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# Library and Information Science Education for the New Medical Environment and the Age of Integrated Information

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## ABSTRACT

IN A REVIEW OF FACTORS that are changing the ways in which medical librarians and health information specialists are educated, the present scene is set and the current educational practice described. In particular, contemporary library and information science (LIS) schools and programs, their faculty, and current course work for medical librarianship are reviewed. Those LIS programs emphasizing doctoral research are indicated as models. Specific success factors for health sciences information education are identified. The impact of changes in medical education that are leading to new and changing roles for medical librarians and health information professionals is described, as is the effect of the emergence of the field of medical informatics on health information practice. Finally, suggestions for the reformation of medical library education are made.

## THE PRESENT SCENE

The key sites for medical librarianship in the United States include not only traditional medical libraries in academic settings, but also those in hospital settings, corporate organizations, professional associations, and in public and specialized sites.

Professional positions at these sites may range from those of a traditional librarian to others such as an information management specialist, medical informaticist, or faculty member. The primary professional society affiliations for many of these individuals are the Medical Library Association (MLA), the Special Libraries Association

TABLE 1  
EMPLOYMENT SITES FOR MEDICAL LIBRARIANS

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*Academic Settings*

- in University-based and independent schools of medicine, nursing, allied health, dentistry, veterinary science, public health, and so on;
- subject to accreditation requirements of appropriate academic boards or societies (Association of American Medical Colleges, National League for Nursing, and so on);
- traditional academic library services for faculty, researchers, clinicians, and students;
- rapidly becoming high technology sites with widespread use of computing and telecommunications.

*Hospital Settings*

- in clinical care facilities: large teaching medical centers, university hospitals, general community hospitals, government hospitals, and occasional HMOs and skilled nursing care facilities;
- included in institutionwide accreditation by the Joint Commission on the Accreditation of Healthcare Organizations;
- traditional special library services to clinicians and sometimes to patients;
- some penetration by information technologies, especially personal computers with applications software, telecommunications, and CD-ROM products.

*Corporate Settings*

- Pharmaceutical companies, healthcare insurance companies, medical equipment manufacturers;
- subject to voluntary standards and corporate long-range planning concerns;
- traditional special library and information services for clinical medicine, basic science, and management information;
- high technology sites with business-based networked computing and telecommunications within and without the parent organization.

*Public Settings*

- in public libraries, storefront information centers, associations and community organizations, and clinics or hospitals;
- subject to public library standards, community boards, or plans of parent organizations;
- specialized services with consumer information and patient education materials;
- little evidence of technology beyond basic computing and some use of CD-ROM and microform technologies.

*Specialized Settings*

- drug information centers, poison control centers;
  - information and referral centers within United Way agencies and community service organizations;
  - telephone referral services for provider information and audiocassette health information services;
  - information industry sites (indexing and abstracting services, medical publishers, vendors of library services).
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(SLA), the American Society for Information Science (ASIS), the American Medical Informatics Association (AMIA), and the American Association of Health Science Library Directors (AAHSLD).

Despite their differences, these information professionals and organizations generally have an interest in the same three key issues:

1. the solution of information problems in health care,
2. the wider applications of information technology to medical concerns, and
3. the education and continuing education of health information professionals.

It has been apparent for some years, however, that the role and activities of the traditional medical librarian have been changing in response to major changes in the larger health care environment in which these professionals find themselves (Anderson, 1989).

### PRESENT EDUCATIONAL PRACTICE

The most typical preparation for a career in medical librarianship is to earn a graduate degree from one of the library and information science programs accredited by the American Library Association and, preferably, but not exclusively, to do so in a program that offers a specialization or focused group of courses in medical library work.<sup>1</sup> This preparation is not different from the programs followed by someone seeking credentials for special librarianship in general, except that the elective portions of the Master's of Science<sup>2</sup> degree offer course work in the literatures of medicine and science. An internship or field experience in a medical information setting is also characteristic of this preparation, as few individuals come to the graduate programs in librarianship with much practical background in health sciences or health care. One obvious exception is the corps of experienced nurses who seek library and information science training as a means of making a career shift away from daily clinical care but not away from medicine or medical institutions. An occasional pharmacist, dentist, or even a physician, may also seek library and information science (LIS)<sup>3</sup> training but only rarely and then only when seeking a major career change. Nonprofessional staff members from medical libraries are also good candidates for graduate LIS education.

Among the most sophisticated approaches to education for health information professionals at present are programs in the "full-service" LIS schools which offer a complete range of teaching and research programs from undergraduate through doctoral study. These schools are able to combine their larger faculties, universitywide contacts, extensive technological resources, and large student bodies to form a critical mass for specialized education.

### CURRENT FACULTY AND COURSE WORK

At present, only ten LIS programs in the United States and Canada claim a full-time faculty member with a specialization in

medicine (Association for Library and Information Science Education [ALISE], 1992). Four other academics can be identified as being active in this field by virtue of their publishing widely in the field, while several others have also been identified by those already practicing in the field of medical library education, to yield a total of only seventeen LIS academics with an interest in health sciences.<sup>4</sup> Of these, however, one is a professor emerita and two are deans, suggesting that there may be other professional activities which claim their attention. Of the remaining fourteen, only five are tenured faculty members, while nine are in the tenure stream. Typically, most other LIS programs rely on the adjunct services of local practitioners to teach a course or two which focuses on the bibliography of and/or the management of medical libraries, while twenty-three of the fifty-seven accredited LIS programs simply do not offer any course work or specialization in health information at all.

Those programs which offer the opportunity for students to enroll in courses specifically focused on health sciences issues are likely to be the best places to pursue an MS in preparation to become a health information professional. Course work in health sciences bibliography, on electronic resources for science and medicine, on the management of biomedical information and libraries, coupled with an internship/practicum or field work opportunities in medical sites are most typical. Cooperative registration agreements which allow LIS students to take courses in health sciences schools are also a mark of excellence for programs.

## DOCTORAL RESEARCH

Only eight schools with LIS doctoral programs claim one of the seventeen full-time faculty members specializing in medicine. Recent dissertations and dissertation proposals, however, show that additional schools are engaged in related research. As a search of *Dissertation Abstracts International* and other sources for the last ten years reveals, there were at least twenty-six recent dissertations on various aspects of biomedical/health sciences information work. Table 2 indicates the authors, subjects, and institutions for these research projects. A similar review of proposals accepted by LIS doctoral programs, from the list that appears periodically in the *Journal of Education for Library and Information Science Education* as well as more informal sources, indicates that a number of other projects are underway. A list of these dissertations in progress appears in Table 3.

TABLE 2.  
LIS DISSERTATIONS COMPLETED ON HEALTH INFORMATION TOPICS 1983-1993

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Case Western Reserve University<sup>a</sup>

- Woelfl, Nancy N. (Ph.D., 1984). *Individual Differences in Online Search Behavior [in MEDLINE]: The Effect of Learning Styles and Cognitive Abilities on Process and Outcome*
- Hocking-Keltner, Leila. (Ph.D., 1986). *Development of an Information Retrieval Methodology for Medicine<sup>b</sup>*
- Landau, Lucille. (Ph.D., 1986). *Selecting Journals for Publication: A Bibliometric Approach*
- Rashid, Haseeb Fadhel. (Ph.D., 1985). *Factors Affecting User Satisfaction in a Medical Library and a Comparison With Other Types of Libraries*

Columbia University<sup>a</sup>

- Poisson, Ellen Hull. (DLS, 1983). *Libraries and the Provision of Health Information to the Public*
- Panella, Nancy M. (DLS, 1992). *Patients' Libraries: An Exploratory Study of Cases in Selected Large Voluntary Teaching Hospitals in the Northeastern United States*

Florida State University

- Paskoff, Beth M. (Ph.D., 1989). *Unobtrusive Evaluation of the Accuracy of Telephone Reference Services in Health Sciences Libraries*
- Dec, Cheryl R. (Ph.D., 1990). *Information Needs of the Rural Physician: A Descriptive Study*

George Washington University<sup>b</sup>

- Bader, Shelley A. (Ph.D., 1993). *Scholarly Recognition of Computer-Based Educational Materials Developed by Faculty in American Medical Colleges*

North Texas State University

- Guenther, Johanna Trammell. (Ph.D., 1991). *A Descriptive Survey of Libraries Supporting Baccalaureate and Higher Degree Programs Accredited by the National League for Nursing and Doctoral Programs*

Rutgers The State University of New Jersey

- Burden, Cassandra. (Ph.D., 1991). *Content Analysis of Computer Search Request Forms in a Teaching Hospital Medical Library from 1979 to 1986*
- Tallau, Adeline. (Ph.D., 1988). *An Exploratory Comparison of Eight Collection Assessment Measures in a University Research Library [collections included anatomy, pathology, pediatrics, and surgery]*

Texas Woman's University

- Mury, Mohammad Rajabalipour. (Ph.D., 1991). *South Central Regional Medical Library Program (TALON): An Evaluative Study*
- Razzaghi, Farzaneh. (Ph.D., 1990). *How Selected Faculty in Seven Medical Schools in Texas Meet Their Information Needs*
- Ruddy, Mary Karen. (Ph.D., 1990). *A Sociometric Analysis of Information Seeking Behavior, Information Sources, and Information Networks in Boards, Committees, and Commissions in a Small Rural Iowa Community*

University of Illinois at Urbana-Champaign

- Self, Phyllis C. K. (Ph.D., 1990). *Formal and Informal Communication Patterns Among AIDS Researchers: An Investigation Based on Collaboration and Productivity*

TABLE 2. (Cont.)

## LIS DISSERTATIONS COMPLETED ON HEALTH INFORMATION TOPICS 1983-1993

## University of Michigan

Strong, Blondell McDonald. (Ph.D., 1983). *The Relationships of Socioeconomic Background, Occupational Characteristics and Educational Attainment to the Professional Activities of Medical School Librarians*

## University of Pittsburgh

Gollop, Claudia J. [Ellen Detlefsen, Advisor]. *Health Information Seeking Behavior of Older, Urban, African American Women*

Huber, Jeffrey T. (Ph.D., 1991). *Assisting Persons with AIDS: A Content Analysis of Information Sources on Dying, Death, and Bereavement for Gay Males with AIDS*

Osiobe, Stephen A. (Ph.D., 1984). *Use of Information Resources by Faculty and Students in Nigerian Medical Schools*

Elayyan-Nimer, Ribhi M. (Ph.D., 1986). *An Investigation into the Uses of Sources of Medical Information by the Practicing Jordanian Physicians of Selected Hospitals in Jordan*

## University of Sheffield

Soto, Susana. (Ph.D., 1992). *Information in Dentistry: Patterns of Communication or Use*

## University of Texas-Austin

D'Auria, Jennifer Piersma. (Ph.D., 1992). *A Bibliometric Analysis of Published Maternal and Child Health Nursing Research from 1976 to 1990*

University of Southern California<sup>a</sup>

Fuller, Sherrilynne S. (Ph.D., 1984). *Schema Theory in the Representation and Analysis of Text [Clinical Trials]*

## University of Wisconsin-Madison

Stavri, Zoe. (Ph.D., 1992). *Information Need in Medical Diagnosis: Urgency, Etiology, and Information Seeking Questions*

Georgia State University<sup>b</sup>

Rankin, Jocelyn Ann. (Ph.D., 1989). *The Use of Library Resources in Problem-Based Medical Education*

Northern Arizona University<sup>b</sup>

Wiesenthal, Diane. (Ed.D., 1991). *The Future Role of the Health Sciences Library in the Department of Veterans Affairs*

University of Nebraska, Lincoln<sup>b</sup>

Braude, Robert M. (Ph.D., 1987). *Environmental and Personal Factors in Secondary Career Choice of Graduates of Medical Informatics Training Programs*

University of Texas, Graduate School of Biomedical Science at Galveston<sup>b</sup>

Eaton, Elizabeth King. (Ph.D., 1986). *Evaluation and Model of a Clinical Librarian Program*

<sup>a</sup> LIS program no longer active

<sup>b</sup> Not an LIS program

Sources: *Dissertation Abstracts International*; personal communications; ELEASAI, DOCDIS, MEDLIB-L, LIBRES, and AAHSLD computer conferences.

TABLE 3.  
LIS DISSERTATIONS IN PROGRESS ON HEALTH SCIENCES INFORMATION TOPICS 1992-1993

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Rutgers The State University of New Jersey
Algon, Jackie [Nick Belkin, Advisor]. <i>Effect of Task on Information-Seeking Behaviors of Individuals in Working Groups in Pharmaceuticals</i>
University of Chicago <sup>a</sup>
Weller, Ann C. [Don Swanson, Advisor]. <i>Editorial Peer Review in U.S. Medical Journals</i>
University of Illinois
King, David N. [Linda Smith, Advisor]. <i>Clinical Search Effectiveness: An Assessment of the Contribution of the Computer-Assisted Information Services of Hospital Libraries to Clinical Decision-Making by Physicians</i>
University of Maryland (College Park)
Florance, Valerie [Gary Marchionini, Advisor]. <i>A Clinical Extract of Biomedical Literature for Patient-Care Problem Solving</i>
University of Michigan
McGaugh, Della Lee Ann [Miranda Pao, Advisor]. <i>Library Interrelationships: Electronic Trails on DOCLINE</i>
University of North Carolina-Chapel Hill
O'Neill, Ann [William M. Shaw, Advisor]. <i>Information Transfer in Professions: A Citation Analysis of Nursing Literature</i>
Byrd, Gary [William M. Shaw, Advisor]. <i>Do Clinical and Basic Sciences Research Faculty Make Productive Use of the Common Property Journal Resources Provided by Academic Health Sciences Libraries?</i>
University of Pittsburgh
Flynn, Ida [Margaret Kimmel, Advisor]. <i>Design and Development of an Interactive Multimedia Information System for Educators and Classmates of Young Cancer Patients</i>
Lindberg, Carolyn H. [Edie Rasmussen, Advisor]. <i>A Comparative Study of the Thesaurus of Biomedicine of the National Library of Medicine and the Language of Patient Charts at Presbyterian-University Hospital, Pittsburgh PA</i>
Scheetz, Mary D. [Ellen Detlefsen, Advisor]. <i>Scientific Misconduct and Publishing in the Biomedical Literature: A Content Analysis, 1966-1992</i>
University of Texas at Austin
Calisto, Beatrix [Brooke Sheldon & Sirkka Jarvenpaa, Advisors]. <i>Effects of Integrated Information Systems on the Power of Libraries as Subunits of Organizations</i>
Bowden, Virginia [Donald Davis, Advisor]. <i>Monograph Collections in Academic Health Science Center Libraries, 1980-1992: Patterns of Ownership and Use</i>
University of Western Ontario
Baker, Lynda [Roma Harris, Advisor]. <i>The Information Needs and Information-Seeking Patterns of Women Coping with and Adjusting to Multiple Sclerosis</i>

<sup>a</sup> LIS program being phased out

<sup>b</sup> Not an LIS program

Sources: personal communications; ELEASAI, DOCDIS, MEDLIB-L, LIBRES, and AAHSLD computer conferences.

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The presence of these projects suggests that this research is being done in universities which offer LIS programs where teaching and research on issues in the health information professions is encouraged.

### SUCCESS FACTORS FOR HEALTH SCIENCES INFORMATION EDUCATION

In a 1986 paper on the past, present, and future of medical library education, Detlefsen and Galvin (1986) argued that alliances with other professional schools was a necessary attribute for successful medical library education; in particular, they stressed the need for alliances with faculty in medical schools, especially those with programs in the then-new field of medical informatics. Subsequently, at an evening workshop at the 1989 Symposium on Computer Applications in Medical Care (SCAMC), the discussion was focused on issues in the educational preparation of the medical librarian for the new age of integrated medical information. At that workshop, Detlefsen identified five criteria which she labeled as success factors for an LIS program which sought to be a center of excellence in the preparation of health science information professionals. Table 4 lists these success factors.

TABLE 4.  
SUCCESS FACTORS FOR A SPECIALIZED LIS PROGRAM IN HEALTH INFORMATION

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- One or more full-time, tenured, faculty members in a doctoral-degree granting LIS program with a declared interest in health information.
  - A group of associated medical or health sciences faculties and programs nearby, preferably within walking distance and preferably including a medical school.
  - A large academic health science center library nearby, preferably within walking distance.
  - Medical informatics research and training initiatives underway in the university of which the LIS program is a part.
  - Personal, professional, and electronic links among the four groups (LIS faculty members, health sciences faculties, the academic health science center library, and the medical informatics researchers).
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A recent review of existing programs and course offerings in medical librarianship<sup>5</sup> showed that only a few programs have met these criteria or are even very close to having all the success factors. Those closest to meeting the criteria are the LIS programs at the University of Pittsburgh, the Texas Woman's University, and the University of North Texas. There is also progress apparent toward achieving the success factors at the University of Illinois, University of Alabama, and University of Wisconsin—Milwaukee. Two of the Canadian schools—the University of Toronto and University of Western Ontario—also appear to be on the path to excellence for

health sciences information education, although the U.S.-based and National Library of Medicine-funded research initiatives are less likely to be present on their medical and LIS campuses. Other LIS programs with full-time faculty interested in medical information are limited by such factors as their small size, the absence of a research-centered doctoral program, and the inability to link conveniently to a university medical school.

Sadly, however, much of the innovative research work in medical informatics and many of the excellent academic health science center libraries are in universities without programs in LIS education<sup>6</sup> or in universities which have closed their LIS programs.<sup>7</sup> Still other universities have strong academic medical libraries and excellent LIS schools with doctoral programs, but their university LIS programs do not as yet focus on biomedical and health sciences information or do not have full-time faculty with strength in the field.<sup>8</sup> Other major universities are faced with the real dilemma of having a strong LIS program on one campus and excellent medical facilities (libraries, faculties, researchers) on another campus physically miles distant or institutionally separate from the LIS site.<sup>9</sup>

#### CHANGES IN MEDICAL EDUCATION WHICH CAUSE CHANGE IN LIS EDUCATION

A major influence for change in the education of health information professionals is the move toward major curriculum reform in medical education itself; these changes in medical education often have immediate repercussions for medical librarians in practice and for medical library education. In particular, the trend toward *problem-based learning* (PBL)<sup>10</sup> in medicine has been a shift away from lockstep memorization of facts and rote learning to an increased emphasis on "learning how to learn," or independent self-directed learning, in order to become lifelong learners (Jonas et al., 1992). Medical students in a PBL curriculum are typically involved in clinical settings and hands-on patient interactions from their first days in medical school. There is increased attention to the need for doctor-patient communication ("Dartmouth Redesigns Medical Training...", 1992), to computer and science information literacy amid an avalanche of literature (Williamson, 1990), to oral and written communication skills, and to an awareness of ethical and social issues in the physician-patient relationship. Physicians in training are specifically being taught to use e-mail and telecommunications, bibliographic and full-text databases, expert systems, office automation programs, and personal file management software.

This need to be an active participant in a PBL curriculum is one of at least six changing roles for which LIS professionals will

now need to be educated.<sup>11</sup> Some academic health science center libraries have already responded to these changes in medical curriculum (Rankin, 1992) with library professional staff instructing medical, nursing, dental, and veterinary students in many of the basic skills of information management through expanded bibliographic instruction (BI) or information management education (IME) programs (Burrows et al., 1989; Schwartz, 1987). LIS professionals must, therefore, be comfortable in a new and expanded "teaching" role, and their professional education needs to include much more attention to issues such as learning styles, techniques for instruction, the use of instructional media, methods for evaluation, and adult learning.

Also of particular interest to health information professionals is the need to teach medical students and other health professionals the skills involved in the art of critical evaluation or "quality filtering" of the medical literature. The ability to judge critically and to assess the potential value of a reference to a particular clinical problem is a skill that reference professionals have honed over many years of providing services to health sciences clients; what is new is that the information professionals are now faced with teaching these skills to others rather than just performing the tasks for them. The work of physician/librarian research teams from the McMaster University School of Medicine and the University of Illinois College of Medicine offers some good examples of the collaborative teaching role and interdependent learning that is necessary to master the art of quality filtering (Frasca et al., 1992; Dorsch et al., 1990; Haynes et al., 1990; Bennett et al., 1987). If programs of LIS education are to produce health information professionals to work in this "new" medical school environment and to support future health care professionals, then these LIS programs must offer instruction (or access to instruction in other appropriate professional schools) in such areas as medical terminology and language, information-seeking behavior, health sciences research methods and biostatistics, evaluation of medical sources, and teaching skills.

#### OTHER CHANGING ROLES FOR HEALTH INFORMATION PROFESSIONALS

Another area of professional involvement with the clinician, while not new, is receiving increased attention in the medical setting—that of clinical medical librarian (Kuller et al., 1993; Veenstra, 1992). These individuals are trained health information professionals who join a clinical team for morning rounds, daily report, ward walks, clinical conferences, or other activities when health professionals daily gather to review the status of patients in hospitals. As the team

members—attending physicians, residents, medical students, nurses, pharmacists, dieticians, social workers, therapists of various kinds, and so on—discuss the patient and the diagnosis, the therapy, the care plan, and so on, the information professional notes questions and information needs and then does literature searching, reference work, and document delivery in order to bring useful information to the team as rapidly as possible. The results of this information activity are then placed in the patient's chart or at the ward or unit desk for all clinical team members to use in patient care. LIS professionals who work as clinical medical librarians must be specifically educated for the ward, clinic, or patient care setting, a demonstrably different place in which to practice librarianship. These individuals need to develop special skills with medical terminology across the various health professions, with an in-depth knowledge of ethical and legal problems in clinical work, and especially with an understanding of information-seeking behavior and the formulation of questions by clinicians (Florance, 1992; Forsythe et al., 1992; Osheroff et al., 1991).

Some of these individuals will even begin to focus on a specific specialty, subspecialty, or diagnosis, and then serve as clinical medical librarians for a particular population of health care providers (pediatrics or geriatrics, AIDS or Alzheimer's Disease, internal medicine or psychiatry, and so on). Some of these clinical information specialists may also need specialized training in patient and family education resources in order to provide materials and information for clinicians to use directly with patients and their families and care givers; their work will be similar to that of nurse educators, social workers, and health education specialists. Their LIS education must offer these master's degree students the opportunity to take courses in these disciplines and professions, probably through cross-registration into the schools of nursing, pharmacy, education, and social work, where such topics are typically taught at the graduate level.

A logical extension of this clinical role is the newly emerging role of research information specialist for a funded clinical research team or project. Occasional examples are now apparent in which a research project with a large number of professional staff members hires an MS information specialist to serve their information needs. Often the work of this health information professional goes beyond that of information retrieval, quality filtering, and document delivery to include major responsibilities for editing and presenting findings, file management, multifile database massage, and liaison with the academic health sciences center library world. These individuals may work for large meta-analytic projects such as those funded through the PORT (Patient Outcomes Research Team) grants of the Agency

for Health Care Policy and Research or for a National Institutes of Health (NIH)-funded clinical research center (CRC) on a specific disease or syndrome. Such health information professionals will need thorough preparation in technologies for information management, in working with specialized literatures and vocabularies, and in writing and the media for science and medicine.

Health sciences information will also play a very important role in the administrative side of medical care. LIS professionals will have to be able to provide rapid and authoritative service for nonclinical administrators, such as CEOs, hospital lawyers, planning and development officers, medical records managers, insurance providers, and quality care assurance managers. As an example, there is pioneering work underway in the Veterans Affairs Medical Center in Biloxi, Mississippi, in an effort to link quality assurance incidents to the continuing education of physicians through library services. LIS professionals in Biloxi identify a problem from the patient's chart and its accompanying quality assurance documentation, and then prepare a learning package with articles, videos, texts, and so on, designed to educate the health care team on how to proceed. This activity clearly demonstrates that LIS professionals have daily involvement in quality patient care.<sup>12</sup> The education of individuals for this line of work needs to include not only the tools of clinical medical information but also extensive training with legal and regulatory sources and the management literature, with integrated information systems and hospital database management concerns, and even with the use of medical records and patient data. Cooperative course work and joint degree programs with schools of management and/or public health that offer the MBA and MHA degrees may offer health information professionals their best opportunity to prepare for these jobs and professional collaborations. The establishment of combined MS/MBA or MS/MHA programs will require an unusual degree of intra-university cooperation, however.

These new roles are not limited to those LIS professionals working in university medical centers or even large teaching hospitals. As the graduates of medical schools that have reformed their curricula to emphasize lifelong learning and information management enter practice, the sites in which these new MDs find themselves—whether community hospitals, group practices, health maintenance organizations, or skilled care facilities—will need to offer information services that support clinicians' needs and skills. Recent research by a group of library colleagues in the Rochester, New York, area on the specific uses of hospital library information by physicians in clinical decision-making, offers evidence that library resources can cut health care costs and save lives (Marshall, 1992). Traditional

hospital librarians (or those MS students who seek such careers) will increasingly need to be teachers, critical evaluators of the medical literature, and members of clinical teams. With the absence of such new emphases in their professional lives, they risk becoming only document delivery clerks and guardians of old book collections, or they may be replaced altogether with less expensive nonprofessionals who handle routine tasks. Obviously, LIS education for hospital library professionals must prepare them for a changing health care environment.

### MEDICAL INFORMATICS

A second pull that has been exerted on the field of education for health sciences information professionals has come from the field now known as *medical informatics*. The discipline is a youthful one (Blum & Duncan, 1990). It has been defined as:

the field concerned with the cognitive, information processing, and communication tasks of medical practice, education, and research, including the information science and technology to support these tasks. It is both a science and a technology. (Greenes & Shortliffe, 1991)

The Association of American Medical Colleges (AAMC) was an early force for change, insisting that medical informatics must be integrated into medical curricula; a 1989 article summarized the key AAMC recommendations (see Table 5; Haynes et al., 1989).

Early curriculum initiatives for the inclusion of information technology at the Harvard Medical School set an example for others in medical education (Barnett, 1989). Other academic sites have continued to develop strong programmatic efforts to train "medical informaticians" (Frisse, 1992). Although a stated role for health information professionals, and particularly those who work in academic health science centers, was not specifically laid out in the AAMC recommendations or in some of the university plans, many academic health science center librarians were quick to seize on the recommendations and begin to plan for their early involvement with programs in medical informatics.

At present, medical informatics is an academic field, largely the province of medical schools, with some participation by faculties in nursing, dentistry, and veterinary schools (Ball et al., 1988; Ball & Douglas, 1990; Ball & Douglas, 1992). Modest interest has also been expressed by schools and faculties of computer science, intelligent systems, cognitive science, and a few information science programs. The principal professional conferences and societies for those who work in the field are the annual Symposium on Computer Applications in Medical Care (SCAMC), now in its sixteenth year, and the American Medical Informatics Association (AMIA). To their

TABLE 5.

## ASSOCIATION OF AMERICAN MEDICAL COLLEGES' RECOMMENDATIONS FOR INFORMATICS IN MEDICAL SCHOOLS IN THE UNITED STATES

1. Medical informatics should become an integral part of the medical curriculum.
2. There should be an identifiable locus of activity in medical informatics in academic medical centers to foster research, to integrate instruction, and to encourage appropriate use in patient care.
3. Training and career development in medical informatics must be fostered by a series of coordinated actions: (a) the National Library of Medicine should be the major federal agency for training, career development, and research support; (b) to address the immediate problem, at least ten centers of excellence should be established and funded to provide the manpower to implement these programs on a national scale and to conduct research in medical informatics; and (c) support for training programs should be increased.
4. Professional societies and scientific journals should be encouraged to publish and evaluate work in medical informatics.
5. The Association of American Medical Colleges should assist its members by providing seminars on information management, new technologies, and innovations in medical informatics.
6. The National Library of Medicine should help coordinate the assessment of medical software and provide a clearinghouse of information about what is available.

Source: Haynes, R. B.; Ramsden, M.; McKibbin, M. A.; Walker, C. J.; Ryan, N. C.; & Gardner, M. (1989). A review of medical education and medical informatics. *Academic Medicine*, 64(2), 207-212.

credit, these two groups are clearly interdisciplinary and draw participation from individuals with a broad range of professional training, including not only physicians and computer scientists but also nurses, dentists, veterinarians, medical records administrators, librarians, publishers, and software and hardware producers.<sup>13</sup>

Much of the funding for these formal graduate training programs in medical informatics has come through grants from the National Library of Medicine (NLM), which has placed a priority on support for medical informatics training. NLM's research agendas on medical informatics extend well beyond the provision of support for graduate training programs, however. Additional NLM emphasis has been placed on related initiatives on Integrated Academic Information Management Systems (IAIMS)<sup>14</sup> (Lorenzi, 1992; Anderson & Fuller, 1992) and the development of the Unified Medical Language System (UMLS) (Humphreys, 1993; Hattery, 1992; Siegel, 1987).

While relatively new, the field does have several journals of importance as well as a regular column in *Academic Medicine*.<sup>15</sup> There is also an active computer conference for announcements, news, and current awareness information.<sup>16</sup> A basic textbook for the field was recently published (Shortliffe et al., 1990), and a number of graduate training programs, largely affiliated with medical schools, are now in existence. The typical student in these programs is earning an

MS or a Ph.D., often in conjunction with an MD, or is a physician pursuing a postresidency fellowship. Occasionally a postdoctoral fellow from library or information science or a librarian seeking a second master's degree is admitted. Some other NLM-funded educational initiatives have been aimed at medical school faculty and medical librarians who seek to be educated in "applied informatics," and for whom the research focus of the fellowship programs may not be appropriate.

Since 1992, the NLM has also sponsored a specialized short course on medical informatics,<sup>17</sup> and specifically invited "medical educators, medical librarians, medical administrators and young faculty who are not currently knowledgeable but [who] can become change agents in their institutions" (*Medical Informatics Course...*, 1993) to apply for participation in the week-long workshop. Thirty fellowships for the week-long course are offered, and workshop fellows learn how to:

use computer-assisted learning tools, access computerized databases, use communication networks, build and use a knowledge base for an expert system, use medical vocabularies and information retrieval strategies, and work with software for analysis of biological sequence data and high-performance computing and communication...through a combination of lectures and hands-on exercise, [in order to] introduce the student to programming, information systems, pattern recognition, and expert systems, [and to] provide an appreciation of theoretical and experimental challenges in the field. (*Medical Informatics Course...*, 1993)

While the course is directed by a physician, the faculty speakers are drawn from a variety of professions involved with medical informatics, and the participants have clearly come from a variety of medical and information backgrounds, including some medical librarians in the first two classes.<sup>18</sup>

The general curriculum for graduate programs in medical informatics stresses computer science concepts for the clinician; specific use of expert systems and artificial intelligence programs (particularly those for clinical decision support); the development and use of computerized patient records and hospital information systems, with some attention paid to information storage, retrieval, and management; and literature-based research and information-seeking behavior. Two recent follow-up studies looked at the graduates of thirteen programs during the years from 1988 through 1991; both concluded that the typical graduate was a physician, often an internist, who sought a career in an academic setting (Aronow et al., 1991; Braude, 1991).

The issue of career focus in medical informatics led Greenes and Shortliffe (1990) to list some expected career paths in medical informatics; these researchers saw informatics professionals

1. in academic research & development, and educational support positions;

2. in clinical administrative and educational management;
3. as operational service managers;
4. as hospital chief information officers; and
5. in corporate research and development.

The 1992 Symposium on Computer Applications in Medical Care featured two sessions which were also centered on the career concerns of those in medical informatics. There was an evening workshop on "Certification in Medical Informatics and Clinical Informatics as a Medical Specialty," which proposed two distinct and parallel initiatives: one for board-certified physicians leading to a subspecialty qualification recognized (at some point in the future) by the American Board of Medical Specialties, and a certificate in medical informatics, open to all AMIA members regardless of professional background. A second panel was held to discuss "Outreach [and] New Collaborative Roles for Health Professional Librarians," again focused on the emerging "collaborative efforts to foster and facilitate the use of information technology with the ultimate goal of improving health care delivery."<sup>19</sup> These efforts suggest that the additional career path of a health information professional or biomedical librarian should now be added to the list developed by Greenes and Shortliffe in 1990.

#### REFORMATION OF MEDICAL LIBRARY EDUCATION

In response to these efforts to expand the field of medical informatics and to reform medical education, those LIS programs that seek to be leaders in the education of new information professionals for biomedical settings must expand and change their own agendas. Care needs to be taken now to see that LIS programs at both the master's and doctoral level, as well as in the continuing education arena, reflect an awareness of the changes taking place in medical education and in the emergence of medical informatics as a discipline and as a professional field.

The push for added emphases in LIS education was strengthened with the 1992 publication of the *Platform for Change: The Educational Policy Statement of the Medical Library Association* (Medical Library Association, 1992).<sup>20</sup> This document stresses a baseline set of seven areas of knowledge and skills and individual responsibility for the "continuum of learning." In addition, both general recommendations and specific charges for "library and information science education" were made. Table 6 lists the essential "health information science knowledge and skills," and Table 7 outlines the MLA's five recommendations which most directly impact LIS education.

TABLE 6.  
 MEDICAL LIBRARY ASSOCIATION  
 HEALTH INFORMATION SCIENCE KNOWLEDGE AND SKILLS

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- *Health Sciences Environment and Information Policies*  
 Health sciences librarians must understand the contexts in which the need for biomedical and related information emerges and the unique ways of perceiving and interpreting those environments. Therefore, they should be alert to the changing information and health care environments and the major program and policy sources.
  - *Management of Information Services*  
 Leadership in the application of library and information science to the handling of health sciences information resources in complex institutional environments requires specialized knowledge, skill, and understanding of management.
  - *Health Sciences Information Services*  
 Health sciences librarians require knowledge of the content of information resources and skills in using them. They must understand the principles and practices related to providing information to meet specific user needs and to ensure convenient access to information in all forms.
  - *Health Sciences Resource Management*  
 Health sciences librarians must know the theory of, as well as have skills in, identifying, collecting, evaluating, and organizing resources and developing and providing databases.
  - *Information Systems and Technology*  
 Developments in technology have reshaped the goals and systems of health sciences librarianship and changed the way information professionals function. Health sciences librarians must be able to understand and use technology and systems to manage all forms of information.
  - *Instructional Support Systems*  
 Teaching ways to access, organize, and use information to solve problems is an essential and ever-widening responsibility of the health sciences librarian. Effective instruction entails not only knowledge of the structure and content of specific courses and technology, but also an understanding and expertise in [instructional theories and methodologies].
  - *Research, Analysis, and Interpretation*  
 In order to construct and interpret research, the health sciences librarian would be called upon to apply knowledge, skills, and understanding of...information structure, transfer, and processing, analysis, evaluation and application of research results...statistical theory, and research methodologies.

Source: Adapted from MLA's *Platform for Change*, pp. [9-15].

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To respond to these imperatives, LIS programs must take a number of steps. Individuals with a specific interest in, and experience with, health sciences information should be recruited for full-time tenure-stream and tenured positions in LIS schools, and these faculty members should then seek joint appointments and collaborative relationships with medical researchers and faculties. Only full-time LIS faculty members can assume the advocacy and advising roles that are crucial for a specialization in an LIS curriculum. Researchers and teachers from medical education should also be invited to join LIS programs as adjunct faculty and then participate fully in LIS program planning. Interdisciplinarity must be a hallmark of LIS education for the medical environment (Hoke, 1993).

TABLE 7.  
SELECTED MEDICAL LIBRARY ASSOCIATION  
RECOMMENDATIONS FOR LIS EDUCATION PROGRAMS

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*General Recommendation (#5)*

Centers of excellence in health information should be identified, designated, and funded at strategic points across the country to provide opportunity for the acquisition of new knowledge and skills.

*Association-Specific Recommendation (#12)*

MLA must establish a formal liaison with the schools of library and information science education.

*Library and Information Science Education—Specific Recommendations (#17, 18, 19)*

Every graduate program in library and information science must lay a broad foundation that stresses theory over application, places librarianship in a context with other disciplines, fosters professional values, and prepares students to design their own learning program throughout the length of their careers.

Educators should provide a range of programs and opportunities that meet needs throughout one's professional career, rather than focus solely on the master's degree.

Educators need to define the boundaries of their programs and develop effective relationships with other related information disciplines.

*National Library of Medicine—Specific Recommendation (#21)*

NLM should convene a planning panel on education for health sciences librarianship.

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Source: Adapted from MLA's *Platform for Change*, pp. [18, 21, 23-24].

A single health sciences bibliography course or a medical library management class will not be enough.<sup>21</sup> In addition to developing LIS course work with emphases that match the research and clinical needs of medical center personnel, LIS students must be encouraged to take courses in health professions schools, not only for the content but also for collegial networking with those who will become their clients. Rigorous internships, cooperative field placements, and post-master's residency or associate programs<sup>22</sup> must be devised and expanded so that LIS students can participate in real-world settings where health sciences information is used daily in innovative ways.

LIS faculties should look to expanding their continuing education offerings and specifically to sponsoring continuing education work that can attract both current students and health information practitioners who want to become more familiar with topics and techniques that have emerged in the field since their completion of MS studies.<sup>23</sup> Ways in which LIS programs and academic health science center libraries can offer sabbatical opportunities for practitioners and LIS educators to refresh and learn new skills must be developed.<sup>24</sup>

LIS researchers—whether faculty or doctoral students—should be encouraged to pursue investigations of issues in health sciences information and to seek outside support from agencies such as the National Library of Medicine and the Agency for Health Care Policy

and Research which are already funding work in medical schools and health professions programs. Research on information-seeking behavior, on the structure and use of information resources, on the delivery of health sciences information, on the impact of information on clinical practice, and on the relationship of information to patient care outcomes, should take center stage. LIS researchers must be persuaded and encouraged to participate and present findings at SCAMC and at other international meetings, to publish their work in the medical informatics journals, and to seek funding from agencies such as the NLM and the AHCPR.

Health information professionals and LIS faculties alike must pay particular attention to the development of statements of education policy (such as the MLA's *Platform for Change*) and the propositions put forth by health professionals about education and training goals (such as those of the AAMC) in order to stay in the forefront of a changing academic marketplace. As societies and professional organizations develop certification mechanisms and subspecialty qualifications, LIS professionals must be ready to insist on their role and full participation in the activities related to health information.

Perhaps of paramount importance, however, is the necessity to develop firm professional linkages to fellow health information professionals in medical centers and to faculties in the health sciences. This interdisciplinary cooperation will be the hallmark of successful change in LIS education for the changing world of the health sciences. Just as interdisciplinarity is the watchword of good clinical care, so interdisciplinary efforts in the education of health information professionals will be necessary. Absent such links, traditional medical librarianship will become increasingly irrelevant to health sciences, an anachronism that may be seen as a luxury in a time of health care cost containment. If, however, health information professionals and those who would educate them can adapt their programs and skills to meet the needs of the changing health care workplace, the role that they can play in information management will be significant.

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## NOTES

<sup>1</sup> The American Library Association currently lists fifty-seven active North American programs with accredited programs leading to the first professional degree, with twenty-five of them also offering doctoral programs; the Medical Library Association identifies thirty-four of the North American programs as having some specialized course work in health sciences or biomedical librarianship. Both lists are available from the respective association offices in Chicago, IL.

<sup>2</sup> This degree may variously be known as an MS, an MLS, an MALS, an MSLS, or even as an Msc, an MSIS, or an MS/IRM. In this article, however, the acronym *MS* will be used to mean all forms of master's-level degrees from the various library and information science professional schools.

<sup>3</sup> For convenience, the acronym *LIS* will be used in this article to indicate academic programs which cover the broad interdisciplinary area ranging from traditional librarianship to information science and telecommunications. The programs covered by the general LIS acronym carry many names including, but not limited to, library science, information science, information studies, information resource management, and the like.

<sup>4</sup> The ten are (in alphabetical order) Ana Cleveland, Gwen Cruzat, Ellen Detlefsen, Alexandra Dimitroff, Ingrid P. Y. Hsieh-Yee, David King, Edmond Mignon, Fred Roper, Padmini Srinivasan, and Mary Westermann. Based on their publishing records, it seems appropriate to add LIS faculty members Jeffrey Huber, Joanne Marshall, Beth Paskoff, and Linda Smith to the ten listed in the American Library and Information Science Education (ALISE) directory. In addition, Mike Koenig, Jana Bradley, and Robin Overmeier have been suggested as additional faculty members with interests and expertise in medical information.

<sup>5</sup> The materials reviewed included the Association of Library and Information Science Education (ALISE) directory, the Medical Library Association (MLA) brochure on courses in health sciences librarianship, descriptions of recent MLA programs, SCAMC proceedings, the proceedings of the 1989 *International Symposium on Medical Informatics and Education* (Salamon, 1989), as well as numerous personal communications and a broad-based literature review.

<sup>6</sup> This is true of universities such as Harvard, Yale, Johns Hopkins, Stanford, and Utah.

<sup>7</sup> For example, Columbia University and the University of Chicago and University of Southern California have closed their LIS programs in recent years.

<sup>8</sup> This is the case at present of the University of Texas at Austin, University of California at Los Angeles, University of North Carolina at Chapel Hill, and University of Wisconsin at Madison.

<sup>9</sup> These physical and institutional barriers hamper the ability of LIS programs at Catholic, Drexel, Rutgers, and Syracuse Universities, as well as at the University of Maryland, to link with the medical universities in their systems or cities.

<sup>10</sup> The Harvard Medical School's "New Pathway" program is probably the most widely known of these problem-based approaches. It was documented in a popular PBS Nova segment entitled *So You Want to be a Doctor?*

<sup>11</sup> Published as a special symposium issue of the *Bulletin of the Medical Library Association* with five articles on the impact of PBL curricula on medical libraries.

<sup>12</sup> Christiane J. Jones described this effort in a 1993 paper entitled "Making a Difference in the Hospital's Quality Improvement Program Today," given at the annual meeting of the Medical Library Association, Chicago, IL. Requests for further information should be sent to Christiane Jones, Chief of Library Services, Department of Veterans Affairs Medical Center, Biloxi, MS 39531.

<sup>13</sup> Some medical informatics professionals also identify with the American Society for Information Science (ASIS) and its SIG-MED, or with the Medical Library Association and its Medical Informatics Section.

<sup>14</sup> As of 1993, the NLM has begun to refer to IAIMS as Integrated *Advanced* Information Management Systems, in recognition of the move beyond academia and into general medical practice (Lindberg, 1993).

<sup>15</sup> *Artificial Intelligence in Medicine* (vol. 1, 1989, ISSN 0933-3657); *Computers and Biomedical Research* (vol. 1, 1967, ISSN 0010-4809); *M. D. Computing: Computers in Medical Practice* (vol. 1, 1984, ISSN 0724-6811); *Medical Decision Making: An International Journal of the Society for Medical Decision Making* (vol. 1, 1981, ISSN 0272-989X); *Methods of Information in Medicine: Methodik der Information in der Medizin* (vol. 1, 1962, ISSN 0026-1270); the editors of the *Journal of the American Medical Informatics Association* (ISSN 1067-5027) expect to publish its first issue in November 1993; and *Academic Medicine: Journal of the Association of American Medical Colleges* (vol. 64, 1989, ISSN 1040-2446) continues *Journal of Medical Education* (vol. 26[3], 1951, ISSN 0022-2577).

<sup>16</sup> To subscribe, send an email message to <[aimedicine-request@med.stanford.edu](mailto:aimedicine-request@med.stanford.edu)> and ask to be added to the list. At present, there are about 700 subscribers from 30 countries, with about 300 messages posted to subscribers each year.

<sup>17</sup> A 1993 brochure is available from Marine Biological Laboratory, Office of Sponsored Programs, Woods Hole, MA 02543; 508-548-3705 Ext. 401.

<sup>18</sup> Monica M. Unger (NEOUCOM, Rootstown, OH) and Linda M. Jackowitz (West Virginia University Health Sciences Center, Morgantown, WV) presented a poster session at the 1993 annual conference of the Medical Library Association on their experiences as two of the ten medical librarians in the first class of fellows in the Woods Hole medical informatics program.

<sup>19</sup> 1992 SCAMC Preliminary Program (further SCAMC program details are available from the American Medical Informatics Association, 4915 St. Elmo Avenue, Suite 302, Bethesda, MD 20814; Internet: <[amia@camis.stanford.edu](mailto:amia@camis.stanford.edu)>)

<sup>20</sup> Available from the Medical Library Association, Professional Development Department, 6 North Michigan Avenue, Suite 300, Chicago, IL 60602-4805.

<sup>21</sup> Several LIS schools have begun to offer courses or seminars specifically in medical or health informatics, and to attract cross-registrations from individuals pursuing fellowships in medicine or computer and information science to these courses. At the University of Pittsburgh, for example, the graduate-level course entitled *Introduction to Medical Informatics* is cross-listed by the Departments of Information Science, Library Science, and Intelligent Systems, and team-taught by faculty from the Section of Medical Informatics and the Department of Library Science. The instructors—Nunzia Giuse, MD, MLS and Ellen Detlefsen, DLS—each have joint appointments in the other's home departments.

<sup>22</sup> The National Library of Medicine's Library Associates program, and the research library residency programs at the Universities of Illinois at Chicago, and California at San Francisco, are particularly good examples of biomedically focused post-master's residency programs for recent LIS graduates. A similar program (now not in operation due to lack of funding) at the University of Michigan was also successful. Note that two of the three university programs are in institutions that do not have graduate programs of LIS education.

<sup>23</sup> One interesting CE response has been the scheduling of classes by the LIS programs at the University of Pittsburgh and at Rosary College, in which the course content focuses on a series of all-day workshops developed by the Medical Library Association. MS students take all workshops and complete a paper for their graduate credits, while practitioners and alumni take individual workshops and receive CEUs for their participation. In 1991, 1992, and 1993, these workshops featured topics such as *Research Methods for the Health Sciences Librarian* (MLA CE Course #683), *Government Information Resources* (MLA CE Course #905), and *Medical Terminology* (MLA CE

Course #201), all topics with particular relevance for the health information professional in the age of medical informatics.

<sup>24</sup> The Duke University Libraries have begun a program specifically for LIS faculty members to spend a year on-site in the libraries, working with Duke librarians and doing research on topics of mutual interest.

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