Cost-Effectiveness of a medical digital library

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ABSTRACT

The rapid increase in the price of electronic journals has made the optimization of collection management an urgent task. As there is currently no standard procedure to evaluate this problem, we applied the Reading Factor (RF), an electronically computed indicator used for the consultation of individual articles. The aim of our study was to assess the cost effective impact of modifications in our digital library (i.e. change of access from the intranet to the internet or change in editorial policy).

The digital OVID® library at Rouen University Hospital continues to be cost-effective in comparison with the interlibrary loan costs. Moreover, when electronic versions are offered alongside a limited amount of interlibrary loans, a reduction in library costs was observed.

Introduction

The rapid increase in journal prices, both electronic and printed, has made the optimization of collection management both essential and urgent especially in academic health sciences libraries [1-2]. There is however, no standard tool available to accurately assess its financial implications. During the 1970's, manual attempts to count exact number of photocopies or journals left on the table were made [2-3]. This approach was time consuming and has since been discontinued because of the monopoly of the Impact Factor and more recently due to the introduction of digital libraries and electronically computed indicators such as Reading Factor (RF) [4]. RF calculates the relative electronic consultation rate of a medical journal at a given institution. It is defined as the ratio between the number of electronic consultations of a particular journal (i.e., number of clicks on a hyper-link) and the mean number of electronic

consultations of all the journals studied (this is calculated by dividing the total number of electronic accesses by the number of journals in the database).

At Rouen University Hospital (RUH), a medical digital library was created in 1997 [5]. This allows all 306 senior physicians to access Medline and 45 electronic full text journals directly from their offices without charge. Within the limits of these 45 journals, all full text articles were directly accessible either via Medline or the individual journal's table of contents.

In September 2000, three major events occurred: Firstly, the medical librarian decided to modify the access to our Electronic Library (EL) from Intranet to Internet because the Internet provides a much better update than the Intranet (>3 months difference). Secondly, a change of editorial policy by Ovid took place, giving users the opportunity to access the data not only by packages of 15 journals, but also individually. This latter option and the Internet access are more expansive as compared to the Intranet and package solution. Furthermore, we were obliged to keep library acquisition costs to a minimum. Therefore, we found it useful to assess the cost effectiveness of our library.

METHODS

Ovid® is a company, which has been providing full text electronic journals available directly or through a Medline search. These journals are provided as packages known as Biomedical Collections volumes I, II, and III, each containing 15 journals. They have been available at RUH since June, September and December 1997, respectively, via the RUH Intranet. The content of each package is selected by Ovid. It is based on the coverage of major biomedical specialties, journal impact factors, agreements with publishers, and commercial aims. All 45 journals are listed in table 1.

In order to obtain a standardized measure of the consultation rate, we defined RF as the following equation (1):

$$RF_j = \frac{C_j}{\frac{\sum C_j}{N}} \qquad (1)$$

where Cj is the number of electronic consultations of journal j and N is the total number of journals available in the database. Thus a value of 1 represents an average consultation rate, while a value greater (respectively lower) than 1 represents a higher (respectively lower) than average consultation rate.

Based on the number of electronic consultations of a given journal and the subscription cost, it is possible to calculate the cost of individual consultations and its cost effectiveness compared to interlibrary loan costs. The number of electronic consultations was automatically extracted from log files using Ovid software. This number is increased each time an end-user clicks on a hyper-link in order to access an individual publication.

The prices for 2001 subscription were quoted by Ovid, or directly by editing companies when the journals were no longer available via Ovid. Ovid prices are dependant on the institution (e.g. number of hospital beds, number of journals, number of connections, contents). The mean cost of an interlibrary loan was calculated based on individual costs during the same calendar year. This cost depends primarily on the speed of the answer (fax, Email or normal mail service), the number of pages in the article, and the type of library.

RESULTS

During the year 2000, an interlibrary loan to access an article cost, on average, US $ 3.80 in France. In 1998, the total number of electronic journals' consulted in our institution was 5007, 8280 in 1999, and 10 893 in 2000 (+31% in one year and +118% in two years). The average cost of each electronic article was US $ 3.92 in 1998, US $ 2.53 in 1999 and US $ 1.89 in 2000.

In the year 2000, the third calendar year with full electronic availability of the 45 journals (listed in table 1), the average cost of consulting an article in the Biomedical Collection I was US $ 1.41, US $ 1.53 in Biomedical Collection II and US $ 3.46 in the Biomedical Collection III.

Prices for 2001 increased by approximately 20%, taking in account monetary erosion, quicker availability of information and the four journals that are no longer distributed by Ovid (Canadian Medical Association Journal, Lancet, Pediatrics, Science) and have to be separately purchased. The average annual subscription cost for 2001 was US $ 590. Table 1 details the respective costs for each 45 journals of the electronic library in 2001.

[Insert table 1 about here]

Table 2 summaries the different simulations we calculated in order to optimize our strategy. We simulated the cancellation of the less cost effective subscriptions and calculated the additional cost of an equivalent number of interlibrary loans. In general, the subscription cancellations did not produce sufficient savings to balance the general increase in costs. However, a break-even point can be achieved by off-setting journal subscriptions by interlibrary loans. A cancellation of the nine most expensive journals led to break-even point in 2001, with a total of 390 loan demands.

[insert table 2 about here]

DISCUSSION

Digital libraries have become an essential tool in medical education. The theme of the 2001 Yearbook of Medical Informatics was Digital Libraries and Medicine. Haux and Kuliwoski [6] defined this topic as one of the most critical concerns of medical informatics. Not only data but objects stored in a medical digital library have grown far beyond electronic journals and textbooks to include catalogues, images, audios, videos and biosignals [7].

Electronic full text journals have several advantages over printed journals and photocopies, one of which is their computer access via Medline, table of contents or internal search engines in each care unit 24 hours a day, 365 days a year. However, this interesting approach to four journals (Canadian Medical Association Journal, Pediatrics, Science, and Lancet) is no longer possible due to a change in OVID's editorial policy. Nonetheless, OVID warrants a holdings policy to medical libraries whatever the access is by Internet or Intranet: the library owns the electronic journals and may access journal archives if the subscription is not renewed. Other providers, specially in France, only have an access policy, sometimes restricted to paper subscription.

A major factor in library management is not only the number of medical journals available and its diversity but also its targeted evolution. Moreover with the recent introduction of digital access, cost analysis should be considered, in particular budgetary limitations as economic factors are hindering collection development [2].

The economical version of Reading Factor was used in this study to compare the individual costs of consultations via our digital library and its most economical alternative: the interlibrary loan. Our simulation (see Table 2) shows the possibility of reaching a break-even point, where the cost increase of journal subscription is balanced by a cancellation of certain journals. The exact break-even point (2.5 times the cost of interlibrary loan) in our institution was highly dependant on the supplier price and the specific range of journals offered.

This approach can also be extended to the inclusion of a new journal and is essential in order to make an objective decision to initially compare the cost of the electronic journal vs. interlibrary loans of this journal. Moreover, it could be a very useful tool for medical institutions, where consensus is sometimes difficult to obtain. Nonetheless, this study needs to be tested in various health institutions, including medical schools where the results could be different.

CONCLUSION

The measurement of RF is highly automated and practical. RF is an objective and immediately available criterion of local journal use and its cost-effectiveness, or interest in a particular journal. It is a promising economical approach for local collection management of an electronic library.

Based on our experience at Rouen University Hospital, it is possible to conclude that our electronic library was and will remain cost-effective for several years when compared to interlibrary loan costs. Also the library is most cost-effective when electronic versions are offered in conjunction with a low but significant flow of interlibrary loan.

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Table 1: Electronic Library journals: consultations and costs (US $) Costs 2000 are real costs, costs 2001 are provisional (new prices, same number of consultations) .

	Cost (US US $)	
	2000	2001
Biomedical Collection I		
American Journal of Medicine	1.41	1.75
American Journal of Obstetrics & Gynecology	1,41	2.00
American Journal of Surgery	1.41	2.11
Annals of Internal Medicine -	1.41	1.45
British Medical Journal	1.41	1.22
Circulation	1.41	1.05
JAMA: The Journal of the American Medical Association	1.41	3.31
Journal of Bone and Joint Surgery (American Volume)	1.41	5.52
Journal of Clinical Investigation	1.41	2.67
Lancet	1.41	0.58*
New England Journal of Medicine	1.41	2.20
Pediatrics	1.41	0.99*
Science	1.41	8.93*
Biomedical Collection II	1.53	
American Journal of Cardiology	1.53	2.21
American Journal of Psychiatry	1.53	6.46
Archives of Internal Medicine	1.53	2.16
Archives of Neurology	1.53	5.26
Archives of Surgery	1.53	9.17
Arteriosclerosis, Thrombosis and Vascular Biology	1.53	14.57
British Journal of Surgery	1.53	1.10
Circulation Research	1.53	34.69
Fertility and Sterility	1.53	7.03
Gut	1.53	1.85
Journal of Pediatrics	1.53	2.41
Mayo Clinic Proceedings	1.53	2.62
Medicine	1.53	5.58
QJM: Monthly Journal of the Association of Physicians	1.53	5.35
Thorax	1.53	2.74
Biomedical Collection III	3.46	
American Journal of Public Health	3.46	7.54
Anesthesiology	3.46	2.21
Archives of Dermatology	3.46	13.64
Archives of Ophthalmology	3.46	15.20
British Journal of Haematology	3.46	6.14
Chest	3.46	0.99
Diabetes	3.46	15.00
Heart (formerly the British Heart Journal)	3.46	3.38
Hypertension	3.46	26.43
Journal of Clinical Pathology (with Clinical Molecular Pathology)	3.46	6.22
Journal of Neurology, Neurosurgery & Psychiatry	3.46	1.77
Journal of Urology	3.46	1.40
Nature	3.46	25.80
Obstetrical & Gynecological Survey	3.46	10.00
Stroke	3.46	1.63

Journals with * will no longer be directly accessible via Ovid

Table 2: Cost effectiveness of different subscription cancellations

Cut off*	0.1	0.4	0.6	0.8	1.0	2	2.5	3	4	8	12
Number of cancelled journals	45	38	29	22	20	11	9	8	4	2	0
Number of interlibrary loans generated	10893	6113	4008	3071	1372	565	390	339	111	40	0
Financial balance (US $)	-23002	-6507	-2107	-2719	2232	675	-216	-522	-2910	-4471	-5996
Extra subscriptions affordable					4	1	0				

The cut off value (*) is the relative cost of a single paper consultation defined as the journal subscription cost divided by the interlibrary loan cost. Above the cut off value, we simulate the journals cancellations. A cut off value of eight (electronic consultation is eight times more expensive than inter libraries loan) implies the cancellation of two journals and implies 40 demands of loan, with an economy too small to compensate the general cost increase.