

RMJ RESEARCH SERIES: LITERATURE SEARCHING

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MY EXPERIENCE

Christian is a year 5 medical student in Rwanda embarking on his first research project

I had never undertaken a formal literature search until my 5th year of medical studies, I was therefore very much challenged by how rigorous it was. For the first time, I had to use websites like PubMed, Cochrane to find the information I needed. This replaced my usual sources of information which had been Wikipedia and Google. I then had to learn how to use a reference manager, Mendeley, to store and cite the papers I found. I was using it and so many terms I hadn't heard of before. It was all unfamiliar to me.

I found it really difficult to find relevant papers in PubMed and because of the scarcity of papers and poor internet connection I found it really discouraging.

Organizing articles and summarizing them was the hardest of all. Multiple pages of conference reports, articles and surveys all were to be transformed into relevant systematically coordinated summary.

As a solution to these problems I used the Mendeley literature search which contains an abundance of articles. I then hand-searched the bibliographies of the articles I had found. To overcome problems of internet connection I would work in places with strong Wi-Fi and spend the whole day nonstop searching and downloading everything ready for offline reading and reviewing.

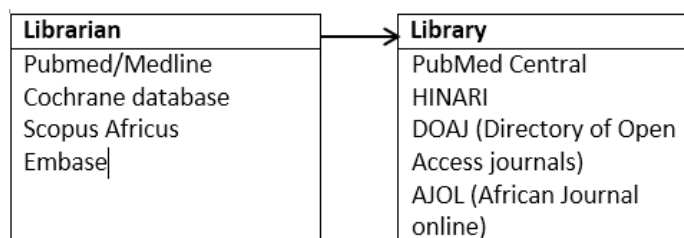
So, as a result, my research project got quicker, more organized, more comprehensible and I found this really satisfying.

You are new to research or looking to improve your research skills. In this article, we will be looking at how you undertake a literature search. Maybe you have a topic that you would like to research. You therefore need to gain a deeper understanding of the topic as a whole. Here we will show you how to find the information you need from the literature.

Literature searching takes two steps; step 1 involves finding the titles of journal articles and then step 2 involves accessing the actual full-text of the articles you need. A good way to think of this is to imagine you are visiting a public library. You want to find a book which will help you answer a specific question. There are usually tens or hundreds of thousands of books and you can't start reading from the beginning and hope you will stumble upon the answer.

First you need a "librarian" to tell you which journal articles may help answer your questions. Examples of librarians are search engines such as Pubmed or Scopus Africus. Once you know which journal articles you need then you go to the "library" and actually find the article in physical form (e.g. a PDF of the full text). An example of the "library" is HINARI.

Figure 1: Examples of librarians and libraries used for accessing literature



WHY PERFORM A SYSTEMATIC LITERATURE SEARCH?

Before starting any research project, it is essential that you perform a literature search. In fact, this should be done even before the study design or other methodological details are considered.

1. There may be existing data available: Why begin with a literature search? Regardless of your subject, there is almost always data available. When we publish a new study, we add to the larger body of knowledge on that subject, and we want to be sure that our results are placed in the proper context. Especially if your results challenge the existing point of view, it is essential you be fully informed about that point of view. Not only is it good for you to have a good knowledge of what has already been done but it will also give you the opportunity to study the types of research methodology other researchers have used in this field of research. Previous research will also have given suggestions about future useful research. This

is usually found in the discussion section of their articles, often toward the end. This could give you new ideas on how to make your concept even better.

2. It may affect your project design or force you to abandon the topic: Very often the results of a literature search will force you to change the project. It may be just a tiny adjustment, or in the most drastic case the topic may have to be abandoned entirely. Sometimes we think we have a novel idea, only to discover that the study we were planning has already been done. In other cases, the question becomes irrelevant in the face of new information that we learn.

None of this means that your idea was bad: on the contrary, if you are thinking in the same way published academics do, you are on the right track. But it may mean that the project has to be slightly altered, to take into account what has already been done and found. For example you may need to spread the research to a wider population. You may even decide to look for the impacts of previous research findings which have not yet been researched before.

3. To find experts in the field: A final reason to do a literature search is to identify important authors on the topic. Authors who have published papers on a topic are often experts in the field, and their opinions are valuable. Most journal articles will give you the contact details (email) of the authors. You can seek out their advice by contacting them directly. Don't be scared to do this. The authors contact details are there for a reason, so that you can contact them. This can help inform a new researcher whether their proposal will be a useful contribution to the field.

HOW TO START A LITERATURE SEARCH

1. Start with a Question

The first step in a successful literature search is having a clear, specific research question. The more detail that is included in this question, the more effective the results of the search will be. Let's say, for example, that a student has seen a patient with severe aortic regurgitation (AR). This gives her an idea to do a research project about AR management.

- A bad research question: "What is the best way to manage aortic regurgitation?"
- A slightly better research question: "Does a young person with aortic regurgitation benefit from a calcium channel blocker?"
- Best research question: "Among young women with aortic regurgitation and no other co-morbidities, do calcium channel blockers (e.g. nifedipine) extend survival compared with non-calcium channel blocking vasodilators alone?"

PICO questions:

If you are not sure if your research question is detailed

and specific enough, a popular method for framing a clinical question is the PICO method:

P – Patient, Pathology, Problem or Population: What are the key features that describe the patient, population or pathology? Be as specific as you can.

I – Intervention or Interest: Be as specific as you can about the intervention, test or risk factor you are considering.

C – Control or Comparison: Are there any appropriate alternatives? This may be placebo or currently used treatments.

O – Outcomes: Consider patient-oriented short-term and long-term outcomes; remember negative effects too. Avoid "surrogate markers" (e.g. improved CRP).

A good research question should have all four of these elements in it. As you can see in the paragraph above, the "bad" research question has none of the PICO components and is very vague. The "best" research question has all four PICO components: "Among young women with aortic regurgitation and no other co-morbidities [**patient**], do calcium channel blockers (e.g. nifedipine) [**intervention**] extend survival [**outcome**] compared with non-calcium channel blocking vasodilators alone [**control**]."

If you are having trouble with your literature search, it is often a good idea to return to your research topic and be sure you are not missing any of the PICO elements. If you are considering an "observational" study (which we will discuss in a later article) then you most likely will be looking at a PICO question which includes a "comparison" rather than a formal "control" group.

2. Searching for literature: Start Broad and Narrow Down

Starting broad: If you are not already well acquainted with the topic, the first step is to educate yourself generally. You don't want to start by wasting time reading very specific articles until you understand the overall subject better. It is a good idea to find one or two well-written review articles, and read them closely. Many research projects change significantly at this stage. For example, if you have an idea to research the effectiveness of ketoconazole in treating Cushing disease, it would be useful to know that a large cohort study looking at this question was recently published. You might need to change your question to make your research project more relevant to the current medical knowledge.

Often the best way to find review articles is first to type your query into the search box (e.g. "cryptococcal meningitis") which will return thousands of articles. Then filter those results to show only review articles (see section on filters below).

Narrow down: The most commonly and frequently used database of journal articles is PubMed (<http://www.ncbi.nlm.nih.gov/pubmed/>). This is free to search but takes skill and practice to master. There is a huge amount of

guidance on how to search PubMed on the PubMed website.

Tip: don't forget to search other databases, e.g. Scopus Medicus

There are other databases that you should also search. For example if you are working in Rwanda then you must search Scopus Medicus as this is the database that contains the Rwanda Medical Journal (RMJ). It would be disastrous for you as a Rwandan researcher if you were to design a project and find that the same project had only recently been published in the RMJ but you weren't aware because you didn't search Scopus Medicus. Scopus Medicus is available free through the HINARI programme (see below).

The remainder of this section will focus on how to search PubMed well.

SEARCHING PUBMED

The National Institutes of Health (NIH) is a US organisation found at the National Center for Biotechnology Information (NCBI). If you look at the web address (<http://www.ncbi.nlm.nih.gov>) it contains both these abbreviations: NIH and NCBI. This website contains many databases but the two most important are "MeSH" and "PubMed". These are two separate databases with the first finding "official terminology" for searching and the second finding journal articles.

Tip: Searching Pubmed is a skill. Soccer players like Lionel Messi and Pelé (Edson Arantes Do Nascimento) are skilled because they practiced. You will only get skilled at searching for literature by practicing.

1. Keyword Search

This is the search technique that is most commonly used by researchers who use PubMed. You simply type a few words into the search box, and the search tool brings back all articles that contain any of the words you typed. The search function organizes articles in reverse chronological order, meaning the most recently published article will be at the top of the list, regardless of the type of manuscript or which journal it is published in.

TIP: you may want to consider changing your Pubmed search results to be ordered "by relevance". This way you will get the most relevant journal articles rather than the most recent articles

Although keyword searches are simple and easy-to-use, there are several problems with using them as a research technique. First, keyword searches often bring back many articles that are irrelevant or barely relevant to your research question. Second, keep in mind that the most relevant articles for your search are almost never the most recently published. Third, even though keyword searches bring back thousands of hits (Creutzfeldt Jacob disease has more than 6000) you still may miss relevant

articles if they do not contain the exact word you typed into your search box.

Luckily, there are solutions to these problems. Let's take a look at some.

2. MeSH

Tip: Always use the official MeSH term when searching for articles

The challenge of a large database, like PubMed, is separating the articles you don't want from the articles you do. In medicine, there are many ways of saying the same thing. For example, "chronic renal insufficiency" is the same as "chronic kidney disease." So, which phrase do you use to type into the keyword search box? Either way you will exclude a number of articles that may be relevant to your literature search. In order to do this, you need an "official terminology". This is found by searching MeSH (<https://www.ncbi.nlm.nih.gov/mesh>).

Tip: Searching MeSH will not give your journal articles. It will only give you the official terminology with which to search PubMed

Medical Subject Headings are used to create a controlled, standardized vocabulary that avoids the language problems that make keyword searches a challenge. For example, if you type "flu vaccines" into the MeSH database it will automatically adjust your search to "influenza vaccines," which is the standardized MeSH terminology.

Every article in the PubMed database is reviewed by the staff at the U.S. National Library of Medicine and assigned a series of "meta-tags". A meta-tag is a word or short phrase that describes the article. These meta-tags are not necessarily contained in the article itself. The meta-tags are appended to the article, but do not appear in the manuscript itself. These are the "official terminology" that describe the article. This official terminology is taken from a medical thesaurus called MeSH. This stands for "Medical Search Headings". This makes sure that whether you are a researcher in Spain, Rwanda or Japan the same word will be used for searching.

Tip: If you are still finding MeSH difficult then use the Tutorial at <https://www.nlm.nih.gov/bsd/disted/mesh.html>

3. Phrase searching using Quotation Marks

Let's say that you are searching for case reports of Japanese B encephalitis. When you type this into the PubMed search box, you will get articles that contain any of those three words: "Japanese" or "B" or "encephalitis". A case report about a Japanese person will be included, even though that patient did not have the disease you are searching for. If you put quotation marks around a phrase, then PubMed will only bring back articles that have that exact phrase. Sometimes using quotations marks will narrow your search too much and you will not find enough articles. This technique is useful if you are looking for something

very specific within a topic that contains many articles.

4. Booleans Operators

Booleans operators are probably the best way to combine two different search terms. It may sound complicated and confusing, but the word Boolean refers to three very simple words: AND, OR, and NOT.

Term	Search description
OR	(Kidney OR Renal) will find all articles containing at least one of these keywords
NOT	(Kidney NOT urethra) will find articles containing the keyword kidney but exclude those also including the keyword urethra
AND	(Kidney AND carcinoma) will find articles containing both of these keywords
* (Truncation)	Kidn* will find all articles containing the keywords starting with "kidn" e.g. kidney OR kidneys

5. Filters

If you are obtaining many results you find, filters can help. A filter is a way to exclude certain types of articles from the results of your search, so that you only see the articles you want. In the same way that a bed net allows air to pass but keeps mosquitos out, a filter will block irrelevant articles while allowing you to see the useful ones.

Filters can be applied after you get the results of your search. If too many results come back, you may want to filter them until you reach a number that is small enough for you to read all the titles. What number is a reasonable? A good general rule might be that if your search returns more than one or two hundred articles, you should narrow it further. Filters are found down the left column of PubMed.

TIP: NEVER use the "free full text" filter. Just because it's free doesn't mean it's good. Researchers in resource poor countries have access to nearly all articles for free, you just need to go to HINARI (see below) to access them

How do you decide which filters to apply? This depends on your search. If you are just starting your search and are looking for general information, then you can filter to see only review articles. If your Professor told you that there was a great article in the journal Chest a few years ago, but no other information, you can filter by Journal name and set a range of dates. Other types of articles that people like to "filter out" (i.e. exclude) are letters to the Editor, case reports, opinion pieces, and manuscripts written in other languages.

TIP: If you are still finding it difficult to find good articles then arrange to meet with a librarian. They have extensive skills in searching databases such as PubMed.

OTHER PLACES TO SEARCH

Hand searching: Once you have found relevant articles and downloaded the PDF then the next step is to "hand search" the bibliography. Researchers will generally always reference relevant papers in their journal articles. Therefore this is an invaluable location to find further articles and widen your search in a time efficient manner.

Reference managers: What if you don't find any relevant article in the database? Free reference managers such Mendeley or Zotero have a "literature search" function. Type your question into the search box and titles will show up. You can then find the full paper by following the appropriate link. Many unavailable articles from other databases can be found here because they are retrieved from the accounts of users where they were added during referencing.

ACCESSING THE LITERATURE

"But these articles are so expensive for us, it's hopeless searching as we can't get the articles anyway". This is a comment we have heard many times which is simply not true.

TIP: HINARI gives free access to journals to researchers from low-income countries

Once you have searched PubMed or another database and you have the titles of the journal articles you need you then need to access the actual article (e.g. a PDF). Researchers at academic centres in Rwanda and other low-income countries have expanded access to many online resources. Often the journal website will recognise that your computer is located in a resource-poor country (via its IP address) and will automatically give you the PDF for free. If not you will need to use HINARI.

HINARI provides free or very low cost online access to the major medical journals to local, not-for-profit institutions in developing countries (www.who.int/hinari/en/). This is a collaboration between the World Health Organization (WHO) and major academic publishers. HINARI gives free access to almost 14,000 medical journals and we are privileged to be able to get these valuable resources free of charge. In order to get into HINARI you will need to access the username and password for your academic institution (e.g. the University of Rwanda).

Using HINARI can be difficult. If during your PubMed search you have found an article in the British Medical Journal (BMJ) then we have found that the best way to access the article is to enter the "B" of "Journal Collection". Then at the bottom of the page where it states "1-25" of 598 articles to change the setting to "all". You will now have a list of all the free journals beginning with the letter B. If you scroll down to BMJ you will be able to access these journals for free.

WHAT NEXT:

Now that you have found relevant papers and downloaded the PDF files you will need to start reading them. Your next step will be to summarise them in a "literature review". We will cover this topic in the next article in our RMJ research series. Good luck.