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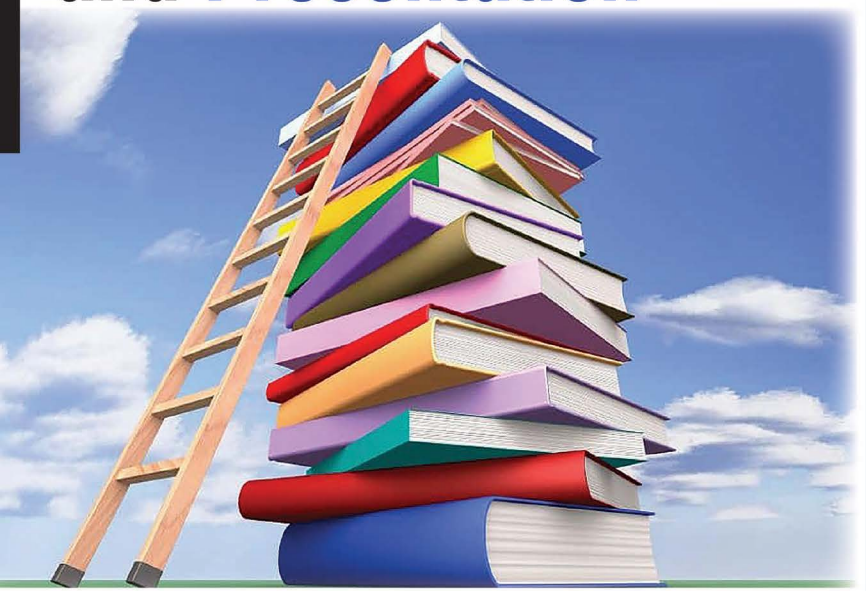
Indian Psychiatric Society Publication

2nd Edition

A Primer of Research, Publication and Presentation



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CHAPTER

3

How to Carry Out a Proper Internet Search

Shahul Ameen

These days, researchers have to sift through an enormous amount of online information to find literature relevant to their study. With appropriate techniques, we can improve our ability to search for and find relevant information. On the other hand, a lack of necessary skills makes online searches for scientific information time-consuming, exhausting, insufficient, and even misleading. To perform successful and efficient searches, one should have (1) a thorough understanding of the technical concepts related to the search process and the reasoning behind the search itself, and (2) the skills needed to search using the specific interface of any particular online resource. This chapter will explore both of these aspects.

First, a quick look at the various types of information and sources:

Primary, Secondary, and Tertiary Sources

Sources of information are called primary, secondary, or tertiary, based on the originality of their content and their proximity to the original source.

Primary sources provide **primary literature** or original materials—like original research and case reports published in individual journal websites, preprints, theses and dissertations, conference posters and papers, and clinical trial protocols. The advantages of looking up primary sources are that you will obtain original data and unbiased information. However, searchers who focus only on primary sources will have to spend a hell lot of time and end up with an unnecessarily massive volume of data.

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Secondary sources provide **secondary literature**, i.e., interpretations and evaluations that are derived from or refer to the primary literature. Examples include review articles, systematic reviews, and meta-analyses. Major secondary sources include PubMed (*https://pubmed.ncbi.nlm.nih.gov/*) and Cochrane Library (*http://www.cochranelibrary.com*). Secondary sources have several advantages: They cover high-quality journals and provide rapid access to primary literature, and complex searches are possible on their websites. However, there is usually a lag time before primary literature gets included in them. Besides, to use them effectively, proficient searching skills are a must.

Tertiary sources provide **tertiary literature**, i.e., a distillation and collection of primary and secondary literature. Examples include textbooks, reference books, and encyclopedia articles. The advantages of tertiary sources are that they are easier to access and use, concise, and less expensive. Their drawbacks are the considerable lag time before primary literature gets incorporated and the possibilities that their information could be outdated or incomplete and that their interpretations could be incorrect.

While searching for literature, you will have to look up sources belonging to more than one of the above categories, as no single source would be comprehensive enough.

Foreground and Background Questions

The kind of questions a clinician/researcher has would determine what kind of sources need to be approached. In this regard, it helps to know if your question is a foreground question or a background one.

Background questions are general clinical questions about a topic, such as: what is the disorder, what is its etiology, what are its symptoms and signs, what are the major treatment options, etc. These often arise when we see a new kind of patient or encounter an unfamiliar clinical situation (olfactory reference syndrome, for example). For answers to background questions, one should look up **background resources,** i.e., resources that give a general overview of the

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topic. Examples include secondary and tertiary resources such as textbooks (both print and electronic) and narrative reviews in journals. Paid websites like UpToDate (*https://www.wolterskluwer.com/en/solutions/uptodate*) too belong to this category.

Foreground questions are more specific questions clinicians can have about a particular patient and would be more multi-faceted and complex than background questions. (For example, "My patient with schizophrenia and uncontrolled diabetes mellitus has developed severe extrapyramidal symptoms and akathisia on 2.5 mg of Trifluoperazine. What do I do next?") Answers to foreground questions are found in **foreground resources** such as primary sources like original research articles and secondary sources like systematic reviews.

Filtered and Unfiltered Resources

Foreground resources could be "filtered" or "unfiltered." **Filtered resources** incorporate primary studies after pre-screening and selection based on their quality and clinical relevance. An example is the American College of Physicians' ACP Journal Club *(https://www.acponline.org/clinical-information/journals-publications/acp-journal-club)*. It offers enhanced abstracts selected from over 120 important journals. Another example is BMJ Best Practice *(https://bestpractice.bmj.com/info/)* from British Medical Journal. It provides step-by-step guidance on diagnosis, prognosis, treatment, and prevention of diseases related to over 30 specialties, including Psychiatry. The database is updated daily using both robust evidence-based methodology and expert opinion. Both the above example resources are paid ones, though. Treatment guidelines prepared by various professional organizations are another example of filtered resources.

In **unfiltered resources**, as the name implies, the studies included are not individually preselected. Examples include PubMed and PsycInfo (*https://www.apa.org/pubs/databases/psycinfo*).

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Grey Literature

This term refers to documents not formally published in sources like books or journals. Examples include theses and dissertations, organization reports, conference papers, white papers, and government papers. Grey literature especially forms a vital component of evidence reviews, such as systematic reviews, because their inclusion protects against publication bias. Their importance is underlined by the finding that approximately 10% of the studies referenced in Cochrane Reviews are from the grey literature.

Tools to locate grey literature include ACM Digital Library (*https://dl.acm.org*). The University of Toronto has provided detailed directions on searching for grey literature (*https://guides.library.utoronto.ca/ld.php?content_id=34461131*).

Bibliographic Databases and Academic Search Engines

To become efficient searchers, we must also be cognizant of the differences between bibliographic databases and academic search engines. **Bibliographic databases**, like PubMed, contain citations for articles from academic publications. The plus points of bibliographic databases are that the entries in them are more likely to be from hand-picked, legitimate scholarly sources and that they are unlikely to contain duplicate entries. Their limitations are that many legitimate sources may be excluded from them and that many of them are not free.

Off late, search engines for academic literature, such as Google Scholar *(https://scholar.google.com/)*, provide a potential alternative to bibliographic databases. While bibliographic databases are populated through a systematic addition of newly published articles from journals indexed in them, **academic search engines** automatically catalog new academic/research publications from across the internet. Hence, they tend to be more comprehensive than individual bibliographic databases. Besides, academic search engines are usually more up-to-date than bibliographic databases, more likely to provide grey literature, and usually free.

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Their disadvantages include the facts that they are more likely to contain duplicate entries and that, compared to bibliographic databases, reproducibility of searches may be lower. Their search results may include many non-peer-reviewed low-quality papers, too.

Now, let us turn to the topic of how to plan and implement a search effectively.

Formulating a Clear Question

To collect the most specific evidence with the least effort, we need to have a clear and focused question. If the search question is too broad, we may end up with an enormous number of results and lots of irrelevant articles. For example, "What is the treatment for depression?" is a broad question, and a PubMed search for *depression treatment* returns about three lakh articles. On the other hand, "What is the evidence for the effectiveness of rTMS in adolescents with treatment-resistant depression?" is a much more focused question. Some formats have been suggested to help us word our focused questions in a clear way, and **PICO** is the most commonly used one. PICO stands for:

- P: Population—demography of the population and its clinical problem (e.g., adolescents with treatment-resistant depression).
- I: Intervention—the treatment under investigation) (e.g., rTMS).
- C: Comparator—the other interventions with which you want a comparison. The comparison could be with another specific intervention (e.g., Fluoxetine), more broadly with all other treatments available for the condition, or with a control group.
- O: Outcome (e.g., reduction in depressive symptoms).

If you apply the PICO format to the earlier question, it can become: "In comparison to SSRIs, how effective is rTMS in reducing depressive symptoms in adolescents with treatment-resistant depression?"

Some other similar formats available are listed in **Table 1**. The use of formats like these will help us define the boundaries of the question, define the concepts, and formulate the

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TABLE 1: Formats other than PICO that can be used to formulate clear search questions.

Acronym	*Expansion*
PECOT	Population, Exposure, Comparator, Outcome, Time period
ECLIPSE	Expectations, Client group, Location, Impact, Profession, Service
PIPOH	Population, Intervention, Profession, Outcome, Healthcare setting
SPICE	Setting, Perspective, Intervention, Comparison, Evaluation

inclusion and exclusion criteria we can later apply to the search results.

Developing Keywords

Once the question is ready, note it down somewhere so that you will remember its specifics. Else, once you get immersed in the search, it is easy to lose sight of your primary aim and get sidetracked by information that is related but irrelevant to your current purpose.

Break your question down into its main concepts and convert them to keywords that can be used for search **(Fig. 1)**. To get an idea of the important keywords related to your concept, do some preliminary reading on the topic. Have a look at the methodology sections of systematic reviews on the topic to see what keywords were used. While creating keywords, think of all the different ways the authors could have used to refer to the concept. Consider:

- Synonyms (e.g., young people/adolescents)
- Differences in European, American, and Indian terminology (e.g., learning disability/intellectual disability/mental retardation)
- Spelling differences (e.g., anemia/anaemia)
- Old and new terms (e.g., manic depressive psychosis/bipolar disorder)
- Lay and medical terminology (e.g., alcoholism/alcohol dependence)
- Acronyms (e.g., PANDAS).

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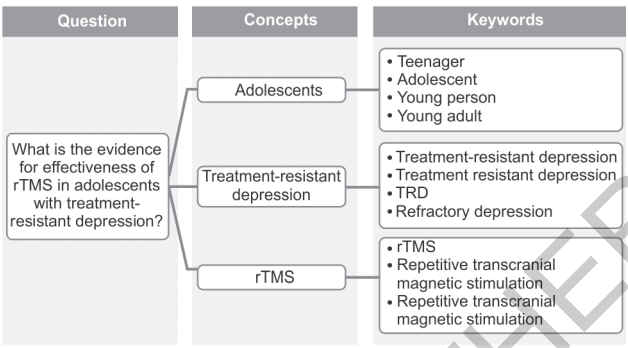

Fig. 1: An example of converting a question to its component concepts and corresponding keywords.

As you proceed with your search, you may identify new terms and encounter alternative ways in which your topic is represented in the literature.

Phrase Searching

When your search term is a phrase, like *acute lithium toxicity*, make sure you enclose it in double quotes (“”). If you search for *acute lithium toxicity* without the double quotes, any article that contains the words *acute* and *lithium* and *toxicity* will be retrieved. On the other hand, searching for *“acute lithium toxicity”* will retrieve only those articles that contain the exact phrase. (While a Google Scholar search for *acute lithium toxicity* returned 1,13,000 papers, *“acute lithium toxicity”* returned only 373—This demonstrates how the use of double quotes removes loads of irrelevant articles from the results).

Truncation Symbols

Most search engines are very “concrete” in the way they comprehend your search and will only match the exact keyword or phrase that you enter. For example, if you search for *schizophrenia*, articles containing the term schizophrenia will be returned, but those containing *schizophrenics* may not be. The use of truncation symbols, which can stand for one

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or more unspecified characters at the end of a word, helps overcome this issue and get more comprehensive results. Different databases use different symbols, like ?, *, $, etc., for this purpose. For example, typing alcoho* into the Cochrane Library database would find alcohol, alcoholic, alcoholics, alcoholism, etc.

Wildcard Symbols

These may be used to search for alternative spellings or forms. For example, typing wom?n into the Cochrane Library database would find both women and woman. Symbols various databases use as wildcard symbols include ?, #, and !.

Combining Keywords

In research databases, it is not a wise strategy to search with a string of terms (like typing in your exact question). Instead, consider how your keywords relate to each other; and use OR, AND, or NOT (in capital letters) as appropriate. These are called **Boolean Operators** or **Logical Operators**. They inform the search engine about the relationship between different terms in your query and thus, make your search more specific.

When you combine keywords with OR, the search will find items that contain either one or both the keywords **(Fig. 2)**. When you combine keywords with AND, the search will find only those items that contain both the keywords **(Fig. 3)**. And when you use NOT, the search will find only those items that contain the first keyword but not the other **(Fig. 4)**. In some databases, NOT is sometimes replaced by a minus sign, without a space between the sign and the keyword (e.g., bipolar-splint).

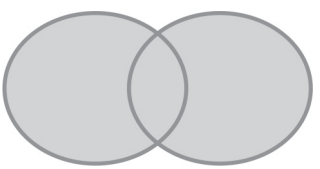

Fig. 2: A search with *Down's syndrome OR Mongolism* will return items that contain either the term *Down's syndrome* or the term *Mongolism*.

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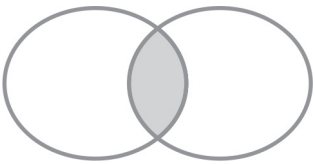

Fig. 3: A search with *Schizophrenia AND Genetics* will return items that contain both the terms.

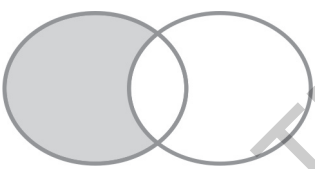

Fig. 4: A search with *Bipolar NOT splint* will return items that contain the term *bipolar* and exclude those containing the term *splint*, thus saving you from the trouble of having to sift through orthopedics articles on the bipolar splint.

Search terms can also be combined in more complex ways, using more than one Boolean operator. For example, here is the search strategy used by a systematic review on the efficacy of melatonin in depression: ((melatonin) AND (depression OR depressive disorders OR mood disorders OR depressive symptoms) AND (therapeutics OR treat* OR effect*). In situations like this, it is crucial to group the terms correctly. Brackets are utilized, as in algebraic equations, to demarcate whether the operator is meant to act upon a single term, a grouping of terms, or even upon two or more full searches. For example, (a OR b) NOT (a AND b) would retrieve all the manuscripts that contain the terms a or b alone and exclude those containing both the terms.

Proximity Operators

These are words or phrases that allow you to search for keywords within a specified number (n) of words of each other. Databases like Cochrane, Ovid, EbscoHost, etc., utilize this feature. For example, in Cochrane, NEAR will find keywords that are within six words of each other in either direction.

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(For example, Typing *prodrome NEAR schizophrenia* in Cochrane will find *schizophrenia prodrome*, as well as *prodrome period of schizophrenia*). In Cochrane, NEAR/n will find keywords that are within 'n' words of each other in either direction. Also in Cochrane, NEXT will find keywords that are next to each other in the direction specified. For example, typing *positive NEXT symptoms* will find *positive symptoms* but not *symptoms positive*.

The more specific you can make your search when entering the search terms by using double quotes, proximity operators, etc., the less work you will have to do while evaluating the results. Options to use wildcards, Boolean operators, and proximity operators are usually found on the "advanced search" page. The searching tip or help section of each database will have the information on which wildcards, Boolean operators, and proximity operators it supports.

Limits and Specialized Filters

Most databases let us limit our results in some way. Most allow to choose from different article fields to search for a keyword—We can choose to search only the titles of articles, only the abstracts, or all text/all fields of each article. Other "limits" usually available in major databases include the date of publication, type of publication (case reports, systematic reviews, etc.), age groups, and type of materials (like journals, books, etc.). PsycInfo provides some unique limiting options like "Classification Codes" (e.g., Neuropsychological Assessment) and whether the intended audience is professionals or the general public.

It would be better to start all searches using all fields/all text and refine later if you are getting a considerable number of results.

Citation Searching and Author Searching

Citation searching means expanding on the subject or keyword searching by: (1) Going backward in time and following the links to similar works included in a known article's references section, and (2) Going forward in time to find out which other articles have cited the original article or an author of interest.

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Citation searching is very useful in discovering the "web" of knowledge or scholarship on your topic. Several proprietary systems, including Web of Science, Scopus, and PsycInfo, allow citation searching. Though Google Scholar has a "cited by" option, many consider it imperfect and undependable.

If you find that many key articles on your topic are by the same author(s), carry out an author search to see whether they have published other relevant material not identified by the initial search.

Evaluating the Results

Once you have the results in hand, see if they are relevant to your purpose and check them for quality. Ask the following questions: Is the article about your topic? Is it the kind of information you wanted (i.e., review article, qualitative study, quantitative study, etc.)? Is it new enough? Was it formally peer-reviewed? Is it from a primary or secondary source? Does it cite its sources? What is the level of evidence as per the classification explained in this book in the chapter on how to write systematic reviews?

If you did not get a sufficient number of relevant articles, consider:

- Which keywords helped to find the best references?
- Which other alternative keywords may be considered?
- Were the correct operators used?
- Was the database used the most appropriate for the purpose?

On the other hand, if you end up with a much larger number of articles than you can handle, consider:

- Adding another concept or keyword to make the search more specific
- Adding limits to your search, i.e., years of publication, peer-reviewed only, etc.
- Restricting the search to specific fields, like the title or the abstract.

Keep Saving and Recording

In most databases, by creating a free account, you will be able to save the search strategy once you finish a search. This will

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prove helpful if you have to repeat the search for any reason, if you want to make any changes to your keywords, or if you are unable to finish the search in one sitting. However, remember that, since most databases are updated frequently, the numbers will change if you rerun the search from a saved history. Most databases also provide the option to email the selected citations to your address.

Especially if you are preparing a systematic review, record each step of the search process. This will make your subsequent writing of the methods section easier and ensure that your review is repeatable.

Now, let us discuss PubMed, one of the most authentic, comprehensive, and popular databases, in some detail.

An Introduction to PubMed

PubMed is one of the world's largest bibliographic databases covering medicine, health, and the biomedical sciences. It has indexed more than 5,600 biomedical journals in medicine, nursing, pharmacy, etc. It has worldwide coverage, though it tends to focus more on journals published from North America. Its database is updated daily.

Though the two terms are often used synonymously, there is a difference between PubMed and MEDLINE. MEDLINE is a journal citation database started in the 1960s by the National Library of Medicine (NLM), USA. Currently, it offers more than 28 million references to journal articles dating back to 1946. PubMed, on the other hand, has been available since 1996 only. It currently has more than 33 million references, i.e., around 5 million more than MEDLINE. This is because PubMed contains many other types of citations too besides MEDLINE, including:

1. In-process citations, which provide records for articles before they are indexed in MEDLINE or converted to out-of-scope status,
2. Citations that precede the date on which a journal was selected for MEDLINE indexing (when supplied electronically by the publisher),
3. Citations to author manuscripts of articles published by researchers the National Institutes of Health (NIH) had funded

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