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## Methodology letter

## Then, how do I document the idea? Bibliographic search engines ☆



## Y ahora, ¿cómo documento la idea? Buscadores bibliográficos

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Information is an essential instrument for the development of any professional, especially for those of us who work in the health sciences. Its application in a rigorous, solid and current manner allows us not only to advance in the scientific and academic field but also in our daily practice. The large volume of knowledge available today makes it necessary to design optimal bibliographic searches to discriminate data that are relevant and worth analyzing from those that should be excluded.

Creating an appropriate strategy for obtaining information is, without a doubt, a determining factor for the achievement of said objectives. It is essential to understand the different stages that constitute a bibliographic search, to know how to execute a timely strategy, and to know the databases and bibliographic managers available.

### Stages in the process of a bibliographic search

To obtain beneficial results that will allow us to find answers to the question posed, different stages have been defined in the course of a bibliographic search<sup>1,2</sup>:

*Properly formulate the clinical question to which we want to obtain an answer.* The initial step in this process involves correctly and precisely formulating the question about which we want to obtain an answer that satisfies our need for

information<sup>3</sup>. Different tools have been described that help define the structure of the question we want to ask. The classically used methodology is PICO, which divides the question into 4 components: Patient, Intervention, Comparison and Outcome<sup>4</sup>. Another search system is SPIDER (Sample, Phenomenon of interest, Design, Evaluation, Research type), which was specifically created to identify qualitative studies by adding the categories 'design' and 'type of research'<sup>5</sup>.

*Identify or choose the database or bibliographic search engines in which the question will be formulated.* There are many databases and bibliographic search engines available that provide access to information. The specialization in a certain area, language, accessibility and type of access (free or subscription) are criteria that will determine the choice of one or the other.

*Planning the search strategy and translating the question into the language of the selected database or search engine.* In this stage, we must decide how to combine the chosen medical terms and which descriptors or medical subject headings (MeSH) to use. Likewise, the use of Boolean operators, which connect our selected search terms, will allow us to either narrow or broaden the search. Finally, we will use the limiting fields, which offer the possibility of selecting our results to carry out a more effective search strategy.

*Formulating the search strategy and analyzing the results obtained.* Sometimes it is necessary to modify the elements of the search and reinitiate it<sup>6</sup>.

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## Creation of the search strategy

In recent years, there has been a significant and exponential increase in the number of scientific publications. Therefore, it is essential to previously prepare a proper strategy as an essential part of the bibliographic search process. *Logical or Boolean operators* should be included in this search strategy<sup>7,8</sup>. These operators form the basis of logical or mathematical sets that link search words to narrow, widen, or define results. There are 3 basic Boolean operators: AND, OR and NOT or AND NOT.

Also, to build a more complex search strategy, different Boolean operators can be combined using parentheses and quotes. The parenthetical command is performed first, and in all cases the operator used must be separated from the preceding and succeeding terms.

## Bibliographic searches in healthcare sciences

There are numerous varied resources available for health professionals to obtain information. In biomedicine, there are currently various databases and search engines that provide access to information for consultation in an agile and dynamic manner<sup>9</sup>.

*Databases* are systems for collecting scientific-academic content publications (primary articles, review articles, books, theses, and communications at medical congresses) that contain relevant, updated, reviewed and proven information, whose purpose is to compile the bibliographic production of a specific field knowledge. Several online databases are available for the health sciences. The most commonly used include MEDLINE, EMBASE (Excerpta Medica DataBASE) and The Cochrane Library. In Spain, the IBECS (Spanish Bibliographic Index of Health Sciences), MEDES (SPANISH MEDICINE) and Dialnet (Dissemination of Alerts on the Network) are also used<sup>10</sup>.

In turn, *bibliographic search engines* are search managers used to access different databases with the purpose of selecting certain citations and references.

*PubMed* is the most widely used and well-known bibliographic search engine in biomedicine. This free-access search engine was developed in 1997 by the National Center of Biotechnology Information at the US National Library of Medicine. Since then, it has undergone numerous changes and improvements that have led to an exponential increase in its use, which now includes more than 32 million citations from the biomedical literature<sup>11,12</sup>. The main component of PubMed is the MEDLINE database, in which it is possible to execute both simple searches and other more elaborate ones through the use of limiters or MeSH to obtain more precise results<sup>13</sup>. Currently, it meets the needs of the millions of health professionals who demand updated and verified information on a daily basis.

In addition to the popular PubMed, there are many others such as Google Scholar, Ovid, Web of Science (WOS), Science Direct, Springer Link, etc. In 2017<sup>14</sup>, Falgas et al analyzed the results of their study in which they compared the characteristics between PubMed, Scopus, WOS and Google Scholar and

**Table 1 – Characteristics of the main databases and bibliographic search engines.**

	Year of creation	Country of origin	Sistema of the resource	Entity of production	Main language	Field of interest	Access method
MEDLINE	1966	USA	Database	National Library of Medicine	English	Health sciences	Free access
EMBASE	1974	Netherlands	Database	Elsevier	English	Biomedicine, pharmacology	Subscription
Cochrane Library	1992	UK	Database	Cochrane	English	Health sciences	Free access
Scopus	2004	Netherlands	Database	Elsevier	English	Sciences, technology, medicine and social science	Free access
IBECS	2000	Spain	Database	Instituto de Salud Carlos III	Spanish	Health sciences	Free access
MEDES	2001	Spain	Database	Fundación Lilly	Spanish	Health and social sciences	Free access
Dialnet	2001	Spain	Database	Fundación Dialnet (University of La Rioja)	Spanish	Sciences; human, legal and social sciences	Free access
PubMed	1996	USA	Search engine	National Library of Medicine	English	Health sciences	Free access
Google Scholar	2004	USA	Search engine	Google	English	Scientific-academic documents	Free access
Ovid	1984	USA	Search engine	Wolters Kluwer Health	English	Health sciences	Free access
Web of Science (WOS)	2004	UK	Search engine	Clarivate Analytics	English	Sciences, social sciences, arts and humanities	Subscription
Science Direct	1997	Netherlands	Search engine	Elsevier	English	Engineering and physical sciences, life sciences, Health sciences, Humanities and life sciences	Subscription (Free access to abstracts)
Springer Link	1996	USA	Search engine	Springer	English	Sciences, technology, medicine, humanities, life sciences	Subscription

indicated that PubMed continues to be the most important resource for doctors and researchers (Table 1).

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## Conclusion

In a global manner, information can be defined as the result of the analysis and treatment of data so that they respond to previously established questions. In biomedicine, accurate and current information enables us to advance, not only in scientific and academic fields, but also in our daily practice, as it is a powerful tool for evaluating, planning and managing resources.

Given the vast amount of knowledge generated and the multitude of data sources, search engines are required to encompass the greatest amount of verified information in a structured manner, using a simple interface.

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## Conflict of interests

The authors have no conflict of interest to declare.

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## Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.cireng.2022.04.020>.

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