A study comparing centralized CD-ROM and decentralized intranet access to MEDLINE

By Stefan J. Darmoni
Computer and Networks Department

Jacques Benichou
Biostatistics Unit

Benoit Thirion
Medical Library

Marie France Hellot
Biostatistics Unit

Jacques Fuss
Computer and Networks Department

Rouen University Hospital
1 rue de Germont
76031 Rouen Cedex
France

Objective: The purpose of this study was to evaluate the efficacy of a decentralized intranet access in each medical department as opposed to centralized unique MEDLINE access in the medical library.

Design: A two-phase questionnaire to evaluate MEDLINE use was given to junior and senior physicians at Rouen University Hospital (RUH). Phase I (August–October 1996) corresponded to a time period when centralized access was the only means of access available and phase II (August–October 1997) to a time period following the introduction of decentralized intranet access.

Results: A total of 168 physicians filled out at least one phase of the questionnaire, among whom 123 (73%) filled out both phases. Use of MEDLINE significantly increased in 1997 (average of 10.2 ± 1.1 searches in three months) versus 1996 (average of 4.9 ± 0.7 searches in three months, $P < 0.0001$). The aim of searches changed, becoming significantly more care oriented in phase II ($P < 0.0001$). The number of searches performed by the physicians alone increased ($P < 0.0001$) and searches performed by the librarian decreased ($P < 0.0001$) in phase II. The method of searches also changed, as searches by author ($P < 0.0001$), by journal ($P = 0.0042$), and by free word ($P = 0.0027$) increased in phase II. Knowledge of the following concepts of MEDLINE significantly increased: explosion ($P < 0.0001$), scope note ($P < 0.0001$), Abridged Index Medicus (AIM) journals ($P < 0.0001$), Medical Subject Headings (MeSH) qualifier ($P < 0.0001$), and focus ($P < 0.0001$).

Conclusion: A decentralized intranet access to MEDLINE increased the number of searches and knowledge of this bibliographic database. MEDLINE intranet access modified the purpose and the methods of searching.

INTRODUCTION

Rouen University Hospital (RUH) is a large hospital (2,500 beds), located in northwestern France. The RUH

Medical Library is specifically devoted to its medical staff and researchers, as medical students use the library at the medical school. At RUH, as at most university hospitals, the primary task of the medical li-

brarian is to provide replies to inquiries related to patient care or research purposes as quickly as possible. Information needs arise twenty-four hours a day, seven days a week [1].

At RUH, bibliographic retrieval costs are not charged to individual physicians or departments but are paid by the hospital. Until 1997, all bibliographic retrieval was performed by the medical librarian, due to larger practical experience and higher effectiveness compared to physicians, including those physicians who were experienced [2]. For this purpose, the medical librarian used CD-ROM access, which was introduced at the medical library in 1992, as a more cost-effective way of accessing MEDLINE than online access by videotext (Minitel) [3]. Since June 1997, MEDLINE has been progressively available from the RUH intranet on more than 400 microcomputers, with at least one access point in every care unit and one dedicated microcomputer in each department library. The microcomputers were implemented to meet the needs of the RUH information system using a commercial provider (Ovid) and its Web client interface, including access to forty-five full-text electronic journals.

The goal of this study was to compare patterns of MEDLINE use in two time periods, a period when centralized access at the medical library was the only available means of access (August–October 1996) and a period following the introduction of a decentralized intranet access in all departments (August–October 1997).

METHODS

A two-phase questionnaire was sent to all RUH physicians and filled out on a voluntary basis. This simple questionnaire was self-administered and contained six sections regarding user type, frequency of MEDLINE use, purpose of search, method of search, typology of the individual carrying out the search, and knowledge of MEDLINE concepts. The first phase of the questionnaire evaluated the database search using centralized MEDLINE access at the Medical Library over a three-month period (August–October 1996). The second phase evaluated the decentralized access during the same period of the following year (August–October 1997).

STATISTICAL ANALYSIS

The relationship between medical seniority (junior status or senior status) and MEDLINE use, as measured by items of the questionnaire, was assessed by using the responses to phase I by the 123 physicians who filled out both phases of the questionnaire. The following statistical tests were used. For binary or non-ordered categorical items, the chi-square test or Fisher's exact test was used, depending on the sample size. For

ordered categorical items, Cochran's trend test was used. Finally, continuous items (i.e., number of searches) were all analyzed as ordered categorical items with three levels (0, 1–3, and 4+). Changes in the distribution of the items in the questionnaire between the two phases of the study were assessed using statistical tests for paired data. An overall analysis was first performed on the 123 physicians who completed both phases of the questionnaire, then separate analyses were performed for junior (n = 44) and senior (n = 79) physicians. McNemar's test for binary items, Agresti's test for ordered categorical items, and conditional logistic regression for non-ordered categorical items were used. Again, continuous items (i.e., number of searches) were all analyzed as ordered categorical items with three levels (0, 1–3, and 4+). All tests were two-sided and considered significant when the P-value was less than 0.05.

Analyses were performed using BMDP software version 7.0 (BMDP Statistical Software Inc., *BMDP Statistical Software Manual,* University of California Press, Berkeley, 1992) and StatXact software version 3 (*StatXact for Windows User Manual,* Cytel Software Corporation, Cambridge, 1996).

RESULTS

In November 1997 (end of phase II), analysis of intranet connections to MEDLINE demonstrated that an average of 1,100 requests per day were performed by end users to access MEDLINE and electronic full-text journals on the RUH intranet (53.0% from the medical librarian, 20.3% during night time, and 8.3% during weekends). A total of 168 physicians filled out at least one phase of the questionnaire, among whom 123 (73%) filled out both phases; 34 physicians filled out phase I only, and 11 filled out phase II only. As of August 1, 1997, RUH medical staff consisted of 397 residents (392 in 1996) and junior physicians and 304 senior physicians (301 in 1996). A total of 67 junior physicians (17%) and 90 senior physicians (30%) filled out phase I; 53 junior physicians (13%) and 81 senior physicians (27%) filled out phase II; 44 junior physicians (11%) and 79 senior physicians (26%) filled out both phases.

In phase I, upon comparing junior and senior physicians, there was only one significant difference, namely senior physicians performed significantly more searches for patient care than junior physicians ($P = 0.0011$). In phase II, there were no significant differences between junior and senior physicians, in particular, in terms of searches for patient care.

In phase I, a majority of searches were performed either by the medical librarian (60%) or by physicians with the help of the medical librarian (21%). Knowledge of basic concepts of MEDLINE was poor, as only 3% of physicians knew the definition of scope note and

6% the definition of Abridged Index Medicus (AIM) journals. Table 1 contrasts the results of the two phases. The comparison between phases I and II was only performed for the 123 physicians who filled out both phases. Use of MEDLINE significantly increased in phase II among all physicians. The mean number of searches increased from 4.9 ± 0.7 (mean $\pm$ standard error of the mean) per user in phase I to 10.2 ± 1.1 per user in phase II ($P < 0.0001$). The proportion of physicians performing searches at least weekly jumped from 16% to 53%. Patterns of MEDLINE use greatly changed as well. Noticeably, a lot more searches were performed for patient care purposes in phase II ($P < 0.0001$), whether symptomatology, diagnosis, and therapeutics. All methods of search (by author, $P < 0.0001$; journal, $P = 0.0042$; free word, $P = 0.0027$) were more significantly used in phase II, except for Medical Subject Headings (MeSH) keyword searches. There was a dramatic increase in searches performed by physicians alone (63% in phase II versus 20% in phase I, $P < 0.0001$). Finally, knowledge of all concepts studied—explosion ($P < 0.0001$), scope note ($P < 0.0001$), AIM journals ($P < 0.0001$), MeSH qualifier ($P < 0.0001$), and focus ($P < 0.0001$)—significantly increased from phase I to phase II. In phase II, only 37% of clinicians still preferred to refer their information requests to the librarian.

Changes between phase I and phase II varied somewhat according to physician seniority. For example, searches for symptomatology significantly increased for junior physicians ($P = 0.0029$) but not for senior physicians. Among junior physicians alone, only one method of search, by author, was more significantly used in phase II ($P = 0.0386$).

DISCUSSION

The introduction of decentralized MEDLINE intranet access at RUH has resulted in a sharp increase in MEDLINE use and a modification of patterns of MEDLINE use. In particular, the aim of searches has changed and has become significantly more care oriented. Similar results were obtained at Yale where technology, policy, and funding have directly influenced use. Growth in MEDLINE use at Yale was directly linked to the implementation of full-network access [4]. At the University of Illinois, two-thirds of health sciences faculty members accessed MEDLINE through electronic means in 1997 [5]. Faculty preferred accessing electronic databases from their offices to doing so from the library.

Because the present study was not a randomized study, alternative factors might have played a role in the observed modification of patterns of MEDLINE use. First, training sessions organized by the medical librarian increased the physicians' knowledge of MEDLINE. Second, physicians accumulated experience in using MEDLINE between the two phases of the study. Third, although the MEDLINE intranet Web client interface was very similar in terms of functions compared to the older client-server interface, minor differences existed [6]: (1) in the intranet version, clicking directly on an author name, a MeSH term, or a MeSH qualifier was possible; (2) in the client-server version, display of MeSH trees was more complete; and (3) the intranet MEDLINE version was more user friendly and intuitive due to the hypermedia navigation.

Selection bias could have occurred in this study, as only 19% of junior physicians and 30% of senior physicians filled out at least one phase of the questionnaire. There was no information regarding the physicians who did not participate in this study, because participation was optional. The reduction of sample size (15%) between phase I and phase II was essentially due to some junior physicians who left the hospital between the two phases. However, the frequency of MEDLINE use by the twenty-three junior physicians who left was not different from that by the 123 physicians who filled out the two phases of the questionnaire.

In late 1996, when the decision to implement intranet access to MEDLINE with a commercial provider (Ovid) was made, free access to MEDLINE lacked basic functions, such as mapping (automatic translation of a question in natural language into MeSH terms), access to the tree structure, scope notes, and display of all the fields of a reference such as entry month, registry number, and ISSN. Therefore, bibliographic searches were not very efficient using free access to MEDLINE without the help of a medical librarian. The mapping function is a key point in enhancing the quality of searches performed by end users [7]. Furthermore, at RUH, MEDLINE was integrated with access to forty-five electronic full-text journals, among the most prestigious ones according to their impact factor.

Since 1998, most of these functions have been made available with free access [8] such as PubMed and Internet Grateful Med (IGM). Even full-text electronic journals are integrated into MEDLINE searches. Some functions such as access to PreMEDLINE, very recent references not yet fully indexed in the MEDLINE database, are only available with PubMed and IGM [9, 10], and are not available in a commercial software package. That lack of availability is why it is suggested that health professionals use free tools in private practice or in community hospitals. For university hospitals and main medical centers, an intranet MEDLINE application with any commercial provider (e.g., Ovid) is the best response to patient care information and research purposes. This solution has the fastest response time and the best functions [11], especially the links to electronic full-text journals.

Part of the success of MEDLINE distributed access is the disappearance of problems encountered when

Table 1
MEDLINE use in the two phases of the study (August–October 1996 versus August–October 1997)

	Phase I 08–10/96 (n = 123)		Phase II 08–10/97 (n = 123)		Phase I versus Phase II (n = 123)	Phase I versus Phase II junior physicians (n = 44)	Phase I versus Phase II senior physicians (n = 79)
Frequency of MEDLINE use*							
Never	10	(8%)	6	(5%)			
Approximately once a year	29	(25%)	6	(5%)			
Approximately once a month	59	(51%)	42	(36%)			
Approximately once a week	16	(14%)	52	(45%)			
Approximately at least once a day	2	(2%)	10	(9%)			
Total	116	(100%)	116	(100%)	$P < 0.0001$	$P < 0.0001$	$P < 0.0001$
Purpose of search*							
General purpose of search in terms of research and patient care							
No research, no patient care	14	(11%)	9	(7%)			
Patient care only	8	(7%)	12	(10%)			
Research only	49	(40%)	37	(30%)			
Research and patient care	52	(42%)	65	(53%)			
Total	123	(100%)	123	(100%)	$P = 0.0017$	$P = 0.0027$	ns†
Research 0	21	(18%)	20	(18%)			
1–3	72	(63%)	37	(32%)			
4 +	22	(19%)	58	(50%)			
Total	115	(100%)	115	(100%)	$P < 0.0001$	$P = 0.0016$	$P = 0.0005$
Patient care 0	63	(52%)	46	(38%)			
1–3	45	(37%)	34	(28%)			
4 +	13	(11%)	41	(34%)			
Total	121	(100%)	121	(100%)	$P < 0.0001$	$P = 0.0002$	$P = 0.0001$
Symptomatology 0	105	(87%)	92	(76%)			
1–3	15	(12%)	18	(15%)			
4 +	1	(1%)	11	(9%)			
Total	121	(100%)	121	(100%)	$P = 0.0003$	$P = 0.0029$	ns†
Diagnosis 0	81	(69%)	59	(51%)			
1–3	29	(25%)	33	(28%)			
4 +	7	(6%)	25	(21%)			
Total	117	(100%)	117	(100%)	$P < 0.0001$	$P = 0.0011$	$P = 0.0002$
Therapeutics 0	80	(68%)	62	(52%)			
1–3	31	(26%)	36	(31%)			
4 +	7	(6%)	20	(17%)			
Total	118	(100%)	118	(100%)	$P < 0.0001$	$P = 0.0011$	$P = 0.0152$
Methods of search							
By author	25	(20%)	49	(40%)	$P < 0.0001$	$P = 0.0386$	$P = 0.0004$
By journal	7	(6%)	19	(15%)	$P = 0.0042$	ns†	$P = 0.0063$
By free word	46	(37%)	64	(52%)	$P = 0.0027$	ns†	$P = 0.0043$
By MeSH key word	69	(56%)	74	(60%)	ns†	ns†	ns†
Typology of the individual carrying out the search							
The librarian alone	74	(60%)	46	(37%)	$P < 0.0001$	ns†	$P < 0.0001$
The physician with the help of the librarian	25	(21%)	26	(20%)	ns†	ns†	ns†
The physician alone	24	(20%)	77	(63%)	$P < 0.0001$	$P < 0.0001$	$P < 0.0001$
Someone else	4	(3%)	18	(15%)	$P = 0.0026$	ns†	$P = 0.0129$
Knowledge of the following concepts							
Explosion	26	(21%)	67	(55%)	$P < 0.0001$	$P = 0.0002$	$P < 0.0001$
Scope note	3	(3%)	27	(22%)	$P < 0.0001$	$P = 0.0039$	$P = 0.0001$
AIM journals	7	(6%)	40	(33%)	$P < 0.0001$	$P = 0.0002$	$P < 0.0001$
MeSH qualifier	30	(25%)	57	(47%)	$P < 0.0001$	$P = 0.0063$	$P = 0.0002$
Focus	22	(18%)	67	(55%)	$P < 0.0001$	$P = 0.0001$	$P < 0.0001$

* Mutually exclusive categories.
† ns: not significant at the 5% level (two-sided test).

using mediated search services at the RUH Medical Library [12]: (1) excessive turnaround time, (2) time required to visit the library (RUH consists of three main hospitals separated by 5 kilometers), and (3) restricted access to the medical librarian due to limited operating hours (50 hours per week) and nonavailability in the evening and on weekends.

This study shows a significant decrease in the searches performed by the librarian. The physicians now perform most of their searches by themselves (Table 1). However, even as end-user searching increases in hospitals, there continues to be a need for librarian-mediated bibliographic database search services [13]. Physicians contact the medical librarian in case of doubt, especially for complex or exhaustive searches [14]. The main drawback of distributed access is the poor quality of search results because bibliographic retrievals performed by health care professionals, even experienced users, are less efficient than those performed by the medical librarian [15]. Indeed, health care professionals are not well acquainted with the basic functions of MEDLINE, such as explosion, focus, and AIM journals (Table 1). MeSH thesaurus knowledge is weak and use of the free-word method of searching and the mapping function predominates. Therefore, in order for physicians to acquire the basic knowledge of how to perform a search, the medical librarian has been organizing bimonthly MEDLINE half-day training sessions since June 1997. These training sessions have been attended by approximately half of RUH physicians. In contrast, most faculty members at the University of Illinois did not take advantage of training sessions offered by librarians [16].

Since the conclusion of this study, growth in MEDLINE use has continued. As of December 1, 1998, each of the 1,500 microcomputers at RUH had a Web browser, permitting MEDLINE access. All senior physicians had microcomputers in their offices.

In conclusion, decentralized intranet access to MEDLINE increased the number of searches and physician knowledge of this bibliographic database. MEDLINE intranet access modified the purpose and the methods of searching.

REFERENCES

1. KLEIN MS, ROSS F. End-user searching: impetus for an expanding information management and technology role for the hospital librarian. Bull Med Libr Assoc 1997 Jul;85(3):260–8.
2. MCKIBBON KA, HAYNES RB, DILKS CJ, RAMSDEN MF, RYAN NC, BAKER L, FLEMMING T, FITZGERALD D. How good are clinical MEDLINE searches? a comparative study of clinical end-user and librarian searches. Comput Biomed Res 1990 Dec;23(6):583–93.
3. THIRION B, DARMONI SJ, MOORE N. Costs of MEDLINE and CD-ROM searching. Lancet 1992 Aug 1;340(8814):308.
4. GRAJEK SE, HELENIUS M, MARONE RK, RODERER NK. The MEDLINE experience at Yale: 1986–1996. Med Ref Serv Q 1997 Winter;16(4):1–18.
5. CURTIS KL, WELLER AC, HURD JM. Information-seeking behavior of health sciences faculty: the impact of new information technologies. Bull Med Libr Assoc 1997 Oct;85(4):402–10.
6. NOTESS GR. On the net. free MEDLINEs on the Web. Database 1998 Jun/Jul;21(3):71–4.
7. IBID.
8. HALPERIN M, CAVANAUGH BB. Onsite loading vs. offsite access: Ovid options. Database 1998 Jun/Jul;21(3):30–4.
9. WILSON JW. PubMed: a winner on the Web for the National Library of Medicine. Online 1997 Nov/Dec;21(6):60–1.
10. THIRION B. PubMed tutorial: IGM help. [Web document]. Rouen, France: Rouen University Hospital Medical Library, 1998. [rev. 22 Sep 1999; cited 8 Dec 1999]. <http://www.chu-rouen.fr/documed/pmeeng.html>.
11. HALPERIN, op. cit.
12. KLEIN, op. cit.
13. IBID.
14. HALPERIN, op. cit.
15. MCKIBBON, op. cit.
16. CURTIS, op. cit.