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# The changing face of health information and health information work: a conceptual framework\*

By Jana Bradley, Ph.D.

Indiana University School of Library and Information  
Science at Indianapolis  
755 West Michigan, UL1110C  
Indianapolis, Indiana 46202-5195

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The purpose of this paper is to examine the changes in health information and health information work using a conceptual framework and to consider the implication of these changes for health sciences librarians. The notion of what constitutes *information* depends heavily on the perspective of those defining the term. In the health care domain, numerous established concepts of *information* exist, many clustering around disciplines and professions. Various information professions—for example, health sciences librarians, information-systems managers, and medical-records administrators—have differing core concepts of information. Although these established concepts of information may seem immutable, they are cultural facts and can and do change. Global networking and changes in health care delivery are just two of many environmental forces that are changing the way the health domain views health information and the way it values the patterns and practices traditionally associated with established types of information and information professions. As new concepts of information arise, the possibility for new expert work surrounding information also arises. Andrew Abbott's systems theory of professions, adapted to the health domain, suggests that some forms of established expert information work may diminish while new types may arise and that both established and new information professions will struggle with each other for official sanction, or jurisdiction, to perform new expert work. This competitive struggle is likely to produce a new balance of information work and roles among the information professions. The specialty areas of library and information science, the heartland of our knowledge base, are as relevant in the electronic environment as in the print environment. Our profession's challenge now is to redefine and communicate our jurisdictional place in the emerging health information environment.

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## INTRODUCTION

The changes in the health information environment and the need for corresponding changes from the

health sciences library profession is a persistent theme in the literature of our profession. Topics have included changes in the roles of health sciences librarians [1-4], changes in medical libraries themselves [5-10], the emergence of informatics and new concepts of information management [11-14], and the need for changes in the education for our profession. [15-21].

The subject of this paper is also the changing health

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information environment but from a slightly different perspective. This paper suggests a conceptual frame for thinking about the changes in health information and health information work. The argument has five parts. Part 1 will explore the notion of health information. Part 2 examines the concepts of health information that are well established today. Part 3 looks at forces in the environment that are changing views of health information. Part 4 presents a theory of the health information professions that helps focus on how and why professions change. And part 5 examines our profession's place in the future system of information work.

### ASSUMPTIONS ABOUT CHANGE

Several assumptions about change underlie the conceptual framework proposed here. The first assumption is commonly called the socio-technical perspective, the assumption that technological and social change evolve together and influence each other. A related assumption places emphasis on the patterns and practices surrounding the use of tools and technologies. In the more than five hundred years since the introduction in Western Europe of printing with moveable type, other mass-communication media of the time—manuscript writing and the oral tradition—have not disappeared, but the patterns and practices of their use and their relationship to printing have changed dramatically [22]. This paper assumes that both established and new concepts of information and information work will exist side by side into the foreseeable future, but the patterns, practices, and values connected with them will continue to shift.

The concrete particulars of socio-technical change are local, enacted in individual institutions responding to local as well as national and global forces. While no one would deny large-scale trends in socio-technical change, there is not one standard blueprint for change that results automatically, even from use of the same technology. A consequence of the assumption that changes are driven by both local and larger-scale factors is that the extent of change as it is observed around us is variable. So, when we ask whether established roles for librarians will change quickly or slowly, the answer is "both." For the librarian whose library is suddenly closed, the change is swift and immediate. Yet, there are and will continue to be libraries that seem relatively unaffected by changes in the notions of information and information work. A final assumption of this paper is that change is emergent. The results are not predetermined but unfold through the incremental action and reaction of the participants.

### PART 1: THE NOTION OF HEALTH INFORMATION

In order to think about the changing notions of health information, it is necessary to have a definitional framework for understanding what "health information" is. In this paper, the phrase *health information* will be used as an inclusive term, meaning "information in the health domain," that vast territory encompassing human disease and wellness. Pinning down a framework for the word *information*, which seems to be innately resistant to definition, is more difficult. Michael Buckland's conceptual framework for thinking about information and information systems, among the most useful of the many attempts to identify key characteristics of information, will be the framework used in this paper [23].

Buckland identifies three principal senses in which the word *information* is used. "Information as process" refers to the action of becoming informed, adding to one's stock of knowledge or information. It is the individual who becomes "informed" and therefore must accept whatever new knowledge or information as "informing." The element of individual "acceptance"—Buckland uses the word *belief*—is crucial to the concept of *information*. "Acceptance" implies some basis on which the decision to accept is made—some legitimating criteria. Legitimizing criteria can be the individual's own, but many are the collective agreement of society or of groups such as professions, long since encapsulated in patterns and practices and taken for granted. Peer review of scientific information is an example of a legitimating criterion.

Buckland calls the second sense in which the word *information* is used "information as knowledge." Here, "information" refers to an unspecified entity. It is the intangible, unspecified specific element he is highlighting here.

The third sense in which *information* is used is "information as thing," the concrete representation of information as knowledge. In other words, any specific instance of "information" qualifies as "information as thing." He links information "things" to their context by the idea of evidence. Information as thing becomes evidence in a particular context, viewed by a particular information user. A key question then becomes, What specific "things" are people either as groups or individuals referring to when they talk about information?

In the health domain, responses might include the following: the patient record (Jane Doe's hospital chart or specific entries on that chart); financial information, such as the year-to-date expenditure by cost center; pharmaceutical information, such as the hospital formulary or specific information about a particular drug; journals and newsletters and particular articles they contain; texts of health care legislation or anal-

ysis of pending legislation; the contents of electronic forms of communication, such as listservs, bulletin boards, or e-mail; Web home pages; aggregate data, such as cost per patient day, or comparative data, such as cost per patient day in Indiana hospitals; books and the information they contain; databases; practice guidelines; clinical indicators and clinical pathways; and the things that "experts" know. This list of possible information "things" is both vast and various—a very mixed bag, referring to things with widely varying characteristics, including varying levels of specificity. As any reference librarian knows, the range of specific "things" that people mean when they use the word *information* is virtually infinite.

Underlying Michael Buckland's conceptual view of the three senses in which the word *information* is used is the centrality of perspective. Information as process turns on adding to one's information stock by accepting something as capable of informing. When information is used to refer to an intangible body of knowledge, there is an assumption of shared understanding of what that knowledge is. Information as thing refers to the identification by groups or individuals of a particular representation as evidence or information. The element of both individual and group perspective is essential in understanding the changing concepts of health information. From this conceptual frame, health information can be viewed as what people in the health domain think that it is.

## PART 2: ESTABLISHED CONCEPTS OF HEALTH INFORMATION

Established concepts of information are "bounded" concepts, definitions of information according to specific dimensions or boundaries. For a concept of information to be "established," sufficient numbers of people need to agree on the boundaries—on what constitutes a particular type of information, including the criteria that make it legitimate. Boundaries are frequently based on primary characteristics and encompass many related characteristics. So, for example, the concept of printed scientific information is based on the printed text but also includes the legitimating patterns and practices of authoring, publishing, and distributing information. Many established concepts of information come from disciplines and vary from discipline to discipline. A major part of a reference librarian's education is learning the established concepts of information in the sciences, the humanities, and the social sciences.

Related to disciplinary concepts of information but with somewhat different boundaries are concepts derived from professions and professional work. Each profession, like each discipline, has notions about what constitutes relevant information. Although most professions deal with information of specific types in

the context of their professional work, some professions focus their primary activity on working with specific types of health information. These health information professions have their primary professional identity focused on a particular established concept of information. Their expert work, or expert tasks, derive from the issues and activities they see as related to that type of information.

In the health domain, we can identify several established health information professions. Information-systems professionals in both academic and clinical environments work with concepts of information bounded by information systems technology. In practice, they have tended to focus on particular applications of that technology—such as financial, administrative, or academic applications—but that varies from situation to situation, and the trend nationally may be shifting to include more clinical applications.

Professionals whose expert work has in the past focused on the hospital chart and now is expanding to a view of an electronic medical record that could span a lifetime of health care have previously been known as medical-records librarians or administrators. In 1992, the primary association for these professionals changed its name from the "Medical Records Association" to the "American Health Information Management Association."

Health sciences librarians, as we all know, work in both academic and clinical settings. Our profession's expert work focuses on two primary concepts of information: printed information published and distributed via establishing legitimating processes and, more recently, electronic surrogates for this printed information, currently primarily electronic bibliographic files. In practice, these professionals work primarily in libraries, and the patterns and practices of management of both types of information are strongly conditioned by the institution of the library.

These three professions, however, aren't the only ones doing this information work in the health domain. In institutions across the country, individuals with other primary professional identities are doing expert tasks related to these and other concepts of information. Professionals whose primary identity is health care management and administration are assuming a variety of information roles, some of which carry the title "chief information officer" but many of which are more informal. These roles typically focus on the resources and policy end of information work. Physicians, nurses, and other health professionals are also doing "information" work in increasing numbers. Coming from professional cultures other than those of the three information professions mentioned above, these other professionals doing health information work often approach that work from "outside" the traditions of the information professions even though they are working with the same

information "things." So, "others" who build information systems may not do it the same way as information systems professionals; "others" who search bibliographic databases or who build links in systems to expert knowledge or who plan to use controlled vocabularies in their systems may not do it the way library and information science professionals would; "others" who work with the computer-based patient record may not follow traditional medical records' patterns and practices. An understandable response from the established professions is "Wait a minute—you don't know; you won't do it right or as well," and often, these responses produce mutually beneficial dialogs. But in reality, work with all these types of information is moving center stage, professionals outside the established information professions are becoming quite good at some of this information work and are bringing different perspectives to old problems, and new patterns and practices are emerging outside the established professional structures. These "others" doing information work may begin forging a new professional identity—not to replace the primary identity but as a strong secondary affiliation—as is now happening with informatics.

In summary, established concepts of health information and health information work can be seen as clustering around disciplines and professions. At different moments in time, these concepts of health information and associated work may seem so established—indeed, entrenched—that we may be tempted to view them as immutable; as natural fact rather than what Andrew Abbott calls "cultural fact" [24]. Cultural facts—shared ways of understanding and acting—are quite durable, but they also are constructed by a domain or a society, and they can and do change. The underlying thesis of this paper is that the "cultural facts" of health information and associated information work are changing, in some cases rapidly and dramatically.

### **PART 3: CHANGES IN HEALTH INFORMATION AND HEALTH INFORMATION WORK**

Numerous environmental forces from within and without the health care domain are fostering new ways of thinking about health information. Two of these environmental forces will be considered here in detail, and others will be alluded to briefly.

#### **Global networking**

Global networking—a fusion of continuing developments in high-performance computing and communications technology—is one of the most obvious environmental forces reshaping our view of infor-

mation [25]. The Internet can be viewed as a harbinger of some of the potential of global networking, and information on the "Net" is an emerging form of recorded knowledge. The evolving development of networked recorded electronic information is the quintessential example of a socio-technical phenomenon. The enabling technology—hardware and software—is available and quickly spreading, and, as it does, social patterns and practices for its use are taking shape.

The Internet, as a vast instantiation of new recorded knowledge, encompasses an overwhelming number of very different things to see and do. Coming to descriptive conclusions about what the Internet "is" presents major challenges, because it is so many things, and it is every minute becoming more and different. The new forms of recorded knowledge that are emerging are at once similar and dissimilar to print-based recorded information. Changes in the essence of what recorded knowledge means in an electronic, networked environment are complex and not yet fully described or understood. A full discussion of these changes is beyond the scope of this paper, but a brief overview of some dimensions of these changes will suggest some ways in which electronic networked information is altering our concepts of recorded information.

A number of changes cluster around exactly what constitutes a "document" in this new environment. The changing look of documents on the Internet is familiar, including the incorporation of multimedia, hypertext, lists replacing narrative text, and the increasingly common referential document that points to other documents.

The context for access is becoming more complex, with multiple models for information exchange. Another access issue, in addition to the access model, is the issue of intellectual access—often expressed as "organizing" the Internet, with multiple prototypical models and approaches emerging.

The technical context for new recorded knowledge includes access technology—platforms, connectivity, data exchange models; server type—technical document structure; and atomic data types—text, image, sound, motion pictures.

Changing notions of creation and authoring of documents are among the most visible and dramatic changes, with both new technological tools and new intellectual relationships. The recent emergence of "Web masters" is an obvious example. New collaborative tools, roles, and relationships are clearly emerging. Issues of ownership, control, and financial structures are all part of the context of authorship.

The contexts of maintenance and preservation of new recorded knowledge are also changing. New expectations of the accuracy of information are emerging, and the concept of an up-to-date, accurately

maintained "living" document seems to be taking hold. Preservation then becomes a matter of cryogenics—freezing the document at a moment in time—but which moment do you choose? Clearly, maintenance and preservation norms and practices have yet to arise and to solidify.

### Changes in health care delivery

Changes in health care delivery are also another cluster of forces affecting the health domain's concepts of health information. These changes include managed care, performance improvement, the reorganization and restructuring in hospitals coming from a variety of pressures, and the change agent activities of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO). New concepts of health information are a central feature of many of these changes; for example, benchmarking, use of aggregate data for comparisons within institutions and comparative data for interinstitutional comparisons, the development of practice guidelines, clinical pathways and clinical indicators, and the emphasis on measurement of outcomes in general.

A full discussion of the effect of each of these changes on the health domain's concepts of information is beyond the scope of this paper; however, a short discussion of one of these changes—JCAHO's information management (IM) standards—will illustrate the thesis that these environmental forces are affecting the way the health domain views information. The IM standards, released by JCAHO in 1994 [26], represent a way of conceptualizing information and information management that is both similar and also radically different from the profession/department-centered approach implicit in the previous standard [27]. Three characteristics of the new standards will be mentioned here. First, the preamble to the standards explicitly defines four categories of health information: patient-specific information, aggregate information, comparative data, and knowledge-based information. Whatever one thinks of the logical basis of these categories, their articulation in these standards almost guarantees that they will become accepted, bounded definitions of health information. Second, the standards explicitly identify activities or tasks connected with the four types of health information, but they deliberately refrain from specifying "who" will do the work or in what organizational structure. And third, while the standards do not explicitly identify "who" will have what information roles, they do send implicit and also ambiguous messages about who should have the responsibilities for information management. In the face of this ambiguity, interpretation about what the standards actually call for and what will be needed to meet the standards is rampant. In the most integrated

interpretation, the standards are promoting a forward-looking vision of information management as teamwork, collaboration, and unified diversity. In the most fragmented and fractious interpretation, the standards open the door for political strife and struggle among the health information professions. It is clear that JCAHO has deliberately set out to influence the health domain's concepts of health information and health information work. The outcomes of that influence will be part of the shifting health information environment that is the subject of this paper.

The effects of the changes in health care delivery on concepts of information, like the effects of global networking, are emerging and not at all solidified or certain, but some trends are evident. The accepted concepts of health information are increasingly thing oriented and systems based. Many of the "things" are composite or deliberately created "things," created through collaborative processes on both national and local levels. Health information concepts are emerging from the context of activity and practice, such as in managed care and in performance improvement. Many of the success factors for the use of health information as envisioned are implicit or only partially articulated, such as collaborative agreement of meaning, uniform language expression, continuity of meaning, and so forth. And finally, the technical and social complexity of these emerging concepts of health information is staggering.

Two environmental forces having a strong impact on the health domain's concepts of health information work have been discussed in some detail. There are obviously others, which will be mentioned briefly. Economic factors will obviously play a central role in shaping the kinds of information that thrive and flourish. Daniel Masys suggests that the economics of unregulated health care reform will have a powerful impact on the types of health information services that the health domain will be able and willing to support [28]. The emergence of informatics, distance learning and other educational trends, economic forces in the print publishing industry, and trends in consumer health information will also affect how the health domain views and values health information.

### Changing concepts of information work

Environmental forces are changing the cultural facts of health information. Integral to the new concepts of health information "things" are the characteristics, patterns, practices, and values that form the socio-technical context of the new information. So, for example, the rise of institutional Gopher sites and Web pages not only represents a new, hybrid concept of health information but also gives birth to a whole set of socio-technical practices, values, and issues sur-

rounding that type of information. These new ideas about health information and patterns and practices associated with them will inevitably give rise to new ideas about expert work associated with health information.

The shape of the forms of new expert work that will be needed is the subject of much speculation [29–35]. Although the character of such work is still emerging, some generalizations can be made in the context of the argument of this paper. The new information work will be increasingly electronic and increasingly networked. Information work will move outward, with more health professionals involved, many of them doing their own information work. The outward spread of information work—which we are all familiar with in online searching—will affect the kind of work that health information professions do, likely increasing roles of administration, technical support, troubleshooting, facilitating, training and coaching, and evaluating. Information work is likely to become increasingly collaborative, including collaboration within institutions and across institutions and directly related to high-priority activities, such as those mandated by regulatory groups. The established boundaries of recorded information will shift, as will patterns and practices associated with its generation, organization, access, legitimation, and use. In addition, however, the boundaries of recorded knowledge will expand to include kinds of information previously considered more informal or more local than recorded knowledge—information more like that arising on listservs and home pages. Again, new boundaries, patterns, and practices will emerge. And the centrality of print, published information—managed and used according to patterns and practices as we have known them in libraries—is likely to decrease and in some institutions, disappear. This is not to say that libraries will necessarily disappear, but it is highly likely that with the rise in prominence of new types of information and information work, print-based “business as usual” may not be sustainable in the ways that we now function—certainly not everywhere.

#### **PART 4: HEALTH INFORMATION PROFESSIONS AND INFORMATION WORK**

If new ideas about expert work develop from the changing cultural facts about what constitutes information, then questions arise about who will do the new work and what professional arrangements, either modifications of current ones or newly developed ones, will emerge. Andrew Abbott’s systems theory of professions provides a conceptual framework for understanding the way professions emerge,

modify, and disappear that can be usefully adapted to the health professions [36].

#### **Systems view of health information professions**

Adopting a systems view of professions alerts us to the fact that professions in a particular domain—in this case, those dealing with health information—constitute a system. They “compete” with each other, in the sense that they depend for their survival on finite resources of all types—money, of course, but also time, effort, attention, value and sense of importance, prestige, organizational position, and public understanding. In Abbott’s theory, the central, defining feature of a profession is its expert work. Extending his analysis to the health domain, each health information profession is organized around a central concept of health information and the problems associated with the management of that type of information and also around the expert tasks that it asserts will address the information problems it has defined.

Information systems professionals define information management problems in terms of creating electronic information systems, and they have specific patterns, practices, and values surrounding these activities. Library and information professionals define information management problems in terms of managing—historically—printed scientific and other knowledge, and in recent years using electronic bibliographic information systems for this management. The patterns, practices, and values surrounding the management of print, published knowledge focus around libraries as institutions. Professionals who work with the patient record define information management problems in terms of the creation, maintenance, access and use of that record.

These central concepts of information, information problems, and information work of a profession can be considered heartland concepts—concepts at the heart of a profession’s self-formulated identity. Professions also do many other activities that follow naturally from the management of their heartland information. For example, this paper suggests that the management of print-based, published literature through the institution of the library and increasingly through electronic bibliographic systems is at the heart of the profession of librarianship. Librarians do many other things in the course of managing libraries and electronic bibliographic files, and these other activities can be called the peripheral concepts of our information work. The peripheral concepts of information work for one profession may well be the heartland work for another. The design, development, and use of information systems and electronic information resources is an example of this built-in overlap. Another example encompasses management

work of all kinds. Most information professions now include the management of people resources as part of their peripheral work, even though management is the heartland work of another profession.

Each profession's expert work is done in the context of its expert knowledge. Abbott makes a useful distinction between academic knowledge and knowledge used by practitioners. Practice knowledge involves processes—how to do things—and describes the patterns and practices the profession develops for actually doing its expert work. The academic knowledge base of a profession provides the context in which practice occurs but is abstract rather than processual in nature. The chief role of academic knowledge, in Abbott's view, is to legitimate the profession's claims that its expert work effectively addresses the problems it has defined: "Because we study X, we are qualified to do Y."

Abbott argues that the chief differentiating characteristic between professional work and other work is not the existence of education in process—how to do something—but education in an abstract, academic knowledge base that provides the enabling context for learning the procedures. "Not just what to do—but what you have to learn *before you can effectively learn what to do.*" Abbott also argues that professions succeed to the extent that their abstract knowledge base is accepted as necessary context for the expert work they perform. The issue of overlap in knowledge bases claimed as central to a profession is crucial. Although professions may share peripheral knowledge bases with others—most information professions teach management, for example—a profession needs a clear body of heartland knowledge that is the essential context for the expert work it claims to do.

### Competition among health information professions

Health information professions "compete" with each other for jurisdiction or for the right to do their expert work to solve their definitions of information problems. As we have seen, each information profession has a different spin on the central and peripheral concepts of information and information expert work, and some of these overlap. In the information professions, matters are complicated by the fact that although the activities are different, the vocabulary is often the same. Most of the professions talk about "information," "information needs," "information technology," "information systems," and "information management," using the same words but meaning different things. Because the health information professions form a system, they are interdependent—they compete for scarce resources, and the actions of one affect the others, and the position of one affects the others. Competition for jurisdiction in the health information professions translates into each profes-

sion's struggle to get the go-ahead—in terms of authority, resources, status, and so forth—to pursue its expert information work effectively.

According to Abbott, competition for jurisdiction occurs in the work place, in the arenas of public opinion and the opinion of other professions, and in the legal and regulatory arena. Hospital librarians have been experiencing the concept of competition among the health information professions in the regulatory arena of standards, which has been alluded to in the brief discussion of JCAHO's information management standards in an earlier section.

From systems theory, Abbott takes the notion of temporary systems balances. In terms of the health information professions, this translates into temporary stability of roles and relationships among all the professions that work with health information. Abbott calls this balance "a negotiated balance." The established views of health information and health information work discussed in an earlier section can be seen historically as a relatively stable temporary balance among the professions doing health information work. There have been conflicts, of course, as every library director and computer center director will attest, but the established notions have in the recent past been relatively stable.

Temporary balances among professions can be disrupted by disturbances from environmental forces, such as those that have been discussed earlier in this paper. Disruptions can also come from within the system of professions, as each profession jockey for jurisdiction. These disruptions can open new jurisdictions and enhance, diminish, or destroy existing ones. Disturbances, whether from within or without, trigger additional jockeying. That jockeying can be directed to protecting existing jurisdictions, extending current jurisdiction, or annexing new jurisdiction, and the actions of one information profession impact the others.

### SUMMARY OF THE ARGUMENT

It will be useful to summarize the argument made to this point. Environmental forces such as global networking and changes in health care delivery are changing the cultural facts of health information and the values, practices, and patterns associated with it. Expert information work is changing: new tasks are emerging, and established tasks are changing or diminishing. The temporary balance of roles among the established health professions is being disrupted, and jockeying for jurisdiction will intensify, complicated by overlap of vocabulary, technology, and even some basic tasks. Over time, a new balance of health information professions will emerge, with new tasks, new roles, and new relationships.

## PART 5: IMPLICATIONS FOR LIBRARY AND INFORMATION SCIENCE PROFESSIONALS

Assuming then that a new balance of concepts of information, information work, and information roles will gradually emerge in the health domain, where will the library and information science profession fit?

### Diminishing historical jurisdiction

The implication of the argument presented above for our profession, at least in the health domain, is that our established jurisdiction—the sanction that we have enjoyed to define *health information* our own way and decree within institutions the best library-based ways to manage that information—is being challenged by new concepts of information; by the need for new ways of dealing with established concepts of information; by the economic inability to sustain the status quo; and by myriad other environmental forces, including the competition from other professions to extend their jurisdiction. As librarians, we can of course put all our energies into resisting these changes and defending our established jurisdiction. And on a case-by-case-by-case basis, that certainly is a valid and important response, resulting in vigorous support for all libraries and librarians whose positions are threatened. But we should also be actively formulating and competing for our evolving jurisdictions.

### Evolving jurisdictions for library and information science (LIS)

As our historical jurisdiction recedes, we should be rethinking our profession's view of information, information problems, and our appropriate expert information work, based on our historical strengths and what we can contribute to future information work in the health domain. The reconceptualizing of our professional base is not only important to our continued viability as a profession, but it is also important for the future of information in the health domain.

Our profession's historical knowledge base has been what the American Library Association's standards for education in library and information studies call "recordable knowledge" and the patterns and practices of its management [37]. The concepts and characteristics of recordable or recorded knowledge are changing, certainly in the health domain and arguably equally so in other domains. The changes are socio-technical in nature, involving not only new

technologies but emerging new patterns and practices of the creation, production, distribution, organization, access, maintenance, preservation, legitimation, and use of health information.

The knowledge base that has formed the basis of academic education for LIS professionals is essential for the effective management of this new recorded knowledge, both for its base in the management of print-based recorded knowledge and for the evolving knowledge base relevant to the new recorded knowledge. Although some critics bemoan what they see as the lack of an extensive knowledge base indigenous to LIS, the curricula of LIS schools attest to a knowledge base informing particular tasks and activities. That knowledge base has historically been interdisciplinary, drawing together perspectives relevant to the task of managing print-based recorded knowledge, primarily in the context of the institution of the library. Today, in many LIS schools, the LIS knowledge base is rapidly being transformed into one that is strongly interdisciplinary, integrating many perspectives relevant to concepts of new recorded knowledge. Academic knowledge, as conceptualized by Abbott, in LIS schools is also being supplemented as it is in all professional schools with practice knowledge, much of which is being developed by practitioners who live and work on the cutting edge of the transformation in information [38].

The LIS profession "fits" in the new balance of health information and health information work by virtue of the interdisciplinary knowledge base, both traditional and evolving, that it brings to the problems of managing new recorded knowledge. LIS curricula are and increasingly should be interdisciplinary filters, bringing relevant academic knowledge to bear on heartland specialty areas in the management of new recorded knowledge.

The concept of heartland specialty areas for our profession is important. There is much information work involved in the emerging concepts of new recorded knowledge and much work that may be outside the scope of even a reformulated LIS profession. Managing the new recorded knowledge may—probably will—prove to be a collaborative effort among many professions, and the emerging balance of new work may prove to be one of drawing new boundaries of responsibility within the territory of new recorded knowledge. Heartland specialty areas for LIS represent our areas of historical strength in the print environment, where our knowledge base will be essential in charting new waters in the electronic environment. LIS professionals and educators may differ on what these specialty areas are, and indeed, schools may specialize. This paper will close with the author's personal list of our profession's heartland areas in the management of print and electronic knowledge, areas where we have both historical and evolving strength.



### **Lexical concerns**

These include topics such as representation of meaning, the many aspects of surrogacy, and vocabulary control in all its guises. The scope for involvement in lexical issues is broad, bringing issues of vocabulary to center stage in both the creation and organization of knowledge and information. The National Library of Medicine has provided strong leadership in this area, and both the need and the opportunity for LIS professionals to apply this work in the health domain are vast [39].

### **Matching information need with recorded knowledge**

Again, this is an area of historical strength that translates well into the new environment. Understanding and negotiating information need, on one hand, and understanding the sources and the surrogates that will lead to the sources is our profession's bread and butter, needed no less in the electronic environment than in the print one.

### **User-focused organization of knowledge**

The organization of recorded knowledge in ways that meet user needs is another traditional strength that can translate well into the new and increasingly interdisciplinary environment, whether that organization involves the organization of databases, digital information sources like home pages, or massive digital libraries.

### **Creation, management, and use of document surrogates**

The development of both descriptive and subject-oriented bibliographic surrogates has been a mainstay of our profession, from conceptual systems like AACR2 and systems of subject headings to thesauri and extensive work in bibliographic retrieval systems. The rational application of surrogates—whether generated by humans or machines—to large, distributed digital files is one of the great challenges of the emerging global information infrastructure and an area where our profession has much to offer.

### **Maintenance and preservation**

The institution of the library has arisen historically as society's major vehicle for the preservation of selected print-based published information. With the changing conditions of both maintenance and pres-

ervation in electronic environments, the maintenance of networked resources as living or up-to-date documents is likely to be an activity of high importance. Preservation of recorded knowledge also takes on new dimensions in an electronic environment that will require new norms of practice.

### **Assimilation and use**

Although the primary focus of the LIS profession has been the organization, preservation, and provision of access for recorded knowledge, assimilation and use of information has occupied the attention of special librarians, librarians who assume instructional roles, and information brokers.

Redefining the jurisdiction of library and information science in the area of new recorded knowledge and in the context of the evolving jurisdictions of other information professions is likely to be our profession's main task in the upcoming decades [40]. I see exciting and challenging roles for our profession as specialists in the socio-technical management of the emerging recorded knowledge. That recorded knowledge will continue for decades to be a blend of print and electronic knowledge, but our profession's real contribution can come in helping to shape the future usefulness of the system of electronic recorded knowledge that will emerge rapidly in the health domain. Our historical and emerging knowledge base equips us to lead the health domain in understanding the emerging socio-technical shifts in recorded knowledge, particularly in the areas of our heartland specialties; in formulating expert work and practice knowledge for effective management of the new recorded knowledge; in developing an interdisciplinary academic knowledge base as the context for work with the emerging blend of established and new types of recorded knowledge; and in forging collaborations among established and evolving health information professions.

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