REVIEWS

Fostering Diffusion of Scientific Contents of National Societies Cardiovascular Journals: The New ESC Search Engine

Fernando Alfonso[1,2], Lino Gonçalves[3], Fausto Pinto[1], Adam Timmis[1], Hugo Ector[1],Giuseppe Ambrosio[1], Panos Vardas[1], On behalf of the Editors' Network European Society of Cardiology Task Force
Author Affiliations

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Vedat Sansoy (Editor-in-Chief, Archives of the Turkish Society of Cardiology),
Valentin A. Shumakov (Editor-in-Chief, Ukrainian Journal of Cardiology),
and Thomas F. Lüscher (Editor-in-Chief, Kardiovaskuläre Medizin)

Abstract: European Society of Cardiology (ESC) National Society Cardiovascular Journals (NSCJ) are high-quality biomedical journals focused on cardiovascular diseases. The Editors´ Network of the ESC devises editorial initiatives aimed at improving the scientific quality and diffusion of NSCJ. In this article we will discuss on the importance of the Internet, electronic editions and open access strategies on scientific publishing. Finally, we will propose a new editorial initiative based on a novel electronic tool on the ESC web-page that may further help to increase the dissemination of contents and visibility of NSCJ.
Keywords: biomedical journal, editors network, open access, Internet, electronic editions

[1] Nucleus Members Editors' Network of the European Society of Cardiology
[2] ESC Editors' Network Task Force Chair
[3] ESC Search Engine Task Force Chair

Contact address:
Fernando Alfonso MD ESC Editors´ Network Task Force Chair. Interventional Cardiology. Cardiovascular Institute. Clínico San Carlos University Hospital. IdISSC. Plaza Cristo Rey. Madrid. 28040. Spain.
E-mail: falf@hotmail.com

European Society of Cardiology (ESC) *National Society Cardiovascular Journals* (NSCJ) are high-quality biomedical journals devoted to publish original research and also educative material on cardiovascular diseases[1-3]. These journals officially belong to the corresponding ESC national societies. However, many of them have achieved major international recognition, are included in most important bibliometric databases and have gained major scientific impact[1-5]. Some NSCJ offer full-text English content and are freely available from electronic editions. NSCJ, however, are largely heterogeneous and some of them are only published in local languages with a limited visibility[1-3].

The main goal of biomedical journals is to publish high quality scientific information. To achieve this goal, journals should compete for the best research generated in their field being the "prestige" of the journal the main driver to attract original contributions[1-3]. In turn, journals prestige is based upon credibility, diffusion and scientific impact[6]. To ensure that the scientific process is fully respected journals relay in the "peer review" system. This process not only allows the Editors to select the best possible material for publication but also ensure the readers that the quality of the information follows the highest scientific standards. Actually, the process significantly improves the final quality of manuscripts eventually published. Once the article is definitively accepted for publication the Journal should guarantee its expedited publication and widespread diffusion among the scientific community[1-3].

The Editors´ Network of the ESC provides a unique platform to devise editorial initiatives aimed to improve the scientific quality and to facilitate diffusion of contents from NSCJ[1-5]. Herein we will discuss on the importance of the Internet and electronic editions on scientific publishing. We will also review the growing relevance of open access strategies. Last but not least, we will propose a new initiative based on a novel electronic tool that may further help to increase the diffusion, dissemination and overall visibility of NSCJ. This tool, located at the ESC web site, should foster collaboration among the different NSCJ and also broaden exposure from diverse scientific sites and ESC official journals. Hopefully, this will help to further expand the scientific impact of European cardiovascular research.

Electronic Editions and the Internet: A paradigm shift in Scientific Publishing:

Sharing the results of late breaking research through peer-reviewed journals remains the mainstay of the scientific process and the progress in science[1-3]. The success of research requires articles to be read, spread, discussed and cited among interested investigators. Therefore, in the fast moving and globalized world of science, journals should ensure the maximal accessibility and diffusion of their articles[1-3]. Indeed, most publications have already moved into a new "online era" where the emphasis is placed on the Internet and in electronic editions[1-3]. Just a few years ago scholars did all their reading from paper journal issues obtained as personal copies circulating inside their organizations, or by retrieving the issues from library archives[7]. Today the predominating reading mode is to download a digital copy and either read it directly off the screen or as a printout[7]. Currently, readers and investigators readily retrieve articles with just a click on their home or office computers[7].

Interestingly, the Internet not only impacts research but also clinical practice. Nowadays, physicians are frequently approached and challenged by patients who had downloaded medical information from the internet. Often they face either unnecessarily worried patients or patients with unrealistic expectations. Although some patients are confused others are over-informed and demand in-depth explanations regarding their diagnosis, management and prognosis. Patient-oriented information should be provided from the scientific societies to address these demands. Therefore, even everyday clinical practice should accommodate the socio-cultural change induced by the Internet.

Access to medical information has been revolutionized by electronic editions. Likewise, bibliometric databases are also evolving. MEDLINE, the ISI Web of Science and more recently Scopus offer comprehensive online information on medical literature[8-11]. In addition, Google Scholar is increasingly used by many investigators[8-11]. Scopus and specially Google Scholar obtain data from a larger data sources including widely diverse scientific items (not only ISI publications) and therefore offer a slightly different perspective of the field. Interestingly, Google scholar is free and different studies suggest that it provides accurate search and data analyses that differ little from those obtained from classical bibliometric sources[8-11].

Traditionally, the most commonly used source of bibliometric data is the Thomson ISI Web of Knowledge, in particular the Science Citation Index and the Journal Citation Reports, which provide the yearly Journal Impact Factors. Recently, other indicators such as SCImago SJR or the Eigenfactor are emerging as alternative indices of a journal's quality[8-11]. These consider not only the number but also the "quality" or relevance

of the citations received by a given paper. Quantitative publication metrics (research output) and citations analyses (scientific influence) are key determinants of the scientific success of individual investigators and institutions because the "publish or perish" dictum still prevails in most academic settings[8-11]. In this scenario, the electronic editions and accessibility on the Internet certainly play a critical role. Nowadays, once a paper is electronically published on a journal website, the information can propagate rapidly in the community and extremely high downloads could be the results of mechanisms such as the "Matthew effect" (richer get richer)[12]. Indeed, the relationship between the number of citations acquired by an article has been explored in relation to the number of downloads[13]. Hit counts on a journal website for an article during the week after the online publication predict the number of citations of that article in subsequent years[14]. Of note, Uniform Resource Locators (URLs), are being increasingly used in scientific publications[15]. Citation of URLs provide the possibility of calculating an objective electronic impact factor (eIF) to measure their impact on scientific research[15]. However, the stability of URLs remains a matter of concern and this should be guaranteed by the responsible organization because URLs are vulnerable to technical problems and may become inaccessible in a time-dependant manner[15].

Notably, the Internet offers a new window to science and provides new insights on access and use of research16. Currently web-usage-data may be analyzed in depth to outline a "map of knowledge". According to Butler et al[16] when readers click from one page to another while looking through online scientific journals, they generate a chain of connections between links they think belong together. These ‚clickstream events' may be analyzed to map such connections and to provide a snapshot of interconnections between disciplines.

Usage maps reveal how often users looking at an article in journal A moved on to an article in journal B during a browser session. By aggregating all these complex relationships using network-visualization algorithms, maps can be generated based on the ‚distances' between journals and disciplines[16]. The structure of these maps is quite similar to those created using citation data: a network of clusters in different fields within which journals have strong connections with one another but fewer links to other clusters. Interestingly, journals in the humanities and social sciences figure much more prominently in these maps than in citation-based maps[16]. Another key difference between citation- and usage-based maps is that the former only reflect citations by researchers who publish, but ignore the impact of papers on the medical community who read and apply the literature in medical practice but who rarely publish. Citation data may undervalue papers written in practitioner-based fields that are widely read but not cited proportionally[16]. Moreover, usage maps are more up-to-date than citation ones because of the inherent delay in publication therefore providing a different time-slice of the scientific process. Accordingly, both usage and citation data each provide complementary information on the impact of papers and journals on the scientific community[16].

Electronic editions provide unique publishing possibilities and open new venues in scientific communication1-3. For instance, they offer a flexible layout and structure for articles, new formats and the possibility of including additional documentation attached to the paper as media enhancements (videos, etc). Important sections as methods and additional data can be now presented as supplementary material without additional costs. Electronic managing systems facilitate both the processes of peer-review and publishing[1-3]. Open peer-review and even post-publication readers´ comments may be uploaded on the journal website facilitating interactivity and a more transparent and dynamic scientific process. Finally, statistics on electronic papers (downloads and citation metrics) are offered to the interest of readers and researchers[17].

Publicly available data is advocated as a means to further promote transparency in research and a more open science[18-20]. Online editions allow the publication of longer papers free from the economic burden of print charges. Posting the complete anonymized "raw data set" has been advocated

in this regard[18-20]. The raw data can be used to confirm original results by independent analyses but also to explore related or new hypotheses, particularly when combined with other publicly available data sets. From an ethical perspective it appears unacceptable that while patients are willing to share data about themselves with investigators and sponsors these may be unwilling to share the trial data with others. Data sharing has been already successful among genomic investigators. However, this strategy may cause concerns including inappropriate analyses, "data dredging" and drawing inappropriate conclusions[18-20]. The *International Committee of Medical Journals Editors* has developed guidelines for the preparation of raw clinical data for Publi-

cation[18]. Interestingly, this practice has been associated with a 69% increase in citations, independently of journal impact factor, date of publication, and author country of origin[20]. The correlation between publicly available data and increased literature impact may further motivate investigators to share their detailed research data.

On the other hand, the Web 2.0 is also been increasingly used in the medical field[21-25]. RSS feeds, podcasts, personal publishing platforms (blogs), social networks (like Twitter and Facebook), and social media are proposed as innovative tools for the education and update of clinicians. They allow physicians to distribute, share and comment medical information[21-25]. However, the scientific community is less than eager to regard them as equivalent to the traditional models of information dissemination on peer-reviewed medical journals. In this regard, some have proposed that platforms of post-publication peer-review may provide the required safe guard in this new setting[22]. In addition, intuitive browsing of Journals´ content on smartphones and the iPad, is being provided by a growing number of publications (including the *European Heart Journal*)[24] to enhance diffusion of contents[21]. Furthermore, some Web 2.0 technologies facilitate collaborative data collection for clinical trials[23]. Google Docs, for instance, is freely available and allows multiple users to enter patient data into electronic case report forms of multicenter trials through mobile devices[23].

Finally, we should keep in mind that English represents the "*lingua franca*" of science. This is important and efforts should be made within the ESC to prevent tower-of-Babel phenomena in the digital era[1-3]. However, this may create major problems and unique challenges for non-English-speaking investigators and countries[26]. Actually, some NSCJ only publish in their mother tongue and therefore they are not readily accessible to the international scientific community. Some NSCJ have decided to publish their articles in both native language and English, to address healthcare professionals and international scholars, respectively. Difficult concepts are easier to remember in the mother tongue. Interestingly, Public Library of Science journals encourage non-English-speaking authors to provide a version of their article in its original language as supporting material[27]. Science should not be considered an "ivory tower" separated from the rest of society but rather imbedded on it to facilitate its cultural assimilation[27].

Some Editorial Perspectives on "Open Access" Initiatives:

The Internet and the electronic editions set the bases for Open Access (OA) initiatives[28,29]. The two main characteristics of OA publications are: 1) all published contents are freely accessible through the Internet, and 2) readers are given copyright permission as long as authors and publishers receive the adequate attribution[28]. In turn, this model requires two major changes from the traditional –subscription based- model. First, OA shifts the financing of publication from readers (subscriptions fees by individuals or universities) to authors and investigators (through the corresponding funding organization or academic institutions) by mean of articles processing fees[28]. Second, the copyright is not longer used to prevent but rather to stimulate re-publication. Subscription-based journals usually require authors to transfer the copyright to the journal to be empowered to restrict access to paying customers and threat with infringement lawsuits to competing publications. Major subscription-based journals are financed by individuals or medical societies but mainly by bundled e-license agreements between publishers and universities or librarians[28,29]. Electronic individual articles can also be accessed on a pay-per-view basis. Readers are charged one way or the other in the traditional way whereas authors and investigators are charged in the OA model[28,29]. Some commercial publishers charge authors a publication fee to substitute for subscription revenue while significantly limiting reuse. This initiatives, however, should not be considered real OA. Some traditional publishers have recently open to "hybrid" initiatives where authors are allowed (after paying a fee) to make individual articles OA[28,29].

In the early 90´s, pioneer OA journals were founded by individual investigators based on voluntary work and usually were hosted in individual or university servers[29]. Thereafter, many established journals made their articles OA when they implemented their digital editions in parallel with print editions. This was especially the case for official journals from medical societies and in non-English speaking countries in an attempt to increase their readership and impact[30]. In the last decade, new, formal, OA journals flourished using article processing charges to finance publications[29]. Interestingly, some major publishers (BioMed Central, Public Library of Science) became specialized in OA[29]. OA has to major pathways: 1) "Gold" OA (via direct publishing) and 2) "Green" OA (traditional publication in subscription-based journals with parallel openly posting on the Web

the final manuscript). Green open access is delivered by repositories whereas gold open access is delivered by journals (31). Licences range from any kind of reuse providing proper attribution is made (CC-BY) to those that limit commercial use (CC-BY-NC)[31].

The health of the free-access author-pay model may be demonstrated by data showing the steady growing of papers published in OA journals (20% per year) and also in the number of OA journals (15% per year), either as new journals or traditional journals switching to this model[32]. Currently 30% of all peer-review journals in the world are open access[31].

OA benefits science by accelerating dissemination and uptake of research findings. A major advantage of OA is that readers can use any Web-based research tool to access and review the literature[28]. These articles are quickly recognized and their results are readily picked up and discussed by peers[33]. As already mentioned, there are two main modalities of open access: open access journals and self-archiving. Interestingly, some studies suggest[33] that articles immediately published as OA on the journal site (gold route) have higher impact than self-archived or otherwise openly accessible OA articles (green route).

Overall OA initiatives increase diffusion of contents, citations and eventually the impact factor of the corresponding journals[33-35]. Early studies 10 on MEDLINE as "full text on the net" also boosts their impact factor[37]. This bias is explained by the tendency to peruse what is more readily available[37]. OA initiatives also appear to increase the impact factor[33-35]. However, some argue that this effect may confound between open and electronic access. Nevertheless, recent reports, suggest that in most developed countries journals articles receive an increase in citations when they come online freely but experience an additional jump when they first come online through commercial sources[35]. This effect appears to be reversed in poor countries where freeaccess articles are much more likely to be cited[35]. All together these findings suggest that free Internet access widens the circle of those who read and make use of scientific research. In addition, this "OA impact advantage" does not appear to be a "quality bias" from authors self-selecting what to make OA, because some studies suggest that this advance persists after adjusting for many other potential confounders related to the editorial and research quality[38].

Interestingly, a randomized trial on OA publishing analyzed the effects of free access on article downloads and citations[39]. Articles placed in the OA received significantly more downloads and reached a broader audience within the first year. However, in this particular study, OA were cited no more frequently, nor earlier, than subscription-access articles within 3 years. It was suggested that the process of "social stratification", accounting for a concentration of scientific authors at as mall number of elite research universities with excellent access to the scientific literature, might help to explain this apparent paradox[39]. Moreover, this controlled study suggests that real beneficiaries of OA publishing may notbe the research community but rather communities of medical practice that consume, but rarely contribute to, the corpus of literature[39].

As discussed, currently, embargoes are imposed by publishers for economic reasons. This may be a significant barrier to access in biomedical sciences. As previously emphasized, it has been suggested that users favor electronic access and often eschew articles that are not available electronically[40]. In a shy attempt to tackle these problems many journals offer now free access to all articles 6 months after publication and welcome the publication of articles as OA after a fee is paid by the authors.

However, research funding bodies are becoming increasingly sensible to this ethical issue. Many would argue that it is unethical to use the research grants from government (people's money) and not allow the scientific community to have free access to the results of the study. To address such issues, the Berlin declaration suggested the establishment of OA repositories. Every investigator who has received public grants should submit the full text of the paper published from his study to PubMed Central and also ensure self archiving at the corresponding university or research institution. Obviously, OA journals provide an attractive solution to the problem of restricted access to results of publicly funded research[41].

Most countries and founding bodies are currently taking further actions to ensure OA for publicly funded research[41-43]. Researches are compelled to make their work publicly available in repositories (green road) within 12 month of publication. Others bodies even suggest that authors should make their work free by the publisher upfront (gold road). Clearly, research budgets should be re-allocated with this aim although the logistics required and the implications of this change remain a matter of ongoing debate. On July 2012, a new OA policy was announced from the European Union that recommended OA policies for all the member states[31,41-43]. Hopefully, this will represent a para-

digm shift in scientific publishing and will herald a new era of academic discovery.

The ESC Search Engine:

In the last decade the amount of documents and educational materials available inside the ESC websites family increased exponentially. This situation was naturally associated with increasing difficulties for the user to find the information they need. It became quite obvious that a more comprehensive search solution was necessary. This is the reason why the ESC decided to provide a better search experience for the ESC site visitors[44]. The ESC search engine uses semantic analysis to provide the best results from the typed keywords[45]. This search engine project has four goals. First, to provide a single entry point to multiple data sources. In fact, from a single entry point, the user will be able to explore ESC rich database of slides, scientific reports, guidelines, abstracts, clinical cases, news, and articles from the ESC Journals. Second, to propose a tool which can treat requests expressed in natural language, in a very user-friendly way. Third, to locate content that would be difficult to find or access otherwise, therefore saving a lot of precious time. Finally, to allow visitors to find contents by topic or person in an intuitive way.

In 2008, the ESC Board chaired by Roberto Ferrari, decided to support the development of a semantic search engine that would be able to search for information inside the ESC Central website and all the six Associations websites, as well (EHRA, EAE, EAPCI, HFA, EACPR, ACCA). This idea was based on the previously reported need of providing to the user a quick and easy way of getting the information needed from hundreds of thousands of documents available in all these websites. Moreover, this engine is also looking into the ESC journals' family were it is possible to get results from more than 30 000 papers! Not surprisingly, this tool was a major success, being already the second most visited page of the ESC website, with 49,853 page views, in October and November of 2012[46]. With the help of this search engine it is now extremely easy to get the information you need by just typing the key words on the top right hand side of the screen, inside the www.escardio.org landing page (**Figure 1**). The result is a list of documents addressing that specific topic, and it is up to the user to select the ones they want (**Figure 2**).

Inside this results page you can get a lot of information and functionalities. Within the document preview you can see how the document looks like (**Figure 2**). The relevance score assigned to this document is also displayed by the search engine. The type of document is also presented (guideline, abstract, slide presentation, scientific report, news, clinical case, or a web document). The document origin can also be easily identified at a glance through a small institutional logo which can also be found inside the results page, just below the icon showing the type of document. Also important to know is the document availability. A padlock symbol is displayed when a document is behind a login so that you can still see that the resource exists, meaning that its access is for members only. This tool also allows to refine the search by using filters located on the toolbar located on the left. With this toolbar you can filter the type of document you are looking for (only slides for example). It is also possible to filter only results from a given time period. During a congress, when a lot of content is published daily, you may filter for what's new since yesterday, or you can filter only the results where a person is cited. Related terms are proposed by the engine from the keywords entered in your request to propose other related topics which could be of interest. If you search the same term on a regular basis, you could be interested in using the RSS feed functionality. We may show any search result page as an RSS feed which you may subscribe to, and get regular updates about what's new in this field.

Time has come to involve the National Societies' Journals!

This project is already in its adulthood and time has come now to enter into a second phase of development and involve also the NSCJ. The ESC Board chaired by Michel Komajda decided to support the development of this project. The ESC Editor's club gave also an enthusiastic response and decided to contact those NSCJ that are already published in an electronic format and that are published in English. Some of them have already a significant Impact Factor. The goal of this second phase of the project is to increase the visibility of the NSCJ and as a consequence to increase their reading and their level of reference in other international journals. Moreover, the excellent research that is performed at the National level in many countries in Europe will become more visible worldwide.

This new tool is already available and you will be able to get, after typing the keywords you can get two results: one from the ESC documents, and a second one from the NSCJ. It will be possible for the user to see both in parallel and easily move from one result to the other with a simple click.

The first NSCJ have been added to the search results and can now be easily identified and selected. The

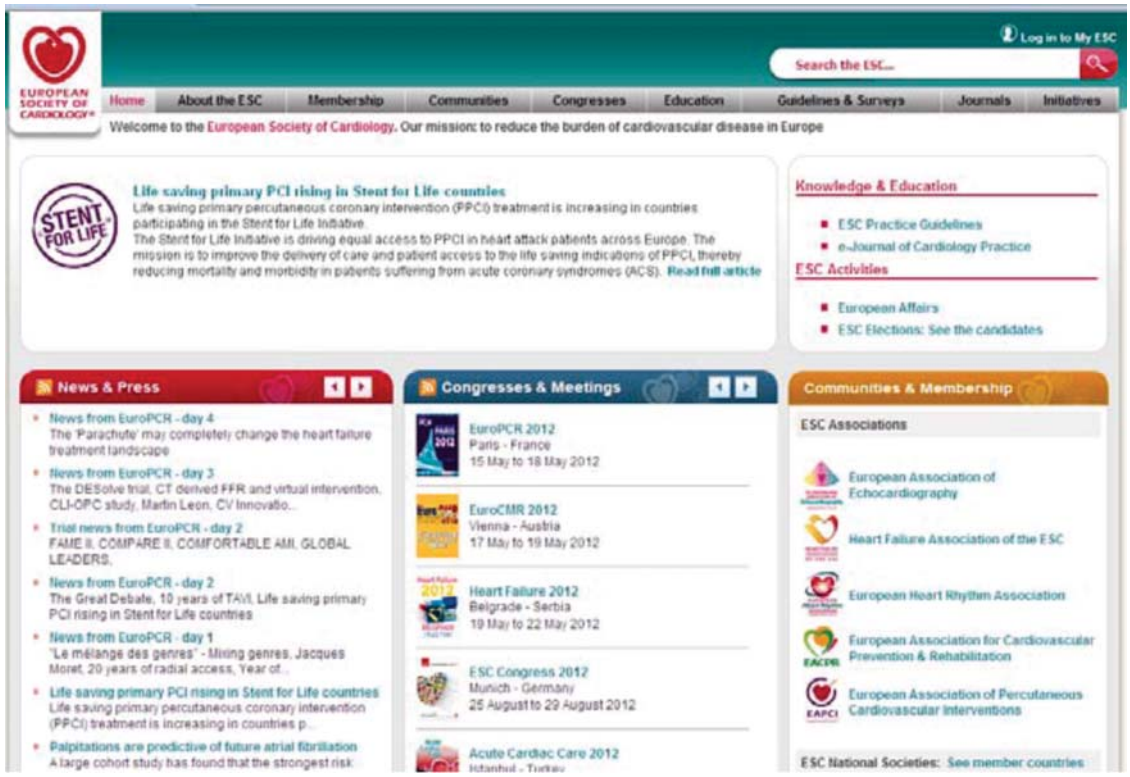

Figure 1. ESC website landing page. The search engine box is located on the top right hand side of the screen (arrow).

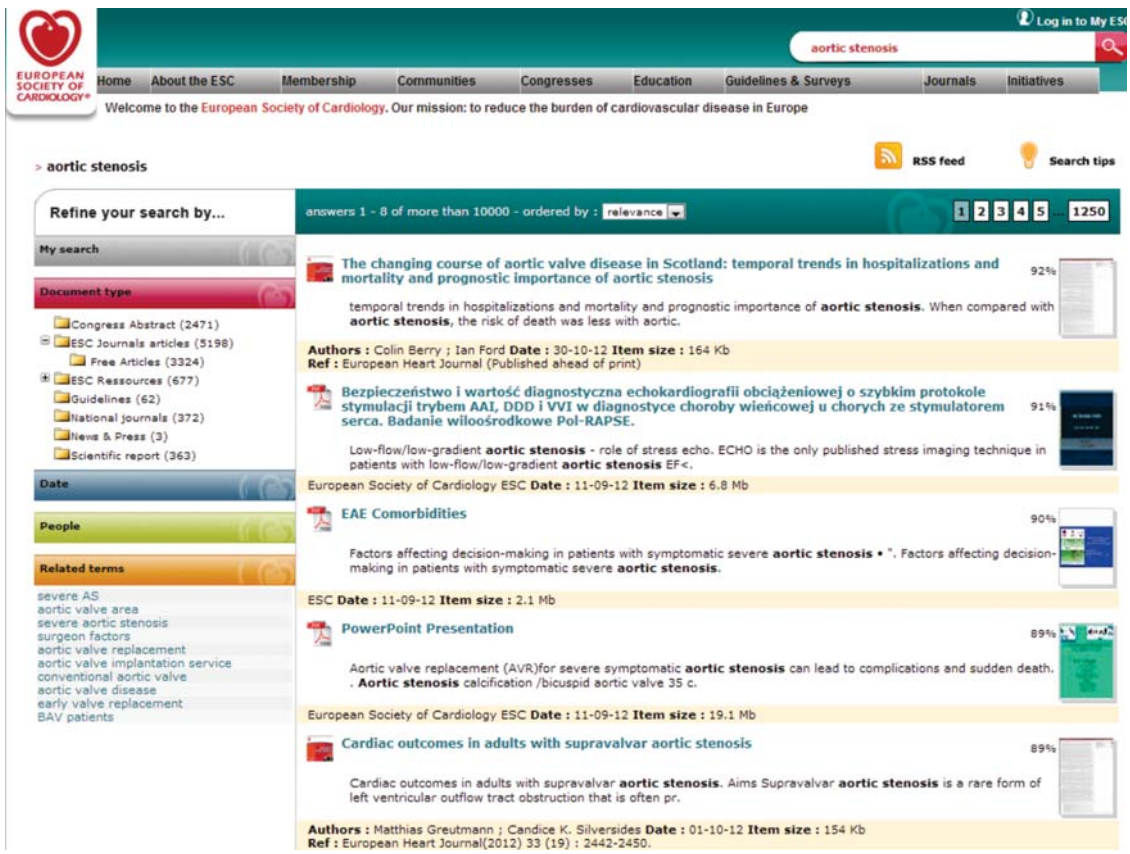

Figure 2. Results page with relevant information about the documents found. On the right, there is a toolbar with a filtering system to refine the search.

first five journals are: Revista Española de Cardiología, Heart and Blood Vessels, Journal of the Cardiology Society of Serbia, Hellenic Journal of Cardiology, Egyptian Heart Journal, and Romanian Journal of Cardiology. An arrangement has been made with the Brazilian Society of Cardiology and its website should soon include our Search Engine. This is an interesting way to raise awareness about this very useful tool and allow the Brazilian cardiologists to have better access to our scientific resources.

There is no doubt in our mind that by providing this tool the bonds between the ESC central and the National Societies will be strengthen even further and that European Cardiovascular Science will become more visible and easily accessible from any place in the world.

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