Cardio Online Reader/COR: A Web 2.0-Based Tool Aimed at Clinical Decision-Making Support in Cardiology

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Abstract. There is a wide acceptance of the fact, that processes of clinical decision-making has to be based on sound scientific evidence. But in the context of a rapidly growing amount of new information, it is increasingly difficult task. That is why specialized tools and resources enabling to quickly and efficiently search and disseminate relevant evidence are needed. Web 2.0 is a platform that provides an armamentarium with great potential to contribute to solving this task. This paper presents a newly developed information resource aimed at support of clinical decision making in cardiology called Cardio Online Reader/COR. The COR provides the best available evidence from database MEDLINE/PubMed by means of an online application equipped with tools and services typical for Web 2.0. A beta-version of the application is freely accessible at http://neo.euromise.cz/cor.

Keywords: EBM, Web 2.0, medical information sources, clinical decision-making support.

1 Introduction

There is a wide acceptance of the fact, that the processes of clinical decision-making has to be based on reliable scientific evidence, nowadays derived from clinical research trials [1], [2], [3], [4]. A general agreement exists also around the statement, that medical doctors have been challenging a huge increase of information, which is still unstoppably growing. They do not know about important advances, and feel overwhelmed by new scientific information [5], [6].

1.1 Information Overload

According to the study of Richard Smith medical knowledge will increase four times during a professional lifetime [6].Nowadays, a total of 20,000 randomized controlled trials (RCTs) are published each year and approximately 50 new RCTs are published every day. Therefore, to keep up to date with RCTs alone, a general practitioner (GP)

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would have to read one study report every half hour, day and night. In addition to RCTs, about 1000 papers are also indexed daily on MEDLINE from a total of about 5000 journal articles published each day [7]. In addition to that, the quality of most of the information is very poor: most published information is irrelevant and/or the methods are not good [7]. Medical doctors have to select and appraise the sought information, which requires specific knowledge, skills and experience. But previous studies unveiled, they are not good at finding new information, and do not know how to evaluate it when it is found [5], [6]. Information retrieval therefore is not a trivial task for most of them.

Even when clinicians have time to read some of a new literature, it is difficult to identify which information will be most useful in clinical practice and to recall the most up-to-date findings when they need them [7]. Moreover, push technology to disseminate information has magnified the problem to unwanted information [8]. Unsolicited information received through the mail alone can amount to kilograms per month [7]. And so busy clinicians are now caught in an information paradox - overwhelmed with information but unable to find the knowledge they need when they need it [8].

Considering this reality, it is not surprising, that medical practitioners, particularly GPs, are overloaded with information[7] and - at the same time - they face a serious problem in keeping up to date [5], [6], [7].

1.2 Evidence-Based Clinical Practice

Evidence-based medicine (EBM) movement has been promoting the use of results of clinical research in medical practice. But in the above described context, it is an increasingly difficult task. It has been published a whole range of studies referring about difficulties and obstacles of adequate utilization of the latest and best available evidence in the clinical practice (e.g. [2], [9]).

One of the biggest obstacles is clinicians´ lack of time [10].A questionnaire study of general practitioners was carried out in the former Wessex region, England. Randomly selected sample of 25% of all general practitioners (452), of whom 302 replied. The study revealed that the major perceived barrier to evidence based practice was lack of personal time [11]. Time limitations dictate that evidence based practitioners also rely heavily on conclusions from pre-appraised resources, which apply a methodological filter to original investigations and therefore ensure a minimal standard of validity (e.g. Cochrane Library or ACP Journal Club) [12].

Another clinicians´ barrier to evidence-based practice is lack of specific skills[12]. They have difficulty finding, assessing, interpreting, and applying current best evidence [13].

1.3 Clinical Information Sources

Doctors need to be linked to the medical research literature in a way that allows them to routinely obtain up-to-date, outcomes-based information [7]. Most of the questions generated by doctors can be answered, usually from electronic sources, but it is time consuming and expensive to do so-and demands information skills that many doctors do

not have [6].Thoughnew resources focused on clinical doctors´ information needs (e.g. Clinical Evidence or Evidence Updates) have been created, new information tools still are needed [4], [6]. They should respect the "3Rs" of evidence communication, which are reliability, relevance, and readability [4]. They are likely to be electronic, portable, fast, easy to use, connected to both a large valid database of medical knowledge and the patient record, and a servant of patients as well as doctors [6].

Some of the features mentioned above can be accomplished by means of the Internet. Doctors are increasingly proficient with the Internet. Searching with Google came out as useful means to formulate a differential diagnosis in difficult diagnostic cases [14]. Yet doctors are seeking new methods of information discovery because of the limitations of search engines [15]. Also the use of MEDLINE/PubMed to answer daily medical care questions is limited because it is challenging to retrieve a small set of relevant articles and time is restricted [9].

The Web 2.0 proved a potent platform able to provide right tools for the above mentioned tasks. Its applications and services are characterized by features enabling collaboration, information sharing and aggregation, composition of independent services and provision of rich user interaction [16]. Using an RSS doctors can fight information overload. RSS feeds enable to them to organize new web content sent to them by various medical websites in a single interface of an RSS reader [15]. All of the facts described above motivated us to develop an information system aimed at targeted dissemination of the best available evidence from the cardiology by means of tools and services of the Web 2.0.

2 Cardio Online Reader/COR

The COR (Cardio Online Reader) application is based on domain focused records of scientific publications, which are presented using Web 2.0 technologies. The application functions as an online RSS reader and database of selected types of scientific articles. In the process of selecting information we put the accent on their high reliability and clinical relevance according to principles of evidence-based medicine. The articles have been gained from the biomedical database MEDLINE/PubMed. The automated script periodically loads selected records from free accessible interface of the PubMed and stores them in the own fully searchable database of the COR. Afterwards the most recent articles are displayed at top positions of the COR title web page. The user interface of the COR was developed with an accent on ease of use and simplicity of control.

The goal of the COR is to simplify tracking and searching for methodologically valid and clinically relevant publications to disseminate the latest piece of knowledge from the clinical research to the clinical practice, and to create a space for discussion about these findings and articles. These goals are reached by following attributes and functions:

- The online reader presents articles selected from the MEDLINE/PubMed database.
- The articles have been chosen according to criteria of evidence-based medicine, specifically methodological reliability and clinical relevance. For that reason content of the application is created from five types of articles. They are Guidelines

(G), Practice Guidelines (PG), Systematic Reviews, (SR), Systematic Reviews with Meta-Analysis, (SR&MA), and Randomized Controlled Trials (RCT). Separate types of articles are marked by variously colored graphical elements.

- A default page of the application contains a chronological list (in the reverse order, latest articles are on top of the list) of abbreviated records in the following format: article title – article authors – the date of enlisting to the PubMed". Besides that the number of comments and user rating for each article are also displayed.
- A directly accessible detailed display of the record consists of bibliographical data, generally the abstract of the article, link to the full text (placed at its original location), and link to the original MEDLINE/PubMed record (which can be accessed in a new browser window). Furthermore each article can be rated using a five-point scale within the detailed display of the article record.
- A search form can be filled out by keywords, MeSH terms, author name, and type of an article. Search results can be limited by a time filter including a graphical calendar. The full text search works with Boolean terms. The interface of the COR application provides also a form enabling a direct retrieval of PubMed using the Entrez system.
- The articles are tagged by MeSH terms, which are displayed as a tag cloud showing the relative frequencies of MeSH terms ("MeSH cloud"). A simple MeSH cloud consists from about sixty the most frequent terms within the selected type of articles (or within all articles, if no type of article is selected). The cloud is displayed in the right column of every page. A complete MeSH cloud (or a MeSH list in alphabetical order) can be accessed by provided link. These lists are built from all MeSH terms contained in all articles enlisted in the COR database. An user can simply add each MeSH term to the search form by clicking on it.
- There are implemented web services enabling viral propagation of the whole application, as well as the individual articles. Users can use the Facebook social network or the Twitter microblog as well as social news websites, social bookmarking websites, and many blogging platforms. The application is connected with web services providing social bookmarks including tools for archiving and sharing expert publications as Connotea or CiteULike.
- Users can trace activities related to the COR through Facebook or Twitter, YouTube, blog, and/or. They can also subscribe to website actualizations via integrated RSS feeds.

3 Discussion

The presented web application uses freely accessible source of biomedical bibliographic information and brings the added value of domain specific focus (cardiology). Its development is concentrated on quality, simplicity, and usability.

We plane to develop a fully individualized interface, predefined filters, list of favorite articles, authors or MeSH tags, and other advanced functions and tools for registered users in next versions of the application. There is also a need for at least basic registration process to ensure the chance to archive the authorship of comments

and ratings. A big deal will be to adjust the application to future trends in information sharing, as they develop spontaneously.

4 Summary

We introduce the Cardio Online Reader/COR, which is a medical information resource focused on cardiology. It is intended to support clinical decision-making and medical care based on evidence ("Evidence-Based Health Care"). The application is therefore designed to facilitate both monitoring and searching for scientific evidence to doctors, and to streamline the transfer of the latest findings of clinical research into the clinical practice. The content has been acquired from one of the leading biomedical databases, MEDLINE/PubMed, and has been equipped with tools and services specific for Web 2.0. It also offers space for communication of users about the articles by means of comments or via the website forum. So emerging content generated by a community of users-professionals ("user-generated content") will be an added value to complement the core of a purely scientific content of the database. A beta-version of the COR is available at http://neo.euromise.cz/cor.

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