
Librarians, clinicians, evidence-based medicine, and the division of labor

By Edwin A. Holtum, M.S.
Coordinator for Electronic Services

Hardin Library for the Health Sciences
University of Iowa Libraries
University of Iowa
Iowa City, Iowa 52242

Have librarians promoted end user searching to the detriment of the profession and promoted clinical inefficiency from causally trained health practitioners? Issues related to the complexity of bibliographic retrieval in the networked environment are explored within the context of evidence-based medicine and the division of labor.

Old Vaudeville joke:

- Doctor, it hurts when I do this.
- Don't do that.

Evidence-based medicine version:

- Doctor, it hurts when I do this.
- Wait a minute [pause]. This article says don't do that.

INTRODUCTION

Twice in my career, I have had the privilege of working closely with hospital librarians throughout the state of Iowa. The first effort (1973–1976) was supported by a National Library of Medicine grant and involved coordinating efforts to set up hospital library consortia. The second instance (1995–1998) was part of a National Library of Medicine contract to establish a National Laboratory for the Study of Rural Telemedicine and involved extending electronic resources to rural hospitals in southeast Iowa. During both projects, I was struck by the willingness of librarians to embrace new and more efficient ways of performing their services and by the leadership they provided within their institutions to promote cooperation and innovation. That librarians should be among the first health care professionals to adopt new technologies will not surprise the readers of this publication. Also not surprising should be the fact that many librarians maintain a healthy real-world skepticism when it comes to the wholesale adoption of new information service models that have yet to be adequately tested in the workplace. Many of the thoughts I have expressed below were formed as a result of rather candid conversations with hospital librarians with whom I have had the privilege of working. Some of these

thoughts are perhaps controversial. I hope they will provide impetus for further discussion.

AN EVIDENCE-BASED MEDICINE SCENARIO

Louise Rameriez, M.D., is a family practitioner in a medium-sized community. On her morning hospital rounds at the 120-bed municipal hospital, she encounters one of her patients who has been hospitalized for circulatory complications associated with diabetes. Since admission, the sixty-three-year-old male patient has also complained of symptoms associated with clinical depression. Dr. Rameriez wishes to prescribe an antidepressant but is at a loss regarding any potential effect this medication may have on glycemic control.

Because Dr. Rameriez attended a medical school at which case-based learning was heavily used as a mode of instruction, she has formed the habit of approaching challenging cases as learning opportunities. The skills and attitudes necessary to practice medicine in this fashion are engendered ideally at the medical undergraduate level and have been recently defined by the Association of American Medical Colleges in its statement on medical informatics:

To support health care, life-long learning, education, research and management, medical students should be able, at the time of graduation, to utilize biomedical information for: formulating problems; arriving at strategies for solutions; collecting, critiquing and analyzing information; taking action based on findings and communicating and documenting these processes and the results [1].

During her residency, Dr. Rameriez embraced the prevailing philosophy of evidence-based medicine and, consequently, she does not hesitate to locate and use all available information at her disposal to both

better understand and manage this current difficulty. Dr. Rameriez also recognizes that practice and learning constitutes a seamless environment and that what she learns as a result of her investigation of this clinical encounter will contribute to her overall effectiveness as a physician. Because this need for information has occurred in a "real-world" setting, what she will learn in the course of her investigation will prove a much more effective continuing medical education experience than would a formal lecture or workshop on a similar topic [2]. She also knows that the state in which she practices has formally accommodated and encouraged this kind of learning by granting continuing education (CE) "granular" credits for her learning efforts and this credit will subsequently contribute toward her relicensure credentials [3].

To begin this exercise in practice and learning, Dr. Rameriez retrieves a "wearable" or "intimate" computer [4]—a device that is now a standard part of the practitioner's armamentarium and easily fits into her lab coat pocket. The hand-held device is fitted with a microphone into which she speaks a few cryptic phrases having to do with the problem at hand. When she is done speaking, the message is transcribed via a voice recognition program on the fly into text. The text is, in turn, transmitted via a wireless transmitter to a hospital system-wide server on which is mounted special "knowledge coupling software." This software matches Dr. Rameriez' request against a knowledge information database comprised of book chapters, current journal articles, relevant local patient records, consensus reports, clinical guidelines, and technical reports. During the matching process, appropriate associations are made between the unique features of the case at hand and the many diagnostic or management options available.

After a few minutes, the system returns a list of options together with a bibliography of relevant supporting literature in descending order of relevance (including abstracts), which Dr. Rameriez can access electronically should she wish to read the entire article or report. Armed with this information, she now proceeds to recommend a plan of action based on up-to-date literature, tempered to take into account her own sound medical judgment and her patient's individual needs.

When Dr. Rameriez returns to her office or home she continues to review her decision as well as the documents on which it was based. She submits a synopsis of the encounter together with a summary of her reasoning and the literature she encountered to the continuing medical education (CME) accrediting body in her state. After review by this body, she will receive an appropriate amount of CME credit for her work.

This sketch, while contrived and perhaps oversimplified, is, nevertheless, based on actual proposals, projects, and technological innovations already report-

ed in the literature. The scenario reflects the modern health care practice model: an investigative approach to patient care, a seamless practice and learning environment, the routine use of current literature in problem solving, and the integration of formally recognized CME with patient care and active life-long learning.

NO MAGIC BLACK BOX

How realistic is this scenario? At this point, a closer look at some assumptions is necessary. The first assumption is that at some point a single up-to-date knowledgebase comprising nearly the whole of medical literature that can be searched by the end user (in this case, the clinician) will be successfully created. Lest anyone think that such a system has not yet actually been proposed, please see Weed's article in the July 26, 1997, issue of the *British Medical Journal* [5].

The barriers to creating and maintaining a single full-text health knowledge database are considerable and such a product will not likely exist within the next ten years. Substantial as they are, however, the barriers relating to raw data capture, storage, and maintenance can, theoretically at least, be overcome. These barriers relate to logistics, copyright, licensing, storage, bandwidth, and networking speed. The extent to and ease with which such a database would be "searchable" however, is a different question entirely and here the answer depends to a great extent on human intervention. The Web, the "mother lode" of databases, for all its speed and supposed comprehensiveness remains searchable in only the crudest sense; the analogy of "drinking water through a fire hose" still holds when it comes to the massive, "brute-force" search engines now in place for Internet searching. Also, while innovations are being made in both the areas of automatic indexing or mark-up and natural language processing, the notion of using simple queries to search the kind of database described above (even if such databases come into existence) accurately and efficiently will remain unrealistic well into the next century. Brisco, of the Computer Laboratory at Cambridge University, notes that, "Despite over three decades of research effort, no practical domain-independent parser of unrestricted text has been developed" [6].

Thus, despite some predictions to the contrary, there will be no magic black box containing the world of medical knowledge into which busy clinicians will be able to speak or type their information requests and receive precisely targeted feedback during the clinical encounter. Instead, relevant databases will continue to be disparate; they will retain their own individuality, limitations, and capabilities; full-text databases may be completely searchable or only retrievable as portable document format (PDF) or image files; indexing sources will remain idiosyncratic with

specialized vocabularies and search engines; and results will not be instantaneous. Mining the wealth of health information will continue to depend to a great extent on the quality of indexing and the expertise of the searcher, just as it does today.

UTILIZING THE SKILLS OF SPECIALISTS

What this means is that clinicians and librarians are going to have to come to a better understanding not only of the capabilities and limitations of databases but of the skills of the humans who search them. It may be quite realistic, for example, to expect physicians to consult an electronic textbook (or indeed, an entire electronic library of textbooks), the *Physician's Desk Reference*, or the patient's electronic record either at the point of care or as a follow-up procedure. It is unlikely, however, that already overburdened clinicians, practicing under the economic constraints of managed care will have the time, inclination, and ability to perform their own bibliographic database searching (and do so with the frequency demanded by an evidence-based practice). In fact, the amount of training and skill necessary to search bibliographic databases effectively is significant enough, that under most circumstances, it makes more sense for librarians, rather than clinicians, to perform literature searches.

When health professionals request lab work, they turn to medical technologists. If an X-ray is needed, they direct the patient to a radiographic technician. The reason is simple: Even though the clinician is certainly capable of learning and performing these tasks (though at considerable time and expense), higher quality and greater cost-effectiveness are obtained by using the skills of specialists instead. Can the same not be said of the expertise and experience that librarians bring to the health care enterprise? Librarians, through false modesty or not wishing to appear professionally self-serving, have sometimes promoted, or at least indulged, the concept of end user searching not only to the point of their own professional detriment but to the point of encouraging clinical inefficiency as well. By underselling their skills and by soft-peddling the complex nature of literature searching, librarians have advanced the notion that all clinicians can search effectively, provided they have had one or two instructional sessions with a librarian or attended a PubMed workshop. Furthermore, by assuming that end user searching should be the rule rather than the exception, librarians are in danger of neglecting those clinicians who would prefer to have their searches mediated by librarians but who, because of prevailing notions, are now reluctant to ask for this service. Already, requests for literature searches are commonly prefaced by a sheepish statement such as, "I know I should know how to do this myself, but . . ."

While there is no shortage of literature relating to

end user searching satisfaction [7–8], search engine comparisons [9, 10], and training effectiveness [11–13], little has been written on the relative cost-effectiveness or overall efficiency of mediated versus end user searching in a clinical setting. Several articles, however, caution that end user searching does not provide the same level of recall and precision as does mediated searching [14–16]. This fact and common sense lend credence to the notion that highly trained professionals at moderate salary would provide more cost-effective results than those obtained by highly salaried clinicians with only cursory training.

Computers, the Internet, the Web, CD-ROMs, and the myriad of other technological wonders that librarians continue to embrace with good reason, create new avenues for accessing information. They make finding information faster, more efficient, timely, and accurate. They do not, however, always make it easier. In fact, the opposite is often true. In spite of the important innovations in search engines such as automatic mapping and clearer navigational aids, searching efficiently through this growing maze of electronic resources requires more, not less, knowledge, skill, and practice. Information retrieval continues to be an art, and mastering it is no trivial matter. Perhaps, now is the time to reexamine the issue of promoting end user searching. From a purely cost-effective standpoint, does it make sense for a clinician to spend half an hour formulating a strategy of questionable validity, when a librarian could execute the entire search in ten minutes with better results? Likewise, hospital librarians also need also to reconsider the amount of their limited time they should spend teaching their clientele how to search. If such instruction does take place, they should impress upon the learner the complexity and difficulty of searching well and that requesting a mediated search is not only a valid alternative but, in many cases, the wiser choice. Those individuals who wish to learn the complexities of database searching should be willing to invest an appropriate amount of time if they hope to become anything more than information diletantes.

One of the most common arguments made in favor of end user searching is that very often clinicians do not want a skilled and comprehensive search of the literature but, rather, "just a few articles on a topic" or a "quick and dirty search." The logic of this argument escapes me. If a clinician has time to read only one or two sources, should not these articles represent the most relevant literature—literature that can be retrieved most efficiently by a skilled searcher? A second reason for encouraging end user searching relates to time: How can librarians possibly find enough time to perform mediated searching given the investigational nature of evidence-based medicine, which makes finding literature imperative and routine? But to accept this rationale, forces a second question: Where will the

clinicians find the time to perform these tasks? Perhaps more librarians are needed if evidence-based medicine is to become a reality.

A SECOND SCENARIO

Consider the following alternative scenario: Dr. Rameriez consults a lap or palm top computer on which resides recent evidence-based review articles and the texts of several recent textbooks (kept up-to-date electronically). Reading the relevant portions, she makes a studied judgment and takes the appropriate action. Should she desire additional information, she leaves a detailed voice-mail message with the hospital librarian, who then selects the most suitable databases, formulates and performs the search, filters the results, and sends the resulting articles to Dr. Rameriez by whatever method is most convenient. Dr. Rameriez, in turn, is free to use her time more productively, reading the article and pursuing continuing education credit as outlined above.

Instead of abandoning the notion of mediated searching, librarians should be looking for ways to make it easier and here is where computers and networking can make a tangible difference. Thanks to easily created Web-based request forms, e-mail, and messaging systems, clinicians can request and librarians can conduct mediated searches in a variety of locations and environments (including real-time if necessary) from their desktops. In addition, off-the-shelf scanning software and easily downloadable display software can turn a networked personal computer into a full-text article receiving station when appropriate. Shifting energies in this direction would help make the second scenario a reality.

Just as importantly, user education efforts can be aimed at teaching those resources that can be used effectively with a minimum of training (e.g., online textbooks) as well as teaching clinicians how to request (as opposed to formulate and execute) mediated searches more effectively. On the larger front, librarians need to be actively engaged in the development and refinement of end user information tools that incorporate the literature types most appropriate to the practicing clinician and are directly relevant and applicable to patient care. These include electronic texts, consensus statements, meta-analyses, practice guidelines, tutorials, and evidence-based reviews.

CONCLUSION

By basing health sciences library services on what clinicians, computers, and librarians do best, librarians can create within the hospital setting a knowledge-based information system that is not only effective and efficient, but realistic as well.

REFERENCES

1. ASSOCIATION OF AMERICAN MEDICAL COLLEGES. Medical school objectives project: medical informatics objectives. [Web document]. Washington, DC: The Association, 1998. [rev. 11 Jun 1998; cited 11 Jun 1999]. <<http://www.aamc.org/meded/msop/informat.htm>>.
2. BARNES BE. Creating the practice-learning environment: using information technology to support a new model of continuing medical education. *Acad Med* 1998 Mar;73(3):278-81.
3. D'ALESSANDRO MP, GALVIN JR, ERKONEN WE, CURRY DS, FLANAGAN JR, D'ALESSANDRO DM, LACEY DL, WAGNER JR. The Virtual Hospital: an IAIMS integrating continuing education into the work flow. *MD Comput* 1996 Jul/Aug;13(4):323-9.
4. D'ALESSANDRO MP, GALVIN JR, CHOI JJ, ERKONEN WE, CRIST LG. Continuing medical education to the point of care using a digital library and intimate computers. *Proceedings of the Fourth Forum on Research and Technology Advances Digital Libraries (ADL '97)*. Los Alamitos, CA: IEEE Computer Society Press, 1997:95-101.
5. WEED LL. New connections between medical knowledge and patient care. *BMJ* 1997 Jul 26;315(7102):231-5.
6. BRISCO T. Robust parsing. In: Survey of the state of the art in human language technology. [Web Document]. National Science Foundation, European Commission, 1996. [cited 11 Jun 1999]. <<http://cslu.cse.ogi.edu/HLTsurvey/ch3node9.html#SECTION37>>.
7. WILDEMUTH BM, MOORE ME. End-user search behaviors and their relationship to search effectiveness. *Bull Med Libr Assoc* 1995 Jul;83(3):294-304.
8. HORRES MM, STARR SS, RENFORD BL. MELVYL MEDLINE: a library services perspective. *Bull Med Libr Assoc* 1991 Jul;79(3):309-20.
9. HAYNES RB, WALKER CJ, MCKIBBON KA, JOHNSTON ME, WILLAN AR. Performances of 27 MEDLINE systems tested by searches with clinical questions. *J Am Med Inform Assoc* 1994 May/ Jun;1(3):285-95.
10. HALLET KS. Separate but equal? a system comparison study of MEDLINE's controlled vocabulary MeSH. *Bull Med Libr Assoc* 1998 Oct;86(4):491-5.
11. ERICKSON S, WARNER ER. The impact of an individual tutorial session on MEDLINE use among obstetrics and gynaecology residents in an academic training programme: a randomized trial. *Med Educ* 1998 May;32(3):269-73.
12. STARR SS, RENFORD BL. Evaluation of a program to teach health professionals to search MEDLINE. *Bull Med Libr Assoc* 1987 Jul;75(3):193-201.
13. MCKIBBON KA, HAYNES RB, JOHNSTON ME, WALKER CJ. A study to enhance clinical end user MEDLINE search skills: design and baseline findings. *Proc Ann Sympos Comp Appl Med Care* 1991:73-7.
14. *IBID.*
15. MCKIBBON KA, HAYNES RB, DILKS CJ, RAMDSEN ME, RYAN NC, BAKER L. 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.
16. WILDEMUTH, *op. cit.*

Received October 1998; accepted February 1999