

## VII. Systematic Research: How to Locate Articles to Answer a Clinical Question

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In the process of solving doubts generated in the process of medical care, the amount of articles appearing during the search is so vast, that a strategy must be considered to refine it. The present article describes the process for searching and selecting information that may help us answering to our patients' needs. Judgment of the quality and relevance of the response will depend on each reader. The search has to be done in peer-reviewed sites, and for that reason, we recommend PubMed and to start the search after breaking down the PICO acronym, where P = patients, I = intervention, C = comparator and O = outcome. The PICO acronym shares components with the classical research architecture model described by doctor Alvan R. Feinstein. A good search must be involved with the answer to our question in the first 20 articles; otherwise, the search will have to be more specific by using filters.

### Key words

PubMed  
MeSH  
clinical research

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### Introduction

In the process of solving doubts generated in the process of medical care, the number of articles appearing during the search is so vast, that we must consider a strategy, which in short time allows us to find those answers to our needs as physicians, so that we are not overwhelmed by an ocean of information. The present article describes the process to systematically search documents that help us answering our patients' needs, although the judgment on quality and relevance will depend on each reader.

Accessibility to medical information has changed with Internet and electronic media. Worldwide, there is an estimated 20 000 journals in the area, which provide approximately 2 million papers each year. This amount of articles, which represents new knowledge, generates great difficulties in keeping updated in every aspect of medicine.

The problem is aggravated by Internet postings on medical issues without peer-review, which depend on the good will of those who edit them and sometimes do not serve scientific purposes. Unfortunately, meta-browsers such as Google or Yahoo identify them easily, which results in these materials being highly consulted by patients and some doctors.

For these reasons, the search for medical literature must be performed in sites where publications are peer-reviewed and according to a system that avoids overseeing relevant articles and inclusion of unspecific articles to solve our questions. Hence, systematic search offers a clear, reproducible and auditable protocol.

The browser we recommend is PubMed, because it is simple, free and, most importantly, the manuscripts that appear are peer-reviewed by experts. Besides, recently it has included options to perform searches on mobile devices. This system is responsible for spreading the Medline database archives of the United States National Library of Medicine, which has over 21 million articles<sup>1</sup> (in areas such as genetics, medicine, nursing, psychology, veterinary medicine, among others), 90 % with an abstract in English; some magazines have links to the full-text article from this page. This medical library claims to be the largest in the world and has started integrating full-length articles, although free-access journals are still few.

Now, the first step in solving a question is to structure it properly based on the three items of the architectural approach outlined in previous chapters: *baseline state*, *maneuver* and *outcome*.<sup>2</sup> For an electronic search, an adaptation of Dr. Alvan R. Feinstein's architectural model has been proposed, in which the acronym PICO is formed, where *P* is

patients, with specification of the disease, if applies; *I*, the intervention or maneuver, treatment, risk factor, prognostic indicator and even a diagnostic procedure; *C* is the comparator, which may be a placebo group, another treatment or an observational maneuver; and, finally, the *O* for outcome corresponds to the result or outcome<sup>3</sup>—this acronym may have some variations such as PEO (patients, exposure, outcome) or PICOST, where *S* and *T* represent the type of study and follow-up time—.<sup>4</sup> Let's translate this into an example where a clinician wants to know if the use of albumin reduces mortality in patients with hypovolemic shock, compared with the use of

saline. With this proposal, the following acronym would be formed:

P = patients with hypovolemia

I = treatment with albumin

C = saline

O = mortality

With this acronym, the question would be:

*Will the use of albumin (when comparing it with saline) reduce the mortality in patients with hypovolemia?*

## 1

A tool that complements this method is the MeSH (Medical Subject Headings) acronym, a United States National Library of Medicine controlled vocabulary by means of which articles are indexed and organized in PubMed. These words enable having the definition of the subject that is being searched. Its catalog can be accessed from the PubMed main screen by selecting three options: the type of catalog (MeSH) (1), the word to be searched (2) and the Search button (3), as is shown in Figure 1.

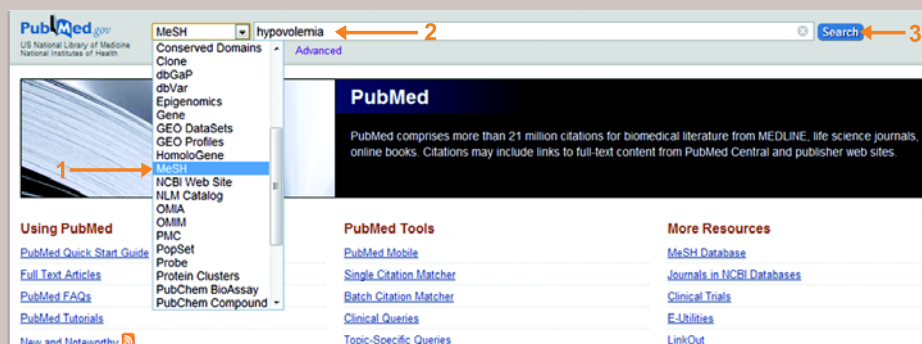


Figure 1 Options in PubMed to search in the MeSH words catalog

## Variants in the process

For novel terms, not recorded in the MeSH catalog or if the nomenclature under which a concept is recorded is unknown, text words or free words can be used, which will be identified anywhere within the articles: title, abstract or body of the article. The advantage is a wide search, with the risk or inconvenience that it may yield articles not directly related with the topic. Other drawback is that *text words* must be written directly in the search box together with the Boolean operator.

```
PubMed search builder
((("Hypovolemia"[Mesh]) AND
"Albumins"[Mesh]) AND (saline
solution) AND ("Mortality"[Mesh]
OR "mortality" [Subheading] OR
"Hospital Mortality"[Mesh] )
```

In our example, saline (saline solution) is not recorded as MeSH word; we used it for considering it to be widely used. It was entered as a text word (manually, together with its Boolean operator)

2

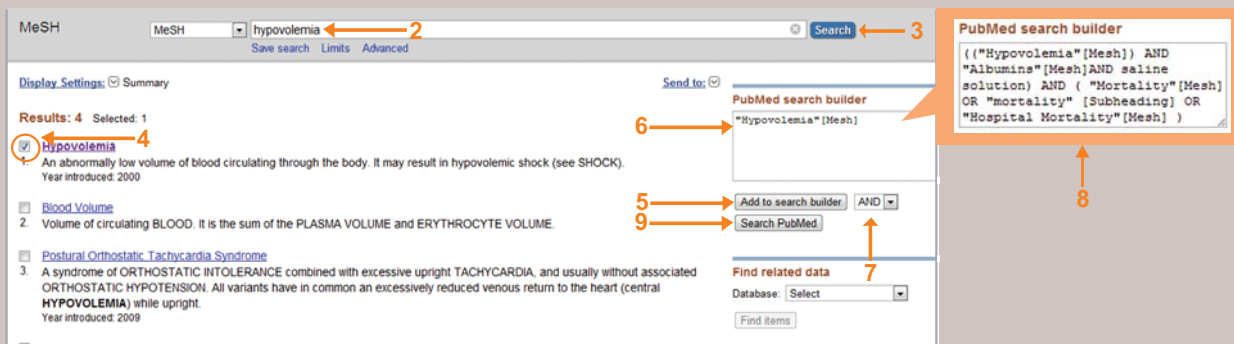


Figure 2 The MeSH words browser offers additional advantages

With the first PICO acronym term entered (2) (in our example hypovolemia), as shown in Figure 2, it will be necessary activating the check box (4) and pressing the *Add to search builder* option (5) to enter the term in the text box (6). Steps 2 to 6 must be repeated for entering other PICO acronym words, which will be linked to each other with ligands, which correspond to Boolean operators (7):

- *and* to link one or more criteria, which allows for more specific searches to be performed;
- *or* takes care of including one term or another, making the search broader.
- *not*, which is used to make total exclusion of the term that follows.

Let's see how our acronym words would combine if we added Boolean operators:

*Will the use of albumin, compared with (AND) saline, reduce (AND) mortality in (AND) patients with hypovolemia?*

As shown in the same figure 2, the PICO acronym words, the Boolean operators and, automatically, brackets, will be added in the search box (8),

so that when we finish to include all terms in the system, the search will be recorded as follows:

((“Hypovolemia”[Mesh]) AND  
 “Albumins”[Mesh] AND saline solution) AND  
 (“Mortality” [Mesh] OR “mortality”  
 [Subheading]  
 OR “Hospital Mortality” [Mesh])

This is because when the terms are combined, the PubMed system includes brackets to perform the search following a similar logic to that of algebra notation, i.e., it solves first the inner parentheses and their results are combined with the external ones.

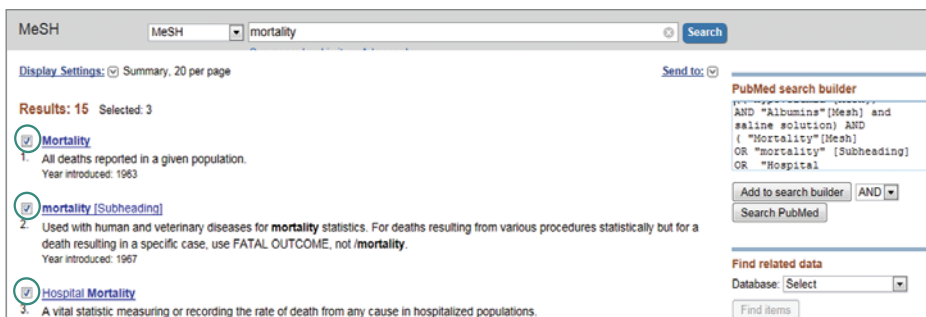
Once all the PICO acronym terms have been entered into the search box, all that is left to do is pressing the Search PubMed button (9).

The importance of previously constructing the PICO question lies in the fact that the order of terms entrance will be followed, which will allow for a search targeted to specifically find information related to our question.

A good search must succeed in finding the solution to our question in the first 20 articles (when there are studies). When no article is retrieved when searching for very rare diseases, the search must be done using only two or three terms or it must be expanded with the Boolean operator OR.

When in order to include a larger number of articles, two or more MeSH terms are selected in the same step, words are automatically linked with OR.

In our example, three *mortality* options were selected



### 3

As shown in Figure 3, PubMed also has other resources for enhancing searches. One of them is Related citations (10), which generates an identification mechanism that displays the articles that most resemble the article selected in our list as the ideal, thereby extending the range of documents that we are able to consult. As we can observe, 10 articles were found in the example (11); when Related citations was used, 130 were retrieved (12). Another PubMed resource are the filters or limits (13), which can be accessed from the main browser.

Limits or filters are a useful system to limit the search to dates (14), type of article (clinical trial, cohort study, meta-analysis, clinical practice guideline) (15), species (humans and animals) (16), language (17), sex (18) and other parameters.

With these limits, more specific results are obtained, which is an essential issue when the number of identified articles is abundant (Figure 4).

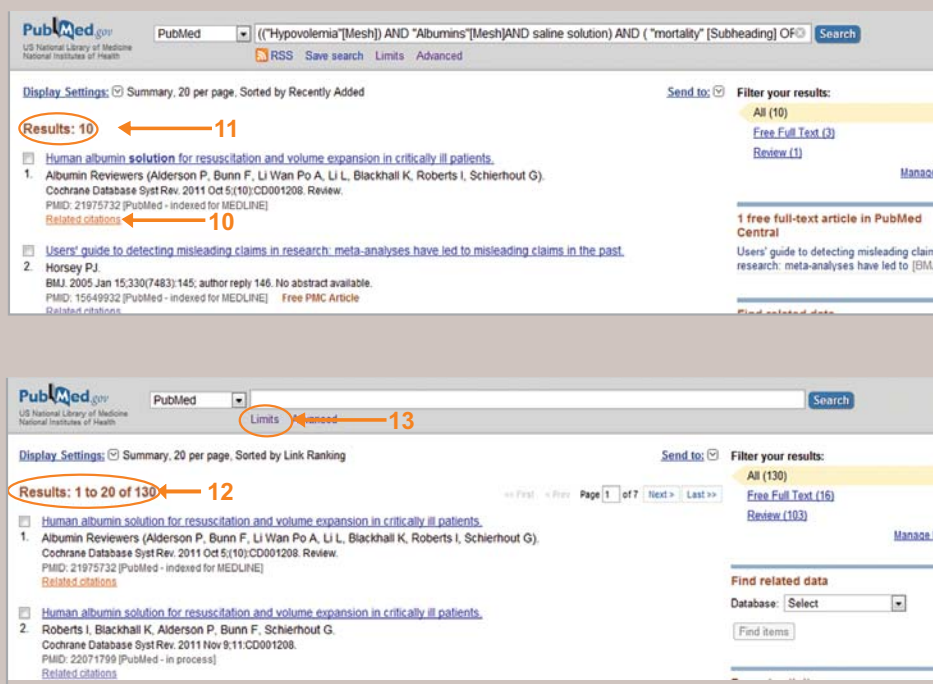


Figure 3 Other search resources

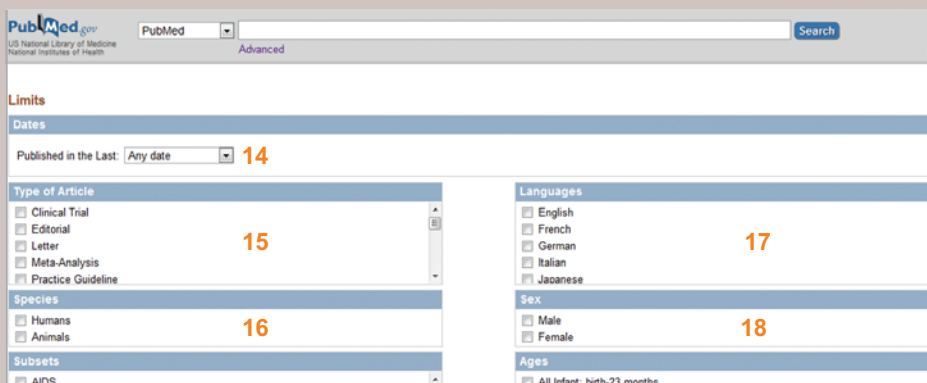
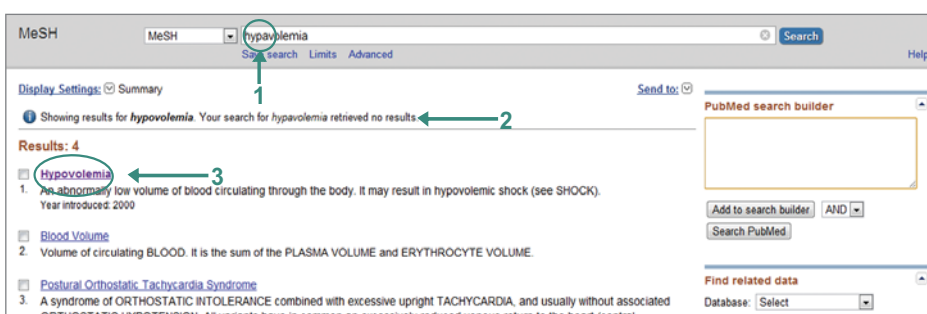


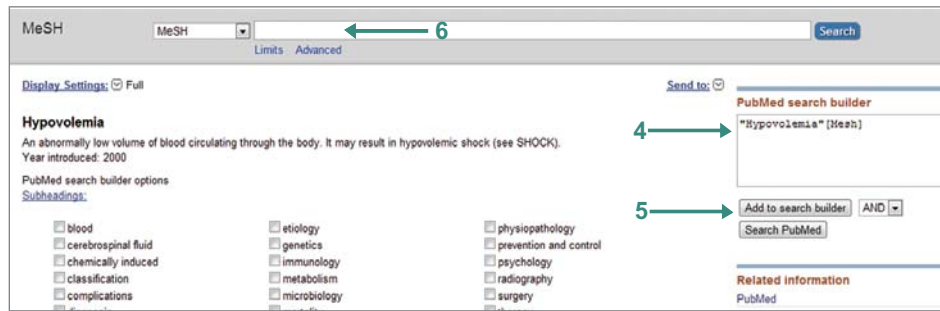
Figure 4 Detail of the limits screen

If the user makes a typing error (typo) (1), the system leads to a screen where a warning is shown and terms that can replace or are related with the desired one are displayed (2). If the user activates the MeSH term (3), another screen will appear





The new screen displays the definition of the term and related concepts in order for the user to verify if it is the desired one. He will be able to add it into the search box (4) with the Add to search builder option (5). To continue, all he has to do is entering the next PICO term (6)



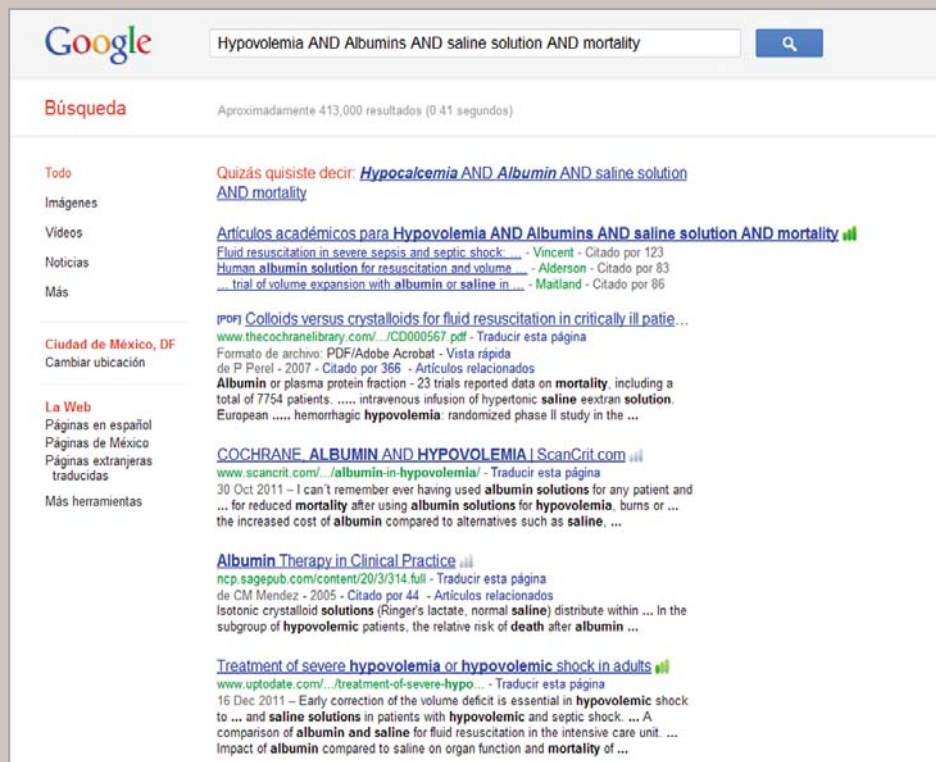
4

This same PICO acronym system can be used in meta-browsers such as Google or Yahoo as well. The words just have to be typed in English and linked with their Boolean terms, as shown in Figure 5. In Google, it is possible that more articles will be found than in PubMed and some that may be sponsored or not endorsed by peers. However, when the order of the PICO words is followed and the search is restricted to them, the result is often similar to that found in PubMed in complementary cases. In this example, we can see similar results to those obtained in PubMed, with the advantage that, in most cases, the full-text is available.

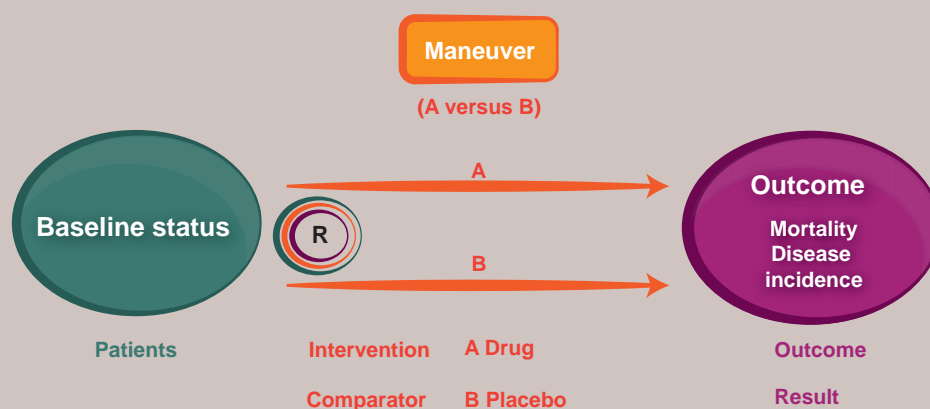
This electronic strategy shares the components of the classical research architecture model described by

Dr. Alvan R. Feinstein in his book *Clinical Epidemiology*.<sup>6</sup> This model was recently quoted by Julian P. T. Higgins and Sally Green in Chapter 6 of the *Cochrane Handbook for Systematic Reviews of Interventions*,<sup>5</sup> and was employed by The Cochrane Collaboration for the elaboration of systematic reviews.<sup>7-8</sup> This acronym has been used recently by the GRADE model as a search mechanism for the development of clinical practice guidelines.

Importantly, for more extensive searches, such as systematic reviews, other sources must be consulted in addition to PubMed, such as EMBASE, LILACS, Imbiomed, conference abstracts and even meta-browsers such as Google and Yahoo.



**Figure 5** Meta-browsers respond to the PICO acronym with the advantage of including not only PubMed articles, but other local publications as well. They have the “disadvantage” that they identify a large number of results, which sometimes precludes a full enquiry



**Figure 6** Usefulness of the classical research architecture model proposed by Dr. Alvan R. Feinstein

We consider that this search and clinical questions formulation mechanism, based on the architectural model and synthesized in the PICO acronym is one of the most useful in current clinical practice, since it is highly sensitive to the available electronic search engines, even in portable devices.

The advantage of the traditional scheme (Figure 6) is that it allows for the parts of a study, potential biases, statistical analysis, feasibility of the study or clinical significance to be identified, and forms the basis of electronic search.<sup>2,9-12</sup>

Disseminating and promoting these search mechanisms in hospitals might help considerably in the solution of clinical questions more quickly—with practice we estimate no more than 10 minutes—and in increasing the certainty in prescription, in the selection of a diagnostic test or in the issue of a prognosis, thus facilitating medical education, peer-wise discussion and the clinician's general work. As a complement to adequate reading and comprehension of articles, this approach might improve health care quality.

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