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ABSTRACT

The Internet provides a quick access to a plethora of the medical literature, in the form of journals, databases, dictionaries, textbooks, indexes, and e-journals, thereby allowing access to more varied, individualized, and systematic educational opportunities. Web search engine is a tool designed to search for information on the World Wide Web, which may be in the form of web pages, images, information, and other types of files. Search engines for internet-based search of medical literature include Google, Google scholar, Yahoo search engine, etc., and databases include MEDLINE, PubMed, MEDLARS, etc. Commercial web resources (Medscape, MedConnect, MedicineNet) add to the list of resource databases providing some of their content for open access. Several web-libraries (Medical matrix, Emory libraries) have been developed as meta-sites, providing useful links to health resources globally. Availability of specific dermatology-related websites (Dermls, DermNet, and Genamics Jornalseek) is useful addition to the ever growing list of web-based resources. A researcher must keep in mind the strengths and limitations of a particular search engine/database while searching for a particular type of data. Knowledge about types of literature and levels of detail available, user interface, ease of access, reputable content, and period of time covered allow their optimal use and maximal utility in the field of medicine.

Key words: Medical literature, search engine, database, internet

INTRODUCTION

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.^[1] The sources are varied, publishers, government agencies, professional organizations, and health libraries, to name a few. Rapid growth of internet has altered continuing education for health professionals by allowing access to more varied, individualized, and systematic educational opportunities.^[2]

Web search engine is a tool designed to search for information on the World Wide Web. Information may consist of web pages, images, information, and other types of files. Some search engines also mine data available in news books, databases, or open directories. Unlike web directories, which are maintained by human editors, search engines operate algorithmically or are a mixture of algorithmic and human input. Search engines for internet-based search of medical literature include Google, Google scholar, Yahoo search engine, etc.

Medical literature databases are an organized collection of medical data for one or multiple users. Databases for medical literature include MEDLINE, PubMed, MEDLARS, etc.

WEB SEARCH ENGINES

Google and Yahoo search engines

Google (www.google.com) and Yahoo search (www.search.yahoo.com) are world's most hit web pages and two largest web-based search engines.^[3]

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Although the search they offer is not limited for medical literature, still their ease of usability, advanced search options, and several other user-friendly features make them an automatic first choice of the most medical researchers.

Google provides a web search engine—a tool that constantly indexes the expanding World Wide Web and allows you to search the index.^[4] One can use Google Analytics to track clicks on links that lead away from his/ her site. Because links that lead away from site are not automatically tracked, one will need to manually tag all outbound links one want to track. To do this, one will have to add some JavaScript customizations to his/her page and to the links one want to track. Google offers options for phrase search, search within a specific website and terms to be excluded. Online reprint request (ORR) is the standard protocol to obtain the reprints (e-print/hard copy) using the internet (author's e-mail address) when the required literature is not available. The list of interesting articles is obtained from Google by journal home page (noting the table of contents) using Google search engine. To obtain an interesting article by ORR, the mail is composed using the subject and text that is copied from the stored template. CA's e-mail address, list of co-authors, page number, vol., and journal title are copied to appropriate places from the journal home page window. To save time, the above steps can be repeated with each ORR using the template stored in the system.

Similarly, Yahoo search offers useful features like shortcut keys and advanced search, latter enabling users to use controlled vocabulary. Pull-down menus, focusing the type of results (web/images/videos/local) make it a simple to use engine.

Google Scholar

Google Scholar (www.scholar.google.com) provides a simple way to broadly search for the relevant scholarly literature and research. Google Scholar is a subset of the larger Google search index, where one can search across many disciplines and sources, from one place—peer-reviewed papers, theses, books, abstracts and articles from academic publishers, professional societies, preprint repositories, universities, and other scholarly organizations. Much of Google Scholar's index derives from a crawl of full-text journal content provided by both commercial and open source publishers.^[5]

Key features of Google Scholar: Include help for searching diverse sources from one convenient place, finding papers, abstracts and citations, locating the complete paper through library or on the web and learning about key papers in any area of research. One can sort articles by types, time, and citations rendering it a simple engine to use.

Ranking of articles: Google Scholar aims to sort articles the way researchers do, weighing the full text of each article, the author, the publication in which the article appears, and how often the piece has been cited in other scholarly literature. The most relevant results will always appear on the first page. Google Scholar is organized according to a so-called federated search: its web crawlers search, process, and index information in the World Wide Web, incorporating it into a single repository, and it refers to this repository to process a search.^[6]

While using Google Scholar, one has to keep in mind its limitations too. It does not index the majority of the scholarly materials indexed by commercial database vendors. Moreover, it does not provide a list of the sources it is indexing. It has never shared with the public their search algorithm which is why many times one may not find key pieces of literature in the database. Perhaps it could be used for citation verification rather than for true searching purposes.

NATIONAL LIBRARY OF MEDICINE DATABASES

National library of medicine Gateway

National library of medicine (NLM) Gateway (<http://gateway.nlm.nih.gov/gw/Cmd/>) is a user-friendly web-based system,^[7] that will search not only MEDLINE, but also several other NLM databases at the same time. NLM has developed an extensive controlled vocabulary called Medical Subject Headings (MeSH) that leads to greater search accuracy and relevancy to locate precise medical terminology.

Medline

Medical Literature Analysis and Retrieval System Online (MEDLINE), one of the crown jewels of medical research, is a literature database of life sciences and biomedical information. MEDLINE (www.medline.com) 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. It is available free

on the World Wide Web (www). 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.^[8]

The database: The database contains more than 18 million records from approximately 5000 selected publications (2008). Originally, the database covered 1965 onwards, but this has now been enhanced, and records as far back as the 1950 printed indexes are now available within the main index. New citations are added Tuesday through Saturday. For citations, around half are for cited articles published in the U.S. and majority is published in English.

Indexing: MEDLINE uses Medical Subject Headings (MeSH) for information retrieval. Engines designed to search MEDLINE (such as Entrez) generally use a Boolean expression combining MeSH terms,^[9] words in abstract and title of the article, author names, date of publication, etc. Entrez allows also to find articles similar to a given one based on a mathematical scoring system that takes into account the similarity of word content of the abstracts and titles of two articles.

MeSH is the U.S. NLM's controlled vocabulary used for indexing articles for MEDLINE/ PubMed. MeSH terminology provides a consistent way to retrieve information that may use different terminology for the same concepts. MeSH descriptors are arranged in both an alphabetic and a hierarchical structure. At the most general levels of the hierarchical structure are very broad headings and more specific headings are found at more narrow levels of the eleven-level hierarchy. The MeSH Website (<http://www.nlm.nih.gov/mesh>) is the central access point for additional information about MeSH and for obtaining MeSH in electronic form.

Impact: MEDLINE functions as an important resource for biomedical researchers and journal clubs from all over the world. Along with the Cochrane Library and a number of other databases, MEDLINE facilitates evidence-based medicine. Most systematic review articles published nowadays build on extensive searches of MEDLINE to identify articles that might be useful in the review. Many articles mention the terms that have been used to search MEDLINE, so that the search is reproducible by other scientists.

Inclusion of journals: Selection is based on the

recommendations of a panel, the Literature Selection Technical Review Committee (LSTRC), based on scientific policy and scientific quality.

Usage: Searching MEDLINE effectively is a learned skill; untrained users are sometimes frustrated with the large numbers of articles returned by simple searches. Counter-intuitively, a search that returns thousands of articles is not guaranteed to be comprehensive.

“MedlinePlus” and “MedlinePlus Medical Encyclopedia”: Is a website network (www.medlineplus.org) containing health information from the world's largest medical library, US NLM, in cooperation with the National Institutes of Health (NIH), US. The website also containing an online medical dictionary, drug/herbal index, and a news service for medical news reports, is intended to be used by health care providers and patients, and designed to provide up-to-date, authoritative information.^[10] MedlinePlus is updated daily.

PubMed

PubMed (www.ncbi.nlm.nih.gov/pubmed/) is one of the open access database for accessing the MEDLINE database of citations and abstracts of biomedical research articles. Offered by US NLM at NIH, it is a part of the Entrez information retrieval system.^[11]

Benefits of PubMed: PubMed has over 16,880,000 citations going back to the year 1865. In addition to MEDLINE, PubMed also offers access to OLDMEDLINE (for pre-1966 citations, recently enhanced for records 1951 onwards), citations to all articles, from the most important general science and chemistry journals, from which the life sciences articles are indexed for MEDLINE, in-process citations which provide a record for an article before it is indexed with MeSH and added to MEDLINE and citations that precede the date that a journal was selected for MEDLINE indexing. There are tutorials for instruction on the PubMed interface to MEDLINE. Unlike Google searching of the Web, PubMed searching of MEDLINE requires a little investment of time. Using MeSH terms in conjunction with limits (such as publication date or publication type), qualifiers (such as adverse effects or prevention and control), and text-word searching is one of the most useful ways to improve the quality of a search.

Before one start to use PubMed, it is recommended to undertake the “PubMed Tutorial,” the Web-based

learning program that will show how to search and gather open access and non-open access articles. It will help users utilize it in a timely, precise and effective manner. PubMed Central (PMC) offers all articles free to the users.

“GoPubMed” and “MeshPubMed”: Are knowledge-based databases for biomedical texts. The Gene Ontology (GO)^[12] and Medical Subject Headings (MeSH) serve as “Table of contents” in order to structure the millions of articles of the MEDLINE data base. The databases allow Biologists (and Medical Doctors) to find relevant search results significantly faster. The technologies used in both (www.gopubmed.com) are generic and can in general be applied to any kind of texts and any kind of knowledge bases.

INDIAN DATABASES

IndMed

IndMed database (www.medind.nic.in) covering prominent peer reviewed Indian biomedical journals, has been designed to provide medical professionals/ researchers/ students and the medical library professional quick and easy access to Indian literature.^[13] The ICMR-NIC Centre for Biomedical Information (Indian MEDLARS Centre or IMC) has designed and developed this bibliographic database of peer reviewed Indian biomedical literature. This database covers prominent Indian journals. These have been selected from more than 200 journals. It is proposed to cover the journals from 1985 onwards in this database.

COMMERCIAL WEB RESOURCES

Medscape

Medscape (www.medscape.com) is a web resource for physicians and other health professionals. It features peer-reviewed original medical journal articles, CME (Continuing Medical Education), a customized version of MEDLINE database, daily medical news, major conference coverage, medical images, medical dictionary and drug information—including a drug database (Medscape Drug Reference, or MDR) and drug interaction checker. All content in Medscape is available free of charge for professionals and consumers alike, but registration is required.^[14] Medscape Drug Reference is quite comprehensive, but may have few errors of commission. It hosts a collection of 25,000 free, full-text, peer-reviewed clinical medicine articles that are searchable and collected from journals or

written for Medscape and also discussion group archives, treatment updates, conference summaries, textbooks and practice guidelines.

MedConnect

MedConnect (www.medconnect.com.au) is another commercial site that 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. MedConnect offers literature reviews, articles, journal clubs, board reviews, and teaching files.^[15] Articles written for MedConnect focus on emergency medicine, pediatrics, managed care, and primary care, although coverage of more topics is planned.

MedicineNet

MedicineNet is a good place to search for understandable yet in-depth medical information. Produced by a network of U.S. board certified physicians, this site (www.medicinenet.com) has hundreds of web articles on diseases, treatments, procedures, tests, and drugs. Articles can be accessed by searching alphabetically in pre-arranged categories.^[16]

LIBRARY AND NON-PROFIT ORGANIZATIONS

Medical Matrix

Medical Matrix (www.medmatrix.org) a comprehensive guide to clinical medicine resources on the Internet. It is a meta-site that annotates, evaluates and links to medical sites which are relevant to the clinical practice of medicine.^[17] Medical Matrix links to more than 10 MEDLINE sites, including Gateway and PubMed and fee and open access sites. It also briefly describes each site and links to a comparison chart.

Iowa Library

Hospitals, medical libraries and professional associations on the Web (www.arcade.uiowa.edu/hardin-www/hslibs.html) link to sites that reproduce or index medical literature. The on-line catalogues of medical libraries are a window to the world of medical publishing with links to academic, hospital and military medical libraries and other medical sites worldwide. The home page also links to a list of open access medical journals.^[18]

JOURNALS AND TEXTBOOKS

Free Medical Journals

For direct access to the current issues of several hundred

free, full-text medical journals, Free Medical Journals (www.FreeMedicalJournals.com) offers good source.^[19] With a goal to promote the open access of full text medical journals on the Web, it has the journals arranged alphabetically and by specialty.

Internet medical bookstore

Often researchers will need to consult medical texts; first, however, they must be identified and obtained. For information about medical textbooks, CD-ROMs, and software that are available for sale, several useful reservoirs are available (www.freebooks4doctors.com, <http://www.ncbi.nlm.nih.gov/sites/entrez?db=Books> and www.freemedicalbooks.org).

SPECIFIC DERMATOLOGY RELATED LITERATURE SEARCH

Dermis

Dermatology Information System (www.DermIS.net) is the largest dermatology information service available on the internet. It offers elaborate image atlases (DOIA and PeDOIA) complete with diagnoses and differential diagnoses, case reports and additional information on almost all skin diseases. Additionally it offers information on skin diseases, illustrated by photographic images, descriptions, therapeutic measures and skin care suggestions. It also has a large collection of links with web pages of hospitals, medical journals and several international dermatology networks, making it an entry point for dermatologists and consumers.^[20]

Genamics JournalSeek

Genamics JournalSeek (<http://journalseek.net/cgi-bin/journalseek/journalsearch.cgi?field=categoryandquery=med.dermatol>) is the largest completely categorized database of freely available journal information available on the internet. The database presently contains 164 journals on Dermatology. Journal information includes the description (aims and scope), journal abbreviation, journal homepage link, subject category and ISSN. Searching this information allows the rapid identification of potential journals to publish one's research in, as well as allow one to find new journals of interest in dermatology.

DermNet

Dermatology Network–Skin disease image atlas (<http://www.dermnet.com/>) contains over 23,000 images of skin diseases.^[21] The website provides a quick as well as alphabetical index of over 600 dermatological

disorders, and several videos for a comprehensive description.

To conclude, internet-based search affords easy and even open access to collections of the world's medical and scientific knowledge. One must keep in mind the strengths and limitations of a particular search engine/database while searching for a particular type of data (original article, review article, case report, etc.). For a similar query, the number of relevant citations may vary from engine to engine or database to database, due to the specific search software used and the frequency of updating the data at the site. User interface may have individual look and feel and may offer different levels of detail thus the overall ease of use of the search engine/database may also vary considerably.

With the growing realization of utility of linking repositories of quality clinical data to populations that most need to use them, additional databases are being made available on web regularly. A researcher needs to be proactive with use of medical search engines and databases for their optimal use and maximal utility to the field of medicine.

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Multiple Choice Questions

1. All of the following are medical literature databases EXCEPT
 - a. MEDLINE
 - b. PubMed
 - c. MEDLARS
 - d. Google
2. All are true about Google search engine EXCEPT
 - a. It constantly indexes the expanding World Wide Web and allows you to search the index
 - b. It offers options for phrase search, search within a specific website and terms to be excluded
 - c. One can use Google Analytics to track clicks on links that lead away from his/ her site
 - d. It has one of the world's least hit web pages
3. All are true about Google search engine EXCEPT
 - a. It helps sort articles by types, time and citations
 - b. The most relevant results will always appear on the first page
 - c. It also index the majority of the scholarly materials indexed by commercial database vendors
 - d. It is a subset of the larger Google search index
4. All are true about Medline EXCEPT
 - a. Is created and maintained by the NLM
 - b. A limitation is it does not use Medical Subject Headings (MeSH) for information retrieval
 - c. Is a literature database of life sciences and biomedical information
 - d. Database contains more than 18 million records from approximately 5000 selected publications
5. True about PubMed all EXCEPT
 - a. Is one of the open access database for accessing the MEDLINE database
 - b. It has over 16,880,000 citations going back to the year 1865
 - c. PubMed Central (PMC) offers all articles at a premium cost to the users
 - d. There are tutorials for instruction on the PubMed interface to MEDLINE
6. Which of the following is an Indian database?
 - a. IndMed
 - b. PubMed
 - c. Medline
 - d. All of the above
7. All are commercial web-resources EXCEPT
 - a. Medscape
 - b. MedConnect
 - c. Medicine Net
 - d. Google
8. Which of the following is used for Specific Dermatology Related Literature Search?
 - a. DermIs
 - b. Genamics JournalSeek
 - c. DermNet
 - d. All of the above
9. All are true about DermIS EXCEPT
 - a. Is the largest dermatology information service available on the internet.
 - b. It does not offer elaborate image atlases
 - c. It provides diagnoses and differential diagnoses, case reports and additional information on almost all skin diseases
 - d. It also has a large collection of links with web pages of hospitals, medical journals and several international dermatology networks, making it an entry point for dermatologists and consumers
10. Which of the following can be found on internet?
 - a. Journals
 - b. Dictionaries, textbooks
 - c. Indexes, e-journals
 - d. All of the above

1. d, 2. d, 3. c, 4. b, 5. c, 6. a, 7. d, 8. d, 9. b, 10. d
Answers