Searching the PubMed for Medical literature: Update for Ophthalmology

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Abstract

Efficient literature search is essential to the practice of Evidence-Based Medicine. PubMed provides free access to one of the largest searchable biomedical databases. Efficient literature search using PubMed requires a good understanding of the available search strategies and tools. In this article I will present a step-by-step approach for performing literature search using PubMed. Several PubMed tools including ‘Single Citation Matcher’, ‘Clinical Queries’, ‘Clipboard’ are highlighted using case based scenarios.

Key words: EBM; PubMed

Introduction

Evidence-based medicine (EBM) is ‘judicious application of the best research evidence integrated with individual physicians’ clinical expertise and patient values’ 1. Physician surveys suggest that most patient encounters generate one or more clinical questions that remain unanswered and need a quick and focused literature search 2-4. Thus, in an observational study at a university setting, an average of five unanswered questions were raised for every patient encounter 2. With biomedical information doubling every five years 5, the standard textbooks and reviews usually lag behind in their ability to provide the most current information on relevant clinical questions 6.

The practice of EBM can be summarized into four basic steps: 1) develop a focused clinical question; 2) search for the best evidence; 3) critically appraise the evidence; 4) apply the evidence and evaluate the outcome. In this review, I will present the techniques involved in formulating a well-built clinical question and searching the literature using the PubMed database. Interestingly, PubMed provides free access to one of the largest searchable biomedical databases.

Searching for Best Evidence: The electronic databases

Several electronic databases are available for searching citations. Most of these are subscription based and may not be freely available to the individual user. The source of biomedical information on the web can be divided into two major categories: 1) original published articles in the journals; and 2) synthesized information available as systematic reviews, synopses or decision support systems 7. However, a lack of experience with search techniques often leads to missing many relevant citations that may have an impact on patient care 8. MedLine is the U.S. National Library of Medicine’s premier bibliographic database. MedLine covers the fields of medicine, nursing, dentistry, veterinary medicine, health care system, pre-clinical sciences, and a few other areas of the life sciences. MedLine contains citations from over 4,600 journals, published in
70 countries. Over 14 million records are indexed in MedLine with most of the records from English language sources or having English abstracts.

The MedLine database can be searched with several search engines. The two most popular are Entrez and Ovid. Entrez is the life sciences search engine that is part of the National Center for Biotechnology Information's retrieval system. Entrez searches several databases including PubMed. PubMed includes MedLine, Old MedLine (1951 to 1965), articles from some non-MedLine journals and issues of journals published prior to their selection for MedLine indexing, and out-of-scope articles from 'selectively indexed' MedLine journals. Thus PubMed database is more comprehensive than MedLine. Furthermore, PubMed is more current and allows access to citations even prior to their indexing with MedLine.

Formulating the search question

The initial essential requirement for performing an effective search using PubMed is the ability to generate a well-built clinical question. The individual key components of this question can then be used as search terms in PubMed. Three basic steps are recommended for formulating the search question: 1) define the components of the search question; 2) identify the study design that will answer the search question; 3) identify the study type that will answer the search question.

Defining the components of the search question – Each search question has four components remembered best by the mnemonic-PICO.

1) Patient (P) – What is the patient group of interest e.g. diabetes mellitus.
2) Intervention (I) – What is the intervention of interest e.g. Tight blood pressure control.
3) Comparison (C) – What is the comparison intervention of interest e.g. Routine blood pressure control.
4) Outcome (O) – What is the primary outcome e.g. progression of diabetic retinopathy.

A search is usually started with two of the four components, usually patient and intervention. Depending on the question and retrieval, the search can be further focused by adding rest of the components of the question.

- Identify the study design that will answer the search question – The study design for most therapeutic interventions is likely to be a randomized double blind clinical trial (RCT). For clinical questions where several RCTs are reported in the literature, a systematic review or meta-analysis might be the most appropriate article to review. The optimal study design to assess prognosis and harm is likely to be a prospective cohort study.

- Identify the study type that will answer the search question – Most clinical questions can be answered by one of the four recognized study types i.e. diagnosis, prognosis, therapy and harm. Several databases including PubMed provide appropriate search filters to retrieve citations with the particular study design.

The rest of this article will cover the important features of PubMed. Clinical scenarios will be used to elaborate the search options. Readers are encouraged to conduct the searches as they go along in the article. All the actions that readers have to take are italicized, with the terms that they have to type placed in double quotes. Individual PubMed options are placed in single quotes.

Introduction to PubMed Homepage

Log on to www.pubmed.gov

The PubMed homepage has three key areas that are frequently used (Figure 1):

1. ‘Query box’ – The ‘Query box’ is used to enter the search terms as a free text entry area.
3. ‘Side bar’ – The blue ‘Side bar’ has some of the advanced PubMed features including the ‘MeSH Database’, ‘Single Citation Matcher’, ‘Clinical Queries’.

In addition PubMed homepage also has a black ‘Menu bar’ at the top that allows the user to link to other Entrez databases.

MeSH Database

It is important to have a basic understanding of the MeSH database prior to exploring actual search
strategies further. Medical subject headings (MeSH) database is the hierarchical library that is used to index citations. MeSH terms are arranged in a tree like structure with the more general terms representing the stem and narrower and more focused terms representing the distal branches. Each citation that is indexed with MedLine is assigned up to 15 MeSH terms based on the content of the article. An important feature of PubMed that increases search yield is ‘automatic term explosion’. This means that when a search term is entered in PubMed that matches with a MeSH term, PubMed automatically includes all the specific narrower terms that are associated with the search term.

Select MeSH Database from ‘Side bar’.

Type “macular degeneration” in the ‘Query box’ and select ‘Go’.

Look at the ‘Subheadings’, ‘Entry Terms’ and then scroll down to look at the MeSH tree associated with macular degeneration.

- Degeneration, Macular
- Degenerations, Macular
- Macular Degenerations
- Age-Related Maculopathy
- Age Related Maculopathy
- Maculopathy, Age-Related
- Maculopathy, Age Related
- Age-Related Maculopathies
- Age Related Maculopathies
- Maculopathies, Age-Related
- Maculopathies, Age Related

Typing any of these ‘Entry Terms’ in the ‘Query box’ leads PubMed to match that term to lung cancer. Selecting ‘Subheadings’ allows you to restrict search to the particular subheadings within the MeSH term.

Basic PubMed search features - ‘Boolean logic’, ‘Limits’, ‘Display options’

**Boolean logic** represents relationships between search terms. The three Boolean operators are ‘AND’, ‘OR’ and ‘NOT’. The operator ‘AND’ is used to retrieve citations that contain all the search terms, while the operator ‘OR’ is used to retrieve citations that contain at least one of the search terms. The operator ‘NOT’ is used to restrict citations containing a particular search.
The use of ‘NOT’ is however confusing and should be avoided. While joining two search terms using Boolean logic, the Boolean terms should be typed in capitals (e.g. “AND” instead of “and”).

The ‘Limits’ option allows the user to narrow the search thereby retrieving fewer citations. The most commonly used ‘Limits’ are Publication Types, Ages, Publication Dates and Subsets.

Case # 1: A 56-year old male with new onset Type II diabetes mellitus consults you for discussion regarding decreasing his chances for retinopathy. He has been told by his physician that strict control of blood sugar and blood pressure can decrease his chances of developing retinopathy. Your question is: Do patients with diabetes and rigorous blood pressure have better ophthalmologic outcomes compared to regular management of blood pressure? Log on to www.pubmed.gov

*Type in the search term, “diabetes AND antihypertensive AND retinopathy”. Look at the search results. You retrieve over three hundred citations.*
Select ‘Limits’ and make the following selections within ‘Limits’:

Language- English

Publication types - Randomized controlled trials

Ages – All Adult: 19+ years

Published in last – Ten years

Subsets – Core clinical journals (Core Clinical Journals is a list of 120 clinical journals that are likely to be available at most medical school libraries)

Click the box: Link to free full text (connects to free articles available in entirety)

The final screen appearance is shown in Figure 2.

Click Go and look at the output. You have much fewer articles that are more relevant.

The article by the UK Prospective Diabetes Study Group published in British Medical Journal in 1998 addresses the specific question that you are searching 10.

Now look at the way the citations are displayed. PubMed defaults to show citations in the summary format, in a set of 20, with the citations arranged in a chronologic order with the most recent citation shown first. The way citations are displayed, number of citations and how they are sorted can all be changed.

In the option ‘Display’ scroll down and select ‘Brief’.

In the option ‘Sort’ scroll down and select ‘Author’.

Click on ‘Display’.

Citations are now displayed in the ‘Brief’ format and arranged in an alphabetical order based on the author’s name.

Now select the ‘Back’ button to reach the previous screen.

Select the UKPDS article in BMJ by checking the box to the left of the citation.

Scroll down in ‘Display’ and select ‘Abstract’.

Click on ‘Display’.

The ‘Abstract’ format is now seen. You can also perform the same function by simply clicking on the authors’ names that is hyper-linked to the ‘Abstract’ format.

Looking for a specific article and expanding your search – The ‘Single Citation Matcher’ and ‘Related Articles’

‘Single Citation Matcher’ can be accessed from the ‘Sidebar’ and allows you to retrieve a single citation of interest. A simple fill-in-the-blank form allows you to enter the relevant information about the article of interest.

Case # 2: A 60-year old chronic smoker seeks your help for management of his moderate dry age-related macular degeneration. You counsel him about stopping smoking and plan on starting Zinc at a dose of 80 mg a day, along with other anti-oxidants. Patient wants to know the reported success of Zinc based on results from previous studies. You recall that the original randomized clinical trial was published in the Archives of Ophthalmology in the early 2000s and would like to pull up the citation.

Select ‘Single Citation Matcher’ from the ‘Sidebar’.

Enter the following information in search fields:

Journal – “Archives of ophthalmology”

Date – “2000:2003”

Title – “Zinc”

(Note that a range of date is entered by putting a colon between the two years)

The final screen appearance is shown in Figure 3.

Select ‘Search’

The second article is the one we are interested in 11. ‘Single Citation Matcher’ is typically used to look for a specific citation but can also be used to search for multiple citations.

Now look to the right of the citation to find ‘Related Articles’. The ‘Related Articles’ tool helps you quickly identify articles related to the citation of interest. Several of the relevant articles are pre-selected and stored by PubMed. A pre-specified word-weighted algorithm that incorporates the assigned Medical Subject Headings (MeSH) and words from the title and abstract is used to choose the related articles. These articles are arranged from the most to the least relevant.

Select ‘Related Articles’.

Look at the citations that are retrieved. Assess their relevance to your search question.

Tools for systematic review – ‘Clinical Queries’ and ‘Clipboard’

‘Clinical Queries’ is accessed from the ‘Sidebar’. This tool gives the user an option to search using the ‘Clinical Queries Using Research Methodology Filter’ or the ‘Systematic Reviews’. ‘Clinical Queries Using
Research Methodology Filter’ incorporates validated search filters that are added to the search term. Search filters are available for four different study types i.e. therapy; diagnosis; etiology; and prognosis. Additionally, search can be specified as sensitive or specific depending on the question that is being asked. The ‘Systematic Reviews’ filter retrieves meta-analysis and systematic reviews for the search question.

Case #3: A 42-year old male with Type 1 diabetes mellitus presents to you with a history of progressive visual loss in the right eye. Examination reveals presence of proliferative and non-proliferative retinopathy in both eyes with advanced retinopathy in the right eye. He is seeking symptomatic relief and asks you if laser photocoagulation would improve symptoms. You would like to look up a systematic review on this topic.

Select ‘Clinical Queries’ from the ‘Sidebar’. Check the line ‘Systematic Reviews’.

In the search box enter the term, “diabetic retinopathy AND photocoagulation” Look at the number of citations and see if your search retrieves relevant articles.

Now select the ‘Back’ button to reach the previous screen.

Check the box to the left of ‘Clinical Queries using Research Methodology Filter’.

In the ‘Category’, select ‘Therapy’ and in ‘Emphasis’, select ‘Specific search (narrow)’.

Your search term “diabetic retinopathy AND photocoagulation” should already be present in the ‘Query box’.

Select ‘Go’.

Look at the number of citations and see if your search retrieves relevant articles. Most of the articles retrieved would be clinical trials.

Now select the ‘Back’ button again to reach the previous screen.

Change the Emphasis to ‘Sensitive search (broad)’. Select ‘Go’.

Look at the number of citations and see if your search retrieves relevant articles. You will retrieve a greater number of articles compared to the specific search and some of the articles will likely have lesser relevance.
‘Clipboard’ helps you temporarily store citations for up to 8 hours. This option is particularly helpful when you are doing several different searches and would like to select and save citations and work with them together. With the citations stored in the ‘Clipboard’, all the functions can be performed that are otherwise possible with a standard PubMed search.

Go back to the previous search just completed.

Select the first four citations by checking the box to their left.

Go to the ‘Send to’ button. Scroll down to ‘Clipboard’ and select ‘Clipboard’.

Select ‘Send to’ button.

The message will appear on the left side of the window stating, ‘4 items were added to the Clipboard’ (Figure 4).

Select ‘Clipboard’ again from the ‘Features bar’. Look at the 3 citations.

You can change ‘Display’ or ‘Sort’ these items like any PubMed search output. Note that if you want to send all the citations obtained from a search to the ‘Clipboard’, do not select any of the citations and select the option ‘Send to’ ‘Clipboard’. All the citations up to a total of 500 will be sent to the clipboard.

While in the ‘Clipboard’, scroll down in the ‘Send to’ button and select ‘Clip Remove’.

Select ‘Send to’.

Select ‘Clipboard’ again.

‘Clipboard’ should now be empty.

Work with other options in the ‘Send to’ button including Text, File, E-mail and Order.

Conclusions

Physicians practicing Evidence Based Medicine will find it helpful to develop a well thought out literature search strategy. PubMed is one of the most comprehensive biomedical database, is available for free and offers several tools for performing a focused literature search. Familiarity with these search tools will help users perform efficient citation retrieval. PubMed provides an online tutorial that might be helpful for both new and experienced users.

References


Fig. 4. Storing searches using ‘Clipboard’


