranged categories. [10] The site includes medical images, quiz, symptom checker, drug information and many other services.

Medscape (www.medscape.com)

It was founded in 1995, provides peer reviewed journal articles, MEDLINE, drug information, continuing medical education, patient case files and many other resources. It provides free information, only registration is required.

Other medical search engines are Bing Health, Entrez (includes PubMed), eMedicinehealth, GoPubMed, Healthline, Rxlist, Nextbio, and Searchmedica.

These sites can be used for presentation of seminars, journal clubs and for general medical information but are not useful for a core clinical research question.

EVIDENCE BASED RESOURCES

Cochrane database of systematic reviews

(www.thecochranelibrary.com/view/0/AboutTheCochraneLibrary.html#CDSR)

The Cochrane Database of Systematic Reviews (CDSR) is one the leading resource for systematic reviews. The CDSR includes all Cochrane Reviews (and protocols) prepared by Cochrane Review Groups in The Cochrane Collaboration. Systematic reviews are prepared by experts in their respective fields. Reviews are prepared after a thorough literature review of several randomized controlled trials. The reviewers also do a hand-search (not computerized) of several journals not indexed in select databases. [11]

There are 53 Cochrane Review Groups which comprises of different systems and the entire process of reviewing the literature is a well-laid methodology. Authors can be contacted if there is any ambiguity or serious error. Thus Cochrane Reviews can be considered as very

dependable sources of evidence. These publications began in the year 1992, and several topics are still not covered; hence one has to go to resources like PubMed and Embase, when a systematic review is not available in Cochrane.

EBM Online (ebm.bmj.com)

Evidence-Based Medicine systematically searches a wide range of international medical journals applying strict criteria for the validity of research. EBM Online is a bimonthly publication by the BMJ group. Experts critically appraise the validity of the most clinically relevant articles and summarize them including commentary on their clinical applicability. EBM also publishes articles relevant to the study and practice of evidence-based medicine.. Again this publication started in the year 2000, and hence you may not retrieve clinical studies in all topics of interest. EBM Online is free to developing countries including India.

Up To Date (www.uptodate.com)

Topic reviews are written exclusively for Up-To-Date by physicians-nearly 5,000 physicians serve as authors. The reviews go through an extensive peer review process to ensure that the information and recommendations are accurate and reliable. Many studies have shown Up To Date may improve patient care and quality. [12, 13]

BIBLIOGRAPHIC DATABASES

National library of medicine (www.nlm.nih.gov)

National library of medicine (NLM) is a user-friendly web based system that will search not only MEDLINE, but also several other NLM databases at the same time. [14] NLM has developed an extensive controlled vocabulary called Medical Subject Headings (MeSH) that leads to greater accuracy and yields relevant results to locate precise medical terminology.

Medline

Medical Literature Analysis and Retrieval System Online (MEDLINE), one of the most important resources of medical research, is a literature database of life sciences and biomedical information. MEDLINE includes medicine, nursing, pharmacy, dentistry, veterinary medicine, and health care and covers much of the literature in biology and biochemistry, and fields such as molecular evolution. MEDLINE contains over 19 million references to journal articles in life sciences with a concentration on biomedicine.

MEDLINE, created and maintained by the NLM, is the world's premier bibliographic database of biomedical literature and is available via multiple interfaces including PubMed, which is also maintained by the NLM. [15]

PubMed (www.ncbi.nlm.nih.gov/pubmed/)

It is a free resource that is developed and maintained by NCBI (National Center for Biotechnology Information) at the NLM (National Library of Medicine), at US National Institute of Health (NIH). PubMed comprises over 22 million citations for biomedical literature from MEDLINE, life science journals, and online books. PubMed citations and abstracts include the fields of biomedicine and health, covering portions of the life sciences, behavioral sciences, chemical sciences, and bioengineering. [16]

Unique features of PubMed

PubMed has citations going back to the year 1865. In addition to MEDLINE, PubMed also offers access to OLDMEDLINE (for pre-1966 citations). It contains citations and abstracts for from thousands of journals. It includes links to full-text articles at many journal web sites as well as to most of the articles in PubMed Central. Abstracts are available for about 70% of articles, and even abstracts of foreign language articles are in English. PubMed Central (PMC) offers all free full text.

There are two ways of searching PubMed, one is by general search in the search box, and the second one is by using MeSH (Medical Subject Headings) terms. One can filter out the results by date, publication type, search fields, text availability and so on.

By searching using MeSH terms PubMed provides a consistent way to retrieve information, and the results are narrowed down to the specific search query. MeSH terms are arranged alphabetic and hierarchical order. The MeSH Website (www.nlm.nih.gov/mesh) can be used for obtaining information about MeSH terms.

Another unique feature is my NCBI, by registering with NCBI one can save records and searches, and customize results display with filters and other options. If beginners find difficult to use PubMed initially, there is a tutorial (PubMed tutorial) available at www.nlm.nih.gov/bsd/disted/pubmedtutorial/.

Disadvantages of pubmed

PubMed excludes a large body of both peer reviewed and also the so called “gray” literature (non peer reviewed). Peer Reviewed literature has its own limitations that gray literature is free from. [17] PubMed by itself does not offer the full text of the article, but only provides links to article which are owned by the respective journal’s publisher. Some full text articles are available on payment. Another disadvantage is PubMed doesn't have the feature of filtering the results country wise, like you cannot search diabetes related to India only.

Embase (www.elsevier.com/online-tools/embase)

It is a maintained by Elsevier. Embase’s comprehensive journal and conference coverage, together with in-depth drug indexing and daily updates, supports tracking and precise retrieval of drug and disease information. From preclinical study to the search for important toxicological information, Embase offers the confidence and tools you need to capture the most relevant and up-to-date biomedical study research. [18] Embase holds millions of indexed records from thousands of active, authoritative journals, including all of MEDLINE as well as 5 million+ records and 2,000 biomedical journals not currently covered by MEDLINE. But Embase is a subscription database only

Scopus (www.scopus.com)

Scopus is a new abstract and citation database, as well as a web-based research tool provided by Elsevier. It contains over 20,500 titles from 5,000 publishers worldwide, 49 million records, 78% with abstracts, includes over 5.3 million conference papers and it provides 100% Medline coverage. [19] Scopus tracks the same journals covered by MEDLINE and EMBASE, as well as many additional journals from a broad range of disciplines. It is available online by subscription.

A study from 2008 [20] compares PubMed, Scopus, Web of Science, and Google Scholar and concludes "PubMed and Google Scholar are accessed for free. Scopus offers about 20% more coverage than Web of Science, whereas Google Scholar offers results of inconsistent accuracy. PubMed remains an optimal tool in biomedical electronic research. Scopus covers a wider journal range but it is currently limited to recent articles (published after 1995) compared with Web of Science

OTHER SOURCES OF MEDLINE DATABASE

OVID www.ovid.com

Dialog	www.dialog.com
Scirus	www.scirus.com
Healthgate	www.healthgate.com
OCLC	www.oclc.org/home
STN	stnweb.cas.org
Physicians	www.po.com

OTHER SITES PROVIDING FREE FULL-TEXT ARTICLES

Medknow Publications (www.medknow.com)

Medknow Publications publish more than 250 journals. [21] They provide free full text mostly in the PDF format, some journals provide the full text in HTML format. One can open the site, fill the key word in the search option and search. Alternatively, you can search in the search option, available in most of their individual journals available through www. journalonweb.com. Go to a journal website, say Indian Journal of Pharmacology, go to search option, enter the key word, and search. Two search options are available, simple search and an advanced search where filters such as year, type of article, search across multiple journals are available. Most of the times, this search provides sufficient number of articles.

Directory of Open Access Journals (www.doaj.org)

The Directory of Open Access Journals (DOAJ) aims to be comprehensive and to cover all open access scientific and scholarly journals. It is maintained by Infrastructure Services for Open Access. [22] As of April 2013, the database contains 9054 journals from over 1,000 publishers. The aim of the DOAJ is to increase the visibility and ease of use of open access scientific and scholarly journals, thereby promoting their increased usage and impact. The DOAJ aims to be comprehensive and cover all open access scientific and scholarly journals that use a quality control system to guarantee the content. In short, the DOAJ aims to be one stop shop for users of open access journals. [23] The one major disadvantage of DOAJ is that some of these journals are in languages other than English.

BioMed Central (www.biomedcentral.com)

BioMed Central (BMC) is a United Kingdom-based, for-profit scientific, open access publisher.It includes fields of science, technology and medicine publishing of more than 240 journals. [24] One has to register to get full text articles, one can search by using filters such as date range, search fields, publication type and so on.

Free Medical Journals (www.freemedicaljournals.com)

It contains more than 3500 journals, some journals have a delay of one to six months after the release.

Bioline International (www.bioline.org.br)

It provides open access to journals published in developing countries.

Indmed (indmed.nic.in)

It is a Indian Council of Medical Research funded project, "National Databases of Indian Medical Journals". It contains about 100 journals from 1985. medIND is a resource produced under this project is a portal of full text articles (medind.nic.in) of select Indian medical journals indexed in IndMED or PubMed.

Europe PubMed Central (europepmc.org)

Previously known as UK PubMed Central (UKPMC), is based on the US National Institutes of Health PubMed and PubMed Central. It contains over 28 million abstracts, 2.6 million full text articles and has access to other records such as Agricola, Patents, and recent biomedical theses. It also differs from PubMed in that the full text and abstract information can be searched in an integrated manner from one input box. All of the articles in UKPMC are "Free Access," Not all content available in PMC is made available to Europe PubMed Central. [25] Some journals have a lag period of six months to one year to access full text articles

Medical Matrix (www.medmatrix.org)

Medical Matrix is a comprehensive guide to clinical medicine resources on the Internet. Medical Matrix links to more than ten MEDLINE sites, including Gateway and PubMed and fee and open access sites. [26]

CONCLUSION

There is abundant of medical information on the internet. Authors and researchers should spend some time on the internet to learn effective online literature search. Internet based search offers easy, rapid, open access to vast collections of the world's medical and scientific knowledge. One must search by knowing the strengths and limitations of a particular search engine/database. Free full text articles play a vital role in research particularly for the persons who cannot subscribe to subscription based databases. Researchers should understand the

scope of the research question and search accordingly in different databases to retrieve highly relevant information.

Conflict of interest: None

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