Update

How to Access the Biomedical Literature and Bridge the "Digital Divide" in Pulmonology*

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In poor and underdeveloped countries, including Brazil, pulmonologists have great difficulty in maintaining a level of service that keeps pace with advances in current knowledge, in keeping up to date with newly developed techniques, and in pursuing research. Due to the rising costs of scientific journal subscriptions, one of the main problems is lack of access to the scientific literature. The term "digital divide" refers to the gap between those who can and those who cannot effectively use new information technology and tools such as the Internet to communicate within and between countries. In this report, we call attention to some solutions to this situation. In particular, the SciELO Project, the CAPES Periodicals portal and the HINARI project, as well as several others, provide access at little or no cost. These options are explained in detail herein.

Key words: Pulmonary Disease (Specialty), Internet. Bibliography. Resource Guides.

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INTRODUCTION

In poor and underdeveloped countries, including Brazil, pulmonologists have great difficulty in maintaining a level of service that keeps pace with advances in current knowledge, in keeping up to date with newly developed techniques, and in pursuing research. Due to the rising costs of scientific journal subscriptions, one of the main problems is lack of access to the scientific literature. The term "digital divide" refers to the gap between those who can and those who cannot effectively use new information technology and tools such as the Internet to communicate within and between countries[1].

Using a personal computer (PC) connected to the Internet, it is possible to build a sort of electronic library at an initial cost of approximately R$3000 (average cost of a PC) plus an additional monthly expenditure of approximately R$40 for electronic access, usually via the telephone line (dial-up access), to a commercial service provider.

Approximately 2.5 million scientific articles are published annually in more than 24,000 journals, of which a little more than 10% are medical journals. These gigantic figures point out the need for digital databases that are indexed and easy to reference. It is relevant to mention that there is a worldwide movement to consider the cost of storing scientific articles in such databases as an inseparable and integral part of the cost of scientific publications. This cost should be covered by the research grant or by the institution undertaking the research [2]. The Budapest Open Access Initiative (BOAI, http://www.soros.org/openaccess/) provides a very lively forum for the debate of this and many other correlated issues. The BOAI presents a declaration of principles as well as an action plan that aims for "open access to peer-reviewed research articles, and the proofs that precede them, from all academic fields". This declaration was formally issued in Budapest on February 14, 2002. Three days later, the millionaire George Soros made a donation of US$3 million to the BOAI. This donation has been of inestimable value to the initiative (http://www.infotoday.com/newsbreaks/nb020218-1.htm).

In order to bridge the "digital divide", there are some access routes, at little or even no cost, to important (although, unfortunately, still very limited) portions of the electronic biomedical literature. These access routes are explored in detail herein.

To access titles and abstracts of articles totally free of charge, the service portal PubMed may be accessed via Entrez (http://www.ncbi.nlm.nih.gov/PubMed/). Entrez is a text-based search engine used by the National Center for Biotechnology Information to provide access to its larger PubMed, Nucleotide and Protein Sequences, Protein Structures, Complete Genomes and Taxonomy databases. This tool is extremely useful for exploring the current biomedical literature on any topic or subject. From the result of the search, we can select the most relevant articles and then search for the full texts. It is certainly one of the reasons identified for the decrease in the use of print material in the majority of medical libraries[3].

For open access (see the definition in the Till paper)[4], or low-cost access, to the full texts of scientific articles, there are some electronic portals available. However, most are quite limited – either in the number of journals accessible, as in the case of PLoS or BioMed Central, or in the type of user allowed, as on the Health Internetwork Access to Research Initiative (HINARI) site.

Abbreviations used in this paper:
BOAI – Budapest Open Access Initiative
DOAJ – Directory of Open Access Journals
FAPESP – *Fundação de Amparo à Pesquisa do Estado de São Paulo* (Foundation for the Support of Research in the state of São Paulo)
HCPA – Hospital de Clínicas de Porto Alegre (Porto Alegre Clinical Hospital)
HINARI – Health Internetwork Access to Research Initiative
ISI – Institute for Scientific Information
NDLTD – Networked Digital Library of Theses and Dissertations
NLM – National Library of Medicine
WHO – World Health Organization
PC – Personal computer
PloS – Public Library of Science

The Public Library of Science (http://www.publiclibraryofscience.org/)

The Public Library of Science (PloS) is a nonprofit organization of physicians and scientists committed to making the world scientific and medical literature a freely available public resource. The following text is reproduced in full from the organization website:

"The Internet and electronic publishing enable the creation of public libraries of science containing the full text and data of any published research article, available free of charge to anyone, anywhere in the world. Immediate unrestricted access to scientific ideas, methods, results, and conclusions will speed the progress of science and medicine, and will more directly bring the benefits of research to the public.

To realize this potential, a new business model for scientific publishing is required that treats the costs of publication as the final integral step of the funding of a research project. To demonstrate that this publishing model will be successful for the publication of the very best research, PLoS will publish its own journals. PLoS Biology launched its first issue on October 13, 2003, in print and online. PLoS Medicine will follow in 2004.

PLoS is working with scientists, their societies, funding agencies, and other publishers to pursue our broader goal of ensuring an open-access home for every published article and to develop tools to make the literature useful to scientists and the public."

Unlike the BOAI, which supports free access as of the date of the publication of the research article, the PLoS accepts a six-month up to a two-year delay, although it propagates immediate free access as the ideal.

Health Internetwork Access to Research Initiative (http://www.healthinternetwork.org)

The Health Internetwork Access to Research Initiative (HINARI) was launched by the Secretary General of the United Nations (UN) in September of 2000 and is led by the World Health Organization (WHO). The initiative has brought together public and private partners under the principle of ensuring that the public health services of the countries in question have equitable access to health information. The core elements of the project are content, Internet connectivity and progressive capacity building.

More than 2000 scientific publications are available via the HINARI portal. This collection was initially compiled through a joint effort of the WHO and the six largest biomedical publishers: Blackwell, Elsevier Science, Harcourt Worldwide STM Group, Wolters Kluwer International Health & Science, Springer Verlag and John Wiley. Landes Bioscience and 22 additional publishers later joined the group. It has been described by WHO Director-General Dr. Gro Harlem Brundtland as "perhaps the biggest step ever taken towards reducing the health information gap between rich and poor countries."

Currently, HINARI has 99 developing countries on its list of beneficiaries. Unfortunately, Brazil is not eligible since, based on the 1998 World Bank figures, it has a per-capita gross national product (GNP) higher than the limit set by the UN. Institutions in countries with per-capita GNPs below US$1000 are eligible for free access. Institutions in countries with per-capita GNPs between US$1000 and US$3000 are eligible for access at reduced prices.

In an editorial published in the February 2003 issue of the British Medical Journal, Richard Smith evaluated the first two years of HINARI use as less than excellent[5].

Other free-access portals

The portals listed below provide free access to many collections of journals or biomedical publications such as theses, book chapters, etc.

BioMed Central
(http://www.biomedcentral.com)
Free Medical Journals
(http://www.freemedicaljournals.com)
Free Books for Doctors
(http://www.freebooks4doctors)
PubMed Central
(http://www.pubmedcentral.nih.gov/
SciELO (http://www.scielo.org)
CAPES Periodicals
(http://www.periodicos.capes.gov.br/)
Directory of Open Access Journals DOAJ
(http://www.doaj.org/)
SPARC (http://www.arl.org/sparc/)
PathMax (http://www.pathmax.com/)

BioMed Central

The original research articles published in the journals indexed on BioMed Central are open access. They are immediately and permanently available online at no charge. A number of journals require an institutional or a personal subscription to view other types of articles, such as reviews or reports.

One may, of course, access the complete list of journals. However, although there is no clinical journal available for pulmonologists, we believe that the basic science journals below may be of particular interest:

BMC Cancer
BMC Cell Biology
BMC Clinical Pathology
BMC Molecular Biology
BMC Public Health
BMC Pulmonary Medicine
Cancer Cell International
Cell & Chromosome
Journal of Biology
Journal of Carcinogenesis
Molecular Cancer

Free Medical Journals

The Free Medical Journals site is dedicated to the promotion of free access to medical journals over the Internet. There are currently 1350 medical journals accessible via this portal with access, in general, to content as far back as the 1990s. The following are the most relevant pulmonology journals:

American Journal of Respiratory and Critical Care Medicine
Asthma Magazine
BMC Pulmonary Medicine – free one year after publication
Chest - free one year after publication
Enfermedades del Tórax
Euro TB
Indian Journal of Chest Diseases and Allied Sciences
Jornal de Pneumologia
Primary Care Respiratory Journal
Pulmonary and Critical Care Update
Pulmonary Perspectives
Respiratory Research
Revista Chilena de Enfermedades Respiratorias
Thorax – free one year after publication

The most pertinent journals outside the specialty are the following:

BMJ – unrestricted access at no charge
Circulation – free one year after publication
Current Allergy and Clinical Immunology
Journal of Clinical Investigation
Journal of Infectious Diseases – free two years after publication
Molecular Biology of the Cell – free two months after publication
Molecular and Cellular Biology
New England Journal of Medicine – original articles free six months after publication
Occupational Medicine - free two years after publication
Radiology - free two years after publication
Science – free one year after publication

PubMed Central

PubMed Central (PMC) is a digital archive of life sciences literature from the collection of the U.S. National Library of Medicine (NLM). Access is free and unlimited. The NLM is digitizing all back issues of the journals on its list in order to make them available on the PMC site. Through this portal, we can access the journals:

Respiratory Research
BMC Pulmonary Medicine

The Scientific Electronic Library Online

The information below has been extracted from the Scientific Electronic Library Online (SciELO) portal and illustrates how this model of access to technical and scientific information works.

"Adequate and up-to-date access to technical and scientific information is essential for social and economic development, especially for supporting decision-making processes in the planning, formulation and implementation of public policies or for supporting professional development and practice. The results of scientific research are communicated and validated mainly through publication in scientific journals. This process is valid for either developed or developing countries. Nevertheless, scientific journals in developing countries are faced with serious obstacles to distribution and dissemination. This limits access to and use of the scientific information generated locally."

The SciELO project is a model for cooperative electronic publication of scientific journals on the Internet. Especially designed to respond to the scientific communication needs in developing countries, particularly in Latin America and the Caribbean, this model provides an effective solution to the problem of how to ensure visibility and universal access to their scientific literature, thus helping surmount the phenomenon known as "lost science". The SciELO model comprises a set of integrated procedures for measuring the usage and impact of scientific journals.

The SciELO model is the product of a partnership that includes the *Fundação de Amparo à Pesquisa do Estado de São Paulo* (FAPESP, Foundation for the Support of Research in the State of São Paulo; http://www.fapesp.br), the Latin American and Caribbean Center on Health Sciences Information (BIREME; http://www.bireme.br) and science editors, as well as national and international institutions related to scientific communication. With the aim of developing and evaluating an appropriate methodology for electronic publishing on the Internet, a pilot project involving 10

Brazilian journals, each from a different field, was successfully carried out from March 1997 to May 1998. Since June 1998, the project has been operating regularly, progressively incorporating new journal titles and expanding its operation to other countries. Since 2002, the project has had the support of the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq – Brazilian Council for Scientific and Technological Development; http://www.cnpq.br).

The SciELO model comprises three components.

The first component is the SciELO methodology, which permits the electronic publishing of complete editions of scientific journals, the organization of bibliographic and full-text databases, content-based text retrieval and the preservation of electronic archives, as well as the production of statistical indicators of the usage and impact of this literature. The methodology also includes criteria for journal evaluation based on international standards for scientific communication. The full texts are enriched with hypertext links to national and international databases, such as LILACS and MEDLINE.

The second component of the SciELO model is the application of the SciELO methodology to the operation of web-based digital libraries of scientific journals. The SciELO model favors the operation of national sites as well as thematic sites. The pioneer web site is the SciELO Brazil site (http://www.scielo.br). Other web sites are also in regular operation in Chile (http://www.scielo.cl) and in Cuba (http://www.scielo.sld.cu). Several other countries are evaluating SciELO and/or are in the process of being trained on the SciELO methodology. SciELO for Public Health (http://www.scielosp.org), a regional thematic library covering Public Health scientific journals from Latin America and Spain, was launched in December 1999. A portal designed to integrate and provide access to the SciELO network of sites is in operation at http://www.scielo.org.

The third component of the model is the development of partnerships among national and international scientific communication players – authors, editors, scientific and technological institutions, funding agencies, universities, libraries, scientific and technological information centers, etc. - aimed at disseminating, improving and upgrading the SciELO model. The operation of the SciELO network depends heavily on national infrastructures. This contributes to ensuring the future sustainability of the SciELO model.

The inclusion of the Brazilian Journal of Pulmonology in the SciELO portal[6] was a great victory for Brazilian pulmonology. As a result, Brazilian scientific production in this specialty no longer falls into the category of so-called "hidden or lost science"[7].

The CAPES periodicals portal (http://www.periodicos.capes.gov.br/)

Brazilian researchers working in any of the more than one hundred authorized universities, research institutions and federal hospitals may access a great number of international journals through the CAPES periodicals portal. In 2004, in addition to the free-access journals available, renewals and new acquisitions will make a total of 4,585 pay-per-view full-text journals available (an increase of approximately 30% in relation to 2003), including the addition of large corporations such as Kluwer, Oxford and Springer. However, we cannot forget that electronic subscriptions cost millions of dollars that could, if these were open-access journals, be invested in research support, equipment and grants.

Authorized Argentine researchers may access the same journals through their *Biblioteca Electrónica de Ciencia y Tecnologia* (http://biblioteca.secyt.gov.ar/). Both portals also allow access to the Institute for Scientific Information (ISI) Web of Knowledge, on which any scientist may identify by whom, where and when any given article in the modern scientific science was cited, although, it must be noted, only in the journals indexed by that company.

These are the principal journals available:

Ann Thorac Surg
Chest

The Directory of Open Access Journals (http://www.doaj.org/)

The Directory of Open Access Journals (DOAJ), sponsored by the Lund University Libraries, encompasses a collection of free, full-text journals under quality control. It aims to cover all subject areas and languages. It belongs to the SPARC group (see below). Currently, there are 551 journals in the directory. The BMC Pulmonary Medicine site

is also accessible via this portal (see BioMed Central above).

The Networked Digital Library of Theses and Dissertations (http://www.ndltd.org/)

The Networked Digital Library of Theses and Dissertations (NDLTD) is a digital repository of theses and dissertations maintained by Virginia Tech University (USA). There are innumerable issues on pulmonology and related sciences available. The site has a very efficient search engine. It is worth visiting and navigating when searching for information or ideas for research projects. It would be interesting if all Brazilian post-graduate programs created a similar database, perhaps within the SciELO portal.

The Scholarly Publishing and Academic Resources Coalition (http://www.arl.org/sparc/)

The Scholarly Publishing and Academic Resources Coalition (SPARC) is an alliance of universities, libraries and research institutions, mounted as a response to market dysfunctions in the scholarly publishing system. It is widely known that these dysfunctions, especially the high cost of subscriptions, have reduced dissemination of research and decreased the efficiency of many libraries. Serving as a catalyst for action, SPARC helps create systems to expand the dissemination of information as well as to promote its use in a networked digital environment, thus addressing the needs of researchers and professors. Examples: DOAJ (http://www.doaj.org/) and FIGARO (http://www.figaro-europe.net/).

PathMax (http://www.pathmax.com/)

PathMax is a large meta-index of pathology, with more than 3200 links, including almost all of the pathology disciplines on the Internet. Each link is evaluated for its potential usefulness to the target audience. It is easy to use, and it is updated by Dr. Shawn E. Cowper, MD and his team of volunteer assistants, who deal with specific topics. There are a large number of accessible sites providing information on respiratory pathology. The cytopathology directory is under our supervision and the microscopy directory is under the supervision of Dr.Vinicius Duval da Silva, our collaborator. In the surgical pathology directory, there is a thoracic and pulmonary pathology subdirectory, under the supervision of Dr. M. McCormick, with very useful links such as one to a site that evaluates the results of a bronchoalveolar lavage, several to self-evaluation tests for pulmonary pathology, and even one to the latest information on SARS from the CDC in Atlanta. We use these resources quite frequently in our pulmonary pathology classes.

The passage below was excerpted from the initial page of the PathMax site and explains its mission:

"PathMax and its mirrors were created to allow pathologists, residents, and other medical professionals to utilize the resources of the World Wide Web speedily and effectively. Each link is personally visited by the author and individual topic link editors and evaluated for its potential usefulness to the target audience. (...) Those wishing to link to this site need not obtain permission. There is no charge for PathMax, nor will there ever be. (...)"

The site has a mirror in the CAP Superlinks (http://www.cap.org/superlinks/).

The Ptolemy project (http://www.utoronto.ca/ois/myweb9/index.htm)

Devised by Dr. Massey Beveridge, a surgeon at the University of Toronto[8], Ptolemy is ingeniously simple. Instead of providing electronic access for medical schools or research institutions, Ptolemy provided electronic access for 100 practicing physicians – in this case, all of them from East Africa. To make this possible, the University of Toronto named these physicians research affiliates of its Office of International Surgery and set up proxy servers in Toronto in order to accommodate them. The university already had user license agreements for its research affiliates. This immediately provided the African physicians with free access to the electronic subscriptions of the University of Toronto library, the largest medical library in Canada and the third largest in North America. This includes 20,000 full-text journals, hundreds of medical books and many other electronic resources.

The beauty of the project is that it is modular and may be expanded according to oriented and monitored demand, lending itself to adoption by other first-world universities in the aid of third-world physicians.

CONCLUSION

Although still limited, there are a large number of medical journals that may be accessed at moderate cost by our pulmonologists, especially by those who have access to the CAPES periodicals portal. For those who do not have access to the CAPES portal, there is still a need for a more far-reaching mechanism whose long-term sustainability could be ensured. The exclusion of Brazil from the HINARI project is a great pity; an irony of fate, actually, since our per-capita GNP makes us ineligible. Our community should work more effectively so that all of us can bridge the digital divide. I have joined the editorial team of an electronic journal on cytopathology, my main area of expertise. This journal will be launched in 2004. An important step would be to insist that all research promoted and financed by the government be made widely available online, free of charge to the users.

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