

EBMPICO: a computer-assisted critical appraisal tool for learning and practicing evidence-based medicine

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Abstract: EBMPICO is an Open Source web application and critical appraisal tool which novelty consists of the integration of all four major tasks of the evidence-based medicine approach: formulating a clinical question, gathering evidence, evaluating gathered evidence and synthesizing and integrating these elements in practice. Using the PICO framework, it aims at automating the process of searching for potentially relevant evidence while promoting critical appraisal.

Keywords: information retrieval, evidence-based medicine, open source software

1. INTRODUCTION

Evidence-based medicine (EBM) is the integration of clinical expertise with best available evidence in clinical practise (Sackett et al. 1996) and applies to all health professionals. To integrate this approach in daily activities, professionals must complete four major tasks: formulate a clinical question, gather evidence, evaluate gathered evidence and, finally, synthesize and integrate these elements in their practice. Most of these tasks can be challenging at times, especially for beginners, and tools are already available to assist the health professional in most of these tasks. However, to our current knowledge, no tool is readily available to assist the practice of evidence-based medicine in all four major tasks. For this reason, we developed an Open Source web application named EBMPICO not only to assist the professional in his daily practice, but also to help teach EBM principles. It aims at automating the process of searching for potentially relevant evidence while promoting critical appraisal.

2. FORMULATION OF CLINICAL QUESTIONS

2.1 PICO framework

EBM guidelines suggest clinicians formulate their questions in terms of population and/or problem (P), intervention (I), comparison (C) and outcome (O). Together, these terms form the PICO framework and help practitioners structure their question. In an attempt to express the context of the clinical question, the type of clinical task it relates to can also be specified. Types of clinical tasks considered by EBMPICO are intervention, diagnosis and prognosis, which are based on the work of Richardson et al. (1995), to which the clinical task exposure was added, based on the harm concept described by Guyatt et al. (2008).

To promote the use of this framework while formulating a clinical question and to gather more relevant evidence, the EBMPICO application suggests the use of keywords to describe each of these terms. In addition, the type of search

task the clinician is pursuing can also be selected and may impact the gathering of relevant evidence (depending on other choices made by the clinician.)

2.2 Keywords for PICO elements

Selection of keywords can greatly affect the search results for relevant evidence. To help users choose significant keywords and minimize typos, a controlled vocabulary made available by the U.S. National Library of Medicine, Medical Subject Headings (MeSH®), is used as an autocomplete feature. Many controlled vocabulary for health information already exist but one of the advantages of MeSH® is that it may be used to search some databases, such as MEDLINE®/PubMed®, as well as The Cochrane Library, amongst others. In addition, MeSH® is also being made available in a bilingual format by the French National Institute of Health and Medical Research (Inserm), which is very useful for a bilingual tool such as EBMPICO. The bilingual MeSH® terms are in fact used as transparent translation tool for French users, since most databases don't recognize French keywords. Figure 1 below shows EBMPICO fields related to formulation of clinical questions and the autocomplete feature.

The screenshot shows the 'My search' interface of the EBMPICO application. On the left, under 'Question type: ?', there are radio buttons for 'Intervention', 'Diagnosis', 'Prognosis', 'Exposure', and 'Unspecified' (which is selected). On the right, under 'Keywords: ?', there are four input fields corresponding to the PICO elements: P (Intervention), I (Diagnosis), C (Prognosis), and O (Exposure). Each field has a dropdown menu with autocomplete suggestions. For the P field, the suggestions are 'Antiarhythmiques [Anti-Arrhythmia Agents]' and 'Troubles du rythme cardiaque [Arrhythmias, Cardiac]'. For the I field, the suggestion is 'Arythmie sinuale [Arrhythmia, Sinus]'. For the C field, the suggestion is 'Dysplasie ventriculaire droite arythmogène [Arrhythmogenic Right Ventricular Dysplasia]'. Each suggestion is followed by a question mark icon.

Fig. 1. The autocomplete feature of EBMPICO

It is however important to note that users can choose to ignore the autocomplete feature and use keywords of their choice.

3. GATHERING RELEVANT EVIDENCE

To help health professionals gather the most relevant evidence while practicing EBM principles, multiple databases are made available to users, according to their individual access and subscriptions, and are regrouped based on the level of evidence they carry. For each data source selected, keywords describing the PICO elements and question type are translated into search queries and are sent to databases. Retrieved results are then presented to the user for appraisal.

3.1 Keywords to search queries

For each PICO element, keywords are translated into a Boolean query in which an 'OR' separates them. Those queries are then reunited into multiple bigger queries that assemble PICO elements by the Boolean 'AND':

- P AND I AND C AND O
- P AND I AND O
- P AND I
- I

Those search queries are then sent, in the presented order, to databases until the specified amount of records specified by the user is returned.

For each keyword, if the databases is searchable by MeSH®, the keyword is searched both as text and as a MeSH® term.

3.2 Clinical tasks

When searching in PubMed and CINAHL, clinical filters are added to the queries when a clinical task is specified alongside the PICO elements. These filters are provided by these databases and help retrieve more clinically relevant evidence (Wilczynski et al. 2011).

4. APPRAISAL OF EVIDENCE AND SYNTHESIS

For each gathered potential evidence, EBMPICO users are encouraged to appraise in detail presented results, and determine if it applies to their patients, directly in the application. They are also invited to write up their assessment of the overall gathered evidence and can share their questions and analysis. To facilitate learning the EBM approach, features are also included for teachers to easily provide feedback to students on their appraisal of evidence, such as surveys, messaging and interactive supervision of work done in the application. These features fully integrate the last task of the EBM approach, consisting of synthesis of information and integration into practice, and promotes discussion of findings.

5. CONCLUSIONS

EBMPICO is an Open Source web application which novelty consists of the integration of all four major tasks of the EBM approach, not only for the professional in his daily practice, but also for learning students. It is currently being used by two medicine and nursing faculties, and could easily be used by other health care professionals.

The search for potentially relevant evidence automation, while promoting critical appraisal, is still underway and could benefit from the re-ranking of evidence after more data is being collected from its usage.

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