BRIEF COMMUNICATIONS

Bioinformatics opportunities for health sciences librarians and information professionals*

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INTRODUCTION

Universities and medical research institutions are hard at work training researchers in bioinformatics, a multidisciplinary field comprising molecular biology, genetics, mathematics, and computer science. Bioinformatics specialists with undergraduate and graduate degrees find their skills are in high demand in a range of research and development environments, including universities, teaching hospitals, and the industrial sector, including pharmaceutical, vaccine, and biotechnology companies. Researchers in bioinformatics currently receive strong support from library and informational professionals in geographic areas where biotechnology corporations are established. However, stronger support and collaboration will be necessary as the field matures. Health information professionals and science librarians with backgrounds and aptitudes in biological, chemical, and computer sciences; genomics; proteomics; and data analysis are ideal candidates for professional involvement and specialization in bioinformatics.

Professional librarians seeking to contribute their talents to the field of bioinformatics must also expand their depth of knowledge in the biological and computer sciences. Additionally, interested librarians need to systematically evaluate and expand traditional roles and services to include the new resources and tools that are emerging worldwide. The aim of this brief communication is to assist health sciences librarians with finding training programs and to give examples of how some libraries are currently expanding services to support bioinformatics research. The authors have identified six key areas of responsibility where information professionals can expand beyond traditional roles to meet the information needs of bioinformatics researchers. These core areas include communication, collection development, knowledge management, education and training, writing or publishing, and intranet systems development.

THE ROLE OF THE HEALTH INFORMATION PROFESSIONAL AS "INFORMATIONIST"

Two very different roles exist for health information professionals supporting research and development efforts in bioinformatics. The first is the more traditional role pursued in academic health sciences libraries and corporate libraries. In this role, professional responsibilities typically focus on collection development and teaching, although these activities require additional education or training for the librarian supporting bioinformatics clients. The second role is more often seen in research and development facilities or clinical settings, where the information professional is actively involved in the research process and project management. Responsibilities of this role may include involvement in searching the primary literature or genomic sequence databases, data and knowledge management and communication, and collaborative technical writing. Significantly, this second role most closely resembles that of the ''informationist'' as set forth by Davidoff and Florance [1], where the information professional possesses both significant domain knowledge in information science and specific technical or biological skills, including an understanding of applied knowledge in the research or clinical setting.

TRAINING OPPORTUNITIES

Specialized training and continuing education will enable health information professionals to reach beyond traditional roles. While it is still easier for librarians with science backgrounds to advance into the field of bioinformatics, new degree programs, fellowships, and workshops are increasingly available for infor-

* Based on a presentation at MLA '03, the 103rd Annual Meeting of the Medical Library Association; San Diego, California; May 5, 2003. Slides from the presentation may be viewed at http://www.mlanet.org/am/am2003/e_present/schwartz.pdf.

mation professionals of any background. The Education Web page of the National Center for Biotechnology Information (NCBI) [2], the Resources Web page of the Molecular Biology and Genomics SIG of the Medical Library Association [3], and Alpi's article, ''Bioinformatics Training by Librarians and for Librarians: Developing the Skills Needed to Support Molecular Biology and Clinical Genetics Information Instruction'' [4], offer additional information about training and education opportunities.

Several models of advanced training in bioinformatics currently exist in the library and information science domain. For example, a ''certificate of specialization in bioinformatics'' is awarded in conjunction with either a master's of library science or a master's of information science from the School of Information and Library Science (SILS) at the University of North Carolina (UNC) at Chapel Hill. Coursework comprises a battery of required courses in information and library science together with courses in biology and biostatistics [5]. Hemminger's list of the major bioinformatics programs in the United States provides information for those seeking master's level training in bioinformatics [6]. Another option is a master's degree in chemical informatics, such as that offered through the program in chemical informatics and bioinformatics at Indiana University [7].

Health sciences librarians who develop greater depth of knowledge in bioinformatics have much to offer researchers in the key areas of communication, collection development, knowledge management, training and teaching, writing or publishing, and intranet systems development. Responsibilities of the health sciences librarian can be extended by embracing the role of the ''informationist'' and pursuing additional training or by seeking contacts in research and clinical settings. The greater the depth of knowledge in these fields, the more deeply involved health informationists can become in team-based research projects.

KEY AREAS OF RESPONSIBILITY

Communication

Communication is essential to understanding and supporting the information needs of researchers. Responsibilities in this area include supporting open communication among research groups, creating progress reports, providing updates on new resources, marketing library services, reporting business intelligence research, providing opportunities for cross-training in emerging research areas, and attending organizational meetings to ensure the flow of information about library services, resources, and programs.

The University of Washington Health Sciences Library improved communication between the library and bioinformatics researchers and students through a number of strategic efforts. These included recruiting a biologist with a doctorate degree to act as a liaison, conducting needs analysis surveys, attending meetings of research groups, giving demonstrations of bioinformatics resources, and holding discussions with clients about desired resources and services [8].

An essential communication activity in university, research, and clinical settings is that of consultation services. Information professionals have discovered that reference consultations range from basic questions, such as how to locate databases or software programs, to inquiries requiring the librarian to know ''the range of problems that can be answered by more advanced bioinformatics tools'' [9] or to provide ''in-depth assistance with data analysis'' [10]. To establish and maintain credibility as research partners, librarians will need to pursue a level of training in bioinformatics that will prepare them to anticipate their clients' consultation needs.

Collection development

Collection development responsibilities in bioinformatics go beyond traditional resources such as journals, books, literature databases, conference information, and Internet resources. These responsibilities include the identification and evaluation of specialized databases and tools, such as genome sequencing databases, protein function analysis tools, structure prediction programs, molecular modeling programs, and data mining software. Information professionals need to be familiar with computer programs for processing biological data written in various technical languages such as Perl, Java, and extensible markup language (XML) and have to understand database programs such as SQL and Oracle.

Many excellent resource guides have been created to support university bioinformatics programs, such as the HealthLinks/BioResearcher Toolkit at the University of Washington,† the Molecular Biology & Bioinformatics Resources guide at the Weill Cornell Medical Library,‡ and the Helix Helper for Molecular Biology and Genetics at the University of Utah.§

Knowledge management

Knowledge management supplies collaborative research groups with effective and efficient organization and retrieval of information, provides record keeping systems and support, and facilitates knowledge sharing. During the course of a research project, knowledge accumulates rapidly as data are processed, interpretations are made, and decisions are recorded. This knowledge assumes a variety of forms including log books, databases and spreadsheets, internal reports, progress reports, memoranda, correspondence, grant

† The Healthlinks BioResearcher Toolkit may be viewed at http://healthlinks.washington.edu/bioresearcher.

‡ The Weill Cornell Medical Library's Molecular Biology & Bioinformatics Resources Web page may be viewed at http://library.med.cornell.edu/Library/HTML/molbiol.html.

§ The Spencer S. Eccles Health Science Library's Molecular Biology and Genetics Web page may be viewed at http://medlib.med.utah.edu/library/helixhelper/molbiol_tx.html.

materials, public relations materials, and documents recording best practices. Access to these resources is crucial to the success of any research project in both corporate and academic research environments. Creating and maintaining a digital library of published information resources, software, unpublished documents, and supporting data are knowledge management activities that allow groups of researchers to access necessary information and tools regularly (see ''Intranet Systems Development'' below).

On a larger scale, academic libraries, including the Massachusetts Institute of Technology (MIT) and the University of Rochester, are currently experimenting with the use of DSpace as a means to ''collect, preserve, index and distribute the intellectual output of an organization'' [11]. Cooperative resource sharing minimizes costs and pools efforts. In New York State, universities and corporations have launched AMDeC Microarray Resource Center, a cooperative initiative to share the costs of expensive bioinformatics analysis tools and equipment, help manage and archive the results of microarray analysis, and speed up the pace of research efforts [12].

Learning organizations focused on research and development and marketing, such as pharmaceutical companies, continuously work to improve information and knowledge management. Lamb, manager of the Knowledge Resource Center of Buckman Laboratories International, uses technology ''to facilitate knowledge sharing when appropriate,'' in the ''form of online discussion forums or publishing on a corporate intranet'' (see ''Intranet Systems Development'' below). She sees the purpose of any knowledge management effort as making ''knowledge visible and accessible throughout the entire organization'' and recognizes information professionals as ''unique individuals who understand how to capitalize on information technology, maintain a synergy between traditional and new information practices, and facilitate knowledge sharing'' [13].

Education and training

Education and training responsibilities in an educational or collaborative research environment involve offering workshops on bioinformatics-specific resources, traditional research methods and tools, and problem-based learning techniques. Librarians who already have instructional experience and have developed expertise in searching complex databases can expand their skills to include teaching workshops on searching genomic sequence databases and protein sequence databases and using visualization tools for structure prediction and molecular modeling.

At the Weill Cornell Medical Library, librarians offer workshops to students, researchers, clinicians, and other librarians on molecular biology searching tools and resources [14]. Librarians at the University of Washington Health Sciences Libraries offer workshops on specific tools for microarray analysis including the GeneSifter Webware package and Vector NTI package [15].

As in other areas of medicine, science, and technology, current awareness is essential to the rapidly growing area of bioinformatics. Examples of current awareness resources are newsletters, such as the quarterly publication NCBI News,** the Genomics & Health Weekly Update from the Centers for Disease Control,†† the annual database issue of Nucleic Acids Research that includes a categorized list of databases;‡‡ electronic lists such as Sigbioinform-l from the American Society for Information Science and Technology;§§ and Websites of groups involved in bioinformatics such as the Molecular Biology and Genomics Special Interest Group of the Medical Library Association*** and the Genomics Working Group of the American Medical Informatics Association [16].†††

Writing

Writing activities permeate all collaborative research projects. These responsibilities range from planning research strategies; creating business intelligence or environmental scanning reports; providing updates on local, regional, national, and global developments in the field; creating annotated resource guides; recording and summarizing minutes of meetings; participating in email correspondence and electronic chats; editing and proofreading documents; preparing research reports for publication; developing public relations materials and press releases; to researching and coauthoring grant proposals.

Experienced health sciences librarians constantly integrate writing skills with communication and delivery of library services for teaching, program promotion, and grant writing and by participating in committees and associations. Information professionals lacking a science background can adapt their writing skills to collaborative science research projects by taking courses in medical terminology, technical writing, or science writing. For example, Northeastern University offers graduate courses in biomedical writing, science writing, and the rhetoric of science [17], while many schools offer both online and local classes in technical writing for local and distance learners.

** Information about NCBI News may be viewed at http://www.ncbi.nlm.nih.gov/About/newsletter.html.

†† The current issue of the Genomics & Health Weekly Update from the Centers for Disease Control may be viewed at http://www.cdc.gov/genomics/update/current.htm.

‡‡ The current Database Categories List from the Nucleic Acids Research may be viewed at http://www3.oup.co.uk/nar/database/c/.

§§ The American Society for Information Science and Technology Special Interest Group's Website may be viewed at http://www.asis.org/AboutASIS/asis-sigs.html#SIGBIO.

*** The Website of the Molecular Biology and Genomics Special Interest Group of the Medical Library Association may be viewed at http://medicine.wustl.edu/%7Emolbio/.

††† The Website of the Genomics Working Group of the American Medical Informatics Association may be viewed at http://www.amia.org/working/genomics/main.html.

Intranet systems development

Intranet systems, the backbone of knowledge management, are the contemporary medium for record keeping, information sharing, communicating, and delivering information in a collaborative research environment. Development of intranets, digital libraries, and electronic discussion forums consists of surveys of user information needs, evaluation of best practices, assistance with information architecture, indexing, design of Web pages, and development of systems, as well as purchasing and implementation of hardware and software.

The University of Washington Health Sciences Libraries staff have developed their intranet services to include access to licensed sequence analysis software, electronic full-text reference titles, an extensive Web pathfinder on molecular biology resources and tools, and Current Contents [18]. Bishop lists general competencies for ''content managers'' primarily concerned with digital information management and intranet development and contrasts these with the skills required of ''knowledge managers'' [19] (see ''Knowledge Management'' above).

CONCLUSION

Traditional librarian activities such as communication, collection development, education and training, writing, and intranet services are equally necessary to support research in bioinformatics, as in any other field, but the diverse set of resources and requirements for extensive domain knowledge in multiple fields places new demands on health information professionals supporting the success of this field. Training and continuing education will enable health information professionals to reach beyond traditional roles and become integral participants in biomedical, biotechnology, pharmaceutical, and vaccine research projects.

Considerable technical knowledge must be gained by the health sciences librarian to contribute to bioinformatics research as a bioinformaticist. The learning curve is shortened for information professionals who can learn enough about the field to participate in knowledge management activities, such as organizing and maintaining access to accumulated research materials on an intranet platform. Knowledge management will continue to be a challenging area in biotechnology research, and environmental scanning and maintenance of up-to-date intranet knowledgebases will continue to be key elements to the success of research projects. This reason is one of the strongest for bringing information professionals into the field and encouraging multidisciplinary training in the informationist-to-bioinformaticist direction as well as from the scientist-to-bioinformaticist direction. Bioinformatics may not be an appropriate fit for every health sciences librarian, but it can, and should, be developed as a viable career path for those who wish to pursue it.

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The Electronic Fund Transfer System (EFTS)

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The Electronic Fund Transfer System (EFTS) is an electronic bill-payment system created at the University of Connecticut Health Center (UCHC) in Farmington. The program was developed and implemented on a regional basis in 1996 to replace a prepaid coupon system utilized by DOCLINE libraries. Health sciences libraries use EFTS for payment of interlibrary loan (ILL) transactions. Centralized electronic billing of participants greatly reduces the need to create invoices and to write reimbursement checks for ILLs and document delivery among participants.

OVERVIEW

EFTS functions similar to a debit card system: It operates as though the loaning library is the retailer, the borrowing library is the consumer, and EFTS is the clearinghouse service that enables the financial aspects of the transaction. Participants enroll in EFTS by placing funds on account at UCHC to cover the costs of their transactions. A fundamental principle of the system is that the reciprocal of a loan is a borrow. Consequently, only lending libraries that wish to collect for their service need to file billing information with EFTS. About 20% of the participants submit files. The rest of the participants monitor their account balances and submit additional funds when necessary. The files are processed as they are submitted, with lenders' accounts credited and the corresponding borrowers' accounts debited. The lender pays a fee based on the amount collected on their behalf.

OPERATIONS

The primary benefit for EFTS participants is the simplification of and reduction in expenses associated with payments for ILL charges compared to direct invoicing. Additionally, EFTS encourages resource sharing by reducing uncertainty about billing when a library considers an ILL transaction with an unfamiliar library. Unfamiliarity often results from geographical location. As a clearinghouse for bill payment, EFTS increases each library's ILL options by allowing the library staff member to focus on item availability and service considerations and not on receipt of payment.

EFTS is an individual transaction billing system; it allows the loaning library to charge whatever it chooses for each transaction. Lending libraries can submit files in a variety of ways. An ASCII-based text file can be generated by such third-party ILL management programs as QuickDOC, Clio, and ILLiad. For lenders who do not use such programs, a small program can be downloaded from the EFTS Website* that will assist in creating the transaction file.

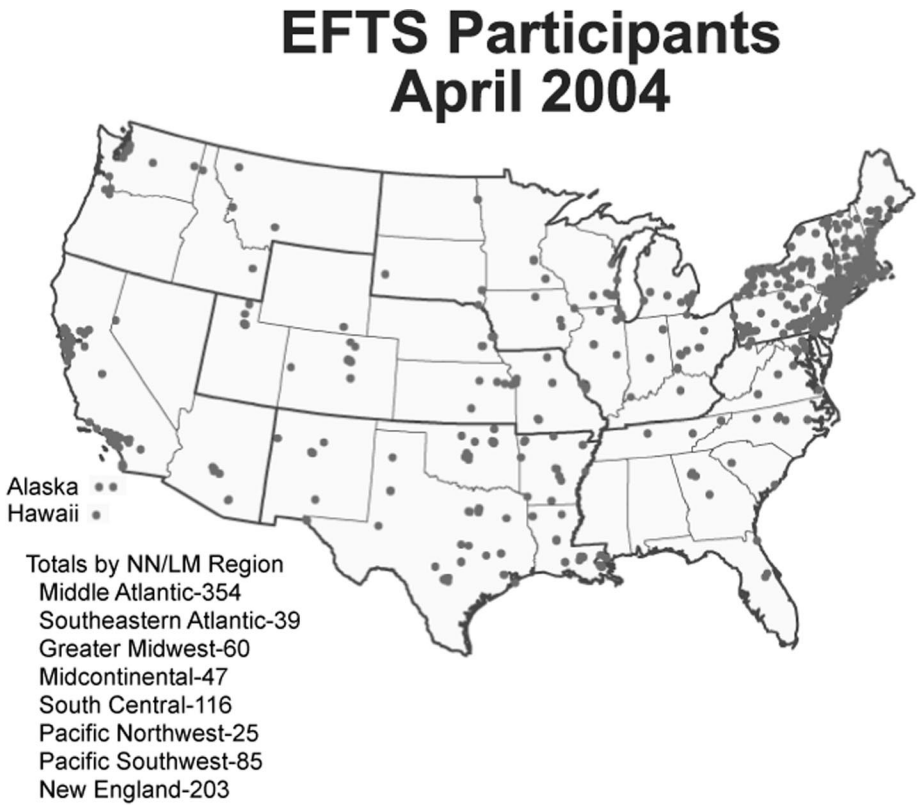
A 3% service fee is currently deducted from the lender for each transaction to cover EFTS operational costs. This fee is analogous to the bank charge a retailer pays for debit card account management.

EFTS participants are now in all eight National Network of Libraries of Medicine (NN/LM) regions, including 48 of the 50 states (Figure 1). EFTS was implemented on a regional basis by the New England (1996), Mid-Atlantic (1998), and South Central (1999) Regions. This implementation resulted in an immediately recognized billing standard for those regions. The EFTS Website contains instructions for joining, policies, and procedures as well as a current participants list.

Looking at 2004 first-quarter data, 85% of the members saw account activity, with 1% of them strictly lending, 70% strictly borrowing, and 29% both lending and borrowing. EFTS has become a substantial benefit to those net loaning libraries in that they maintain a positive cash flow because of EFTS. Those libraries whose lending exceeds their borrowing can elect to receive a check—issued quarterly in January, April, July, and October—from EFTS drawn on their account for the difference between their account balance and the minimum needed to cover their own borrowing activity. The first quarter of 2004 saw 50 libraries receiving a total of $495,000 in redistributions. The regularity of quarterly payments allows for accurate in-

* The Electronic Fund Transfer System Website may be viewed at https://efts.uchc.edu.

Figure 1
Electronic Fund Transfer System (EFTS) participants (April 2004)



come projection and forecasting compared with the irregularity associated with the collection process when paper bills are sent to multiple potential payers.

A primary strategic goal for EFTS has been to meet the needs of the NN/LM DOCLINE community. Table 1 indicates a current snapshot of this relationship.

Regions 1, 5, and 8, where EFTS has been in use the longest, have an average 69% EFTS participation rate for active DOCLINE libraries. Were this percentage applied to the total number of active DOCLINE libraries in the United States (2,899), the potential domestic growth for EFTS is 2,000 institutions or more than double the current level of participation.

Table 1
Electronic Fund Transfer System participants by region

Region	DOCLINE libraries	EFTS participants	Percentage
1	478	339	71%
2	673	40	6%
3	541	59	11%
4	202	48	24%
5	180	109	61%
6	162	27	17%
7	412	88	21%
8	251	191	76%
Total	2,899	781	

Data taken from DOCUSER June 2004.

EFTS has an Advisory Committee that meets via telephone conferencing to review program policies and procedures. Each region of NN/LM is represented with a hospital librarian, a medical school librarian, and the regional network development coordinator. The Advisory Committee roster is on the EFTS Website.

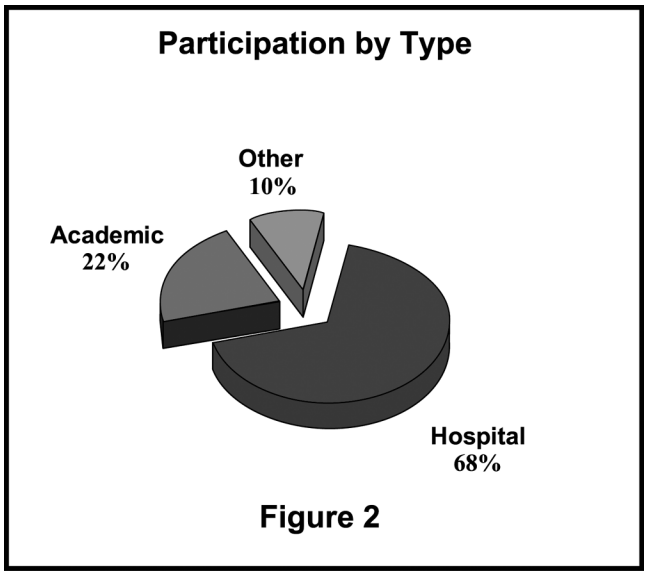
COMPOSITION

NN/LM consists of libraries of various types and functions. A library can be classified as academic, hospital, or other and function as a Regional Medical Library, Resource Library, Primary Access Library, or other. Participation in EFTS spans all of these areas. Figure 2 indicates EFTS participation by type.

Ammon Ripple from the Children's Hospital of Pittsburgh told EFTS, ''We fill 150–250 DOCLINE requests every day. Using EFTS in tandem with QuickDOC helps us take care of most of our billing in just 15 minutes a month instead of the many, many hours it used to take to process all those checks and invoices!! EFTS not only saves us time and money, but helps us provide better service to our ILL customers.''

Even smaller libraries have found EFTS beneficial, as Pat Davis from Falmouth Hospital, Massachusetts, indicated, ''I am the only person in a small hospital library, so I truly appreciate the ease and convenience

Figure 2
EFTS participation by type



of using EFTS over paying individual invoices from libraries who charge for ILLs.''

DEVELOPMENTS

In August 2002, the National Library of Medicine awarded UCHC a 36-month contract to implement EFTS on a national basis. During the first year, the EFTS staff actively promoted EFTS by attending regional meetings, obtaining the support of network coordinators at each of the 8 Regional Medical Libraries, updating EFTS resources, establishing the EFTS-L email discussion list, and preparing for development of a Web-based system upgrade.

During the second year, the National Library of Medicine became an EFTS participant. Ralph Arcari and Edward Donnald were awarded the Thomson Scientific/Frank Bradway Rogers Information Advancement Award at MLA '03 in San Diego, California, for their work with EFTS. The Web-based EFTS was rolled out in January 2004. Participants were assigned secure online accounts, where they could check their account balances, make deposits, monitor transactions, and upload billing files at their convenience.

Financial self-sufficiency is the strategic objective for EFTS. The National Library of Medicine is committed to supporting EFTS until this objective is met. The goal for EFTS now is to maintain the extremely reasonable service fee for the services provided in the interest of increasing EFTS participation. If readers have any questions or would like to discuss EFTS participation, they may contact the office.

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Updating hospital reference resources in the United States–associated Pacific Basin: efforts of the Pacific Islands Continuing Clinical Education Program (PICCEP)*

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BACKGROUND

This article describes a project by the Pacific Islands Continuing Clinical Education Program (PICCEP) at the University of Washington (UW) to supplement hospital reference materials in six jurisdictions in the US-associated Pacific Islands. It outlines a model for cooperatively developing a suite of clinical reference materials suitable to low-resource settings.

The US-associated Pacific Islands encompass the US flag territories of American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI), and Guam, as well as the independent countries, ''freely associated with the United States,''‡ of the Federated States of Micronesia (FSM), the Republic of the Mar-

* This study was conducted by the University of Washington's Pacific Islands Continuing Clinical Education Program, in the Center for Health Workforce Studies, and was funded by the Bureau of Primary Health Care and the Bureau of Health Professions, US Health Resources and Services Administration.

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‡ When these previous trust territories gained independence in 1986 (Federated States of Micronesia and the Republic of the Marshall Islands) and 1994 (Palau), they negotiated a special status that gives their citizens the right to travel freely to the United States and the United States the right to exclude any foreign power from having a military presence in the region.

shall Islands (RMI), and the Republic of Palau. The region contains 104 inhabited islands that cover an area of the Pacific that is larger than the continental United States. Nearly 500,000 total residents live in the jurisdictions. Gross domestic product per capita in 2000 varied from $1,600 in RMI to $21,000 in Guam. English is an official language throughout the region, although many people speak one or more other languages [1]. The United States serves as the region's primary funder of social and health services. Each jurisdiction has one or more secondary hospitals, with bed sizes ranging from under 50 to over 200. Only a few of them offer advanced specialty services.

In 1998, the federal Institute of Medicine (IOM) found numerous health care challenges in the region: deteriorating health infrastructure, high health care costs, serious health problems on some islands such as high rates of substance abuse and infant mortality, and particularly ''shortages of adequately trained health care personnel'' [2]. The IOM recommended an emphasis on health workforce improvement, in large part through continuing medical education (CME). The federal government responded, in part, by funding PICCEP, a four-year effort implemented by the UW Center for Health Workforce Studies.

PICCEP conducted a needs assessment and concluded that, among other problems, the region's health care providers lacked current clinical reference materials [3]. Most hospitals did not have libraries or librarians. They all had at least a small collection of reference materials, but most physicians felt these materials were too limited to help solve specific clinical problems or maintain skills. Personal computers were few in number and not readily available for most clinicians. In addition, limited, slow, and expensive Internet access made computerized references impractical in all but the most developed jurisdictions, such as Guam and the Republic of Palau.

THE PACIFIC ISLANDS CONTINUING CLINICAL EDUCATION PROGRAM TO IMPROVE HOSPITAL REFERENCE RESOURCES

Given the need for reference materials expressed by regional physicians and observed by PICCEP staff, PICCEP sought to improve access to key clinical reference resources as part of its overall CME program. During 2000–2001, it obtained $40,000 for this purpose. Because most health systems in the US-associated Pacific Islands were divided distinctly into a central hospital and a public health system, PICCEP targeted hospitals, where most physicians were based. To distribute available resources equitably in the region, PICCEP divided the funding roughly equally among the eleven major hospitals. PICCEP sought to coordinate its program supplementing reference materials with other organizations engaged in similar efforts. An investigation revealed no preexisting programs in the region and only one documented program in the world, the Blue Trunk Program run by the Library of the World Health Organization (WHO). This program provided African district health centers with about 100 books on medicine and public health and a few medical journal subscriptions [4]. WHO worked with local trainers to help deliver, publicize, and monitor the collection.

Book donation programs can fail for reasons including materials that do not reach their intended audience or are inappropriate to local conditions, placement of materials where few potential users know about them, materials that are removed for personal use and not returned, resources for updating that are missing, and recipients who are unaccustomed to using books and journals as information sources [5]. Aware of these potential pitfalls, PICCEP resolved to develop a program that would ensure long-term access to useful reference materials.

PICCEP wanted to involve each hospital in the selection of suitable materials. But given the limited and one-time availability of funds, PICCEP sought to guide each hospital in creating a package of resources that would suit the needs of a variety of health professionals in clinical settings ranging from urgent care to patient counseling. Program physicians consulted with a medical librarian to develop a reference resource catalog (available from the authors). The Brandon/Hill list for small medical libraries served as the basis for the catalog of recommended resources [6]. The final selection differed slightly due to availability and suitability for hospitals located outside of the United States. The catalog was divided into ''core references,'' material which was determined to be essential for the hospitals, and ''supplemental resources,'' additional options from which respondents could choose, and was further categorized by topic. Hospitals could add their own requests for additional items.

PICCEP identified a key contact at each hospital and asked that contact to consult with physicians, nurses, and allied health staff about their preferences in reference materials. Respondents were instructed to rank the priority of each item in the catalog. This method of assessing preferences worked extremely well; all hospitals returned a carefully considered list that encompassed a wide range of materials suited to a range of clinical topics and professions.

PICCEP attempted to purchase all of the identified materials as ''very strongly desired'' and as many other requested materials as possible. Because the requests from the jurisdictions far exceeded the project budget, PICCEP staff analyzed each hospital's choices to put together a comprehensive package of materials. Staff prioritized core items and materials most relevant to each hospital's resources and community. PICCEP purchased some electronic journal subscriptions for hospitals with greater technical capacity. To help minimize the loss of materials over time, PICCEP gave each hospital a personalized rubber stamp, so they could indicate ownership of each item.

Most selections were purchased through a bookstore in Seattle that offered a discount and free shipping to PICCEP. Most items were shipped to the hospitals and insured by private carrier. Delivery expenses were sig-

nificantly higher than anticipated. Similar programs in the future should budget 5% to 10% above purchasing costs to cover the high costs associated with shipping to remote regions.

The American Academy of Family Physicians (AAFP) Medical Education Materials Clearinghouse, which channels donations of medical reference resources to needy hospitals around the world, contributed additional materials. PICCEP staff selected appropriate materials from the fund's catalog and distributed them to each hospital based on their most appropriate use. University colleagues offered a variety of additional materials. PICCEP accepted many for distribution after screening for relevance and currency.

PICCEP followed up with each hospital to ensure that all items arrived. Two hospitals required a letter from PICCEP indicating that the shipped items were donated, so that they were not assessed import duties. Otherwise, all of the materials reached their intended destinations without difficulty, and PICCEP received enthusiastic feedback about them.

During subsequent PICCEP-provided courses, faculty assessed program success. Most of the reference materials were located in secured areas of the target hospitals, such as a designated room or an area in the doctor's lounge. Specific texts were assigned to individual doctors or wards, where the specialty was most appropriate. Some PICCEP faculty referred to the materials in their sessions to help encourage use of the resources.

RECOMMENDATIONS FOR FOLLOW-UP AND FUTURE PROGRAMS

Ideally, personnel and funding would be available to encourage access to and use of resources over a longer period. Initiatives such as the Health InterNetwork [7] may help poor countries do so. WHO and several publishing companies established the Health InterNetwork Access to Research Initiative (HINARI) in 2000 to ensure equitable access to health information around the world. Its first phase makes a large range of scientific publications available for free or at reduced costs to selected countries, depending on their income. Where applicable—FSM and the RMI became eligible in 2003—this initiative, combined with global efforts to increase telecommunications capacity, logically extends efforts such as PICCEP's to provide clinical reference materials on a limited budget.

PICCEP's initiative overcame many of the challenges facing efforts to donate references. While goals such as fully evaluating the use of reference materials and updating them when they are outdated or lost remain, PICCEP did establish a suite of suitable materials accessible to a variety of clinicians in 11 hospitals at an average cost of under $4,000 per site.

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The role of librarians in patient safety: gaps and strengths in the current culture*

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BACKGROUND

Overall error avoidance and analysis of errors, with the intent of learning from mistakes and preventing future occurrences, are critical issues for persons involved in all aspects of health care. Launched in 1999 by the release of the Institute of Medicine's report ''To Err Is Human'' [1], a dialogue in health care has been continually nurtured by the reports of that organization [2–4]; new organizations devoted to patient safety, such as the National Patient Safety Foundation† and the National Quality Forum‡; and state initiatives seeking ways to improve the situation, such as the Massachusetts Coalition for the Prevention of Medical Errors§ or Virginians Improving Patient Care and Safety (VIPCS).**

Surveys have been used by the patient safety community to not only glean information from the patient community about their awareness of patient safety issues [5], but to gauge individuals' comfort with the culture of safety at their health care organization [6] and to assess the quality of processes in place to assure safe medication delivery [7]. Yet none of these surveys, to the authors' knowledge, have reached out specifically to the community of library and information professionals to seek knowledge about their involvement in safety efforts. The medical library community collects benchmark data from its members on various resources, populations served, and traffic data but does not specifically include queries about medical librarians' contributions to safety from a distinct systems or safety perspective [8].

To begin filling this gap, an exploratory survey was undertaken to assess whether or not information professionals were directly involved in patient safety initiatives and how much they believed they could positively affect patient safety in the organizations in which they worked. One anticipated outcome of the survey was documentation of whether or not information professionals saw themselves as substantively contributing to safety initiatives by aligning themselves with this leadership-valued issue. Questions were developed by two information professionals with backgrounds in (a) patient safety and medical information and (b) strategic planning for information centers, including analysis of return on investment (ROI) and content selection and evaluation. Prior to posting, the questions were reviewed by five information professionals representing a variety of clinical environments.

It should be noted that the terms ''librarians'' and ''information professionals'' are used interchangeably in this paper as a number of persons working in information and knowledge management in health care environments have transitioned to such roles from information technology, clinical work, or other areas and are not specifically trained as librarians.

METHODOLOGY

The survey was announced in May 2003 on discussion lists for information professionals in the health care, medical, and pharmaceutical sectors. Table 1 presents the queried lists. The total number of subscribers on these lists was approximately 2,700, and some interested parties forwarded announcements of the survey to colleagues on other discussion lists and in other countries; the extent of the circulation is not definitely known.

The sampling of 142 responses collected from health care information professionals provides early and limited insights into the extent to which patient safety initiatives are an explicit concern for them. The low response rate is an indicator in itself. Individuals typically respond to a survey when they are interested in the topical area and when they have something to contribute. Members of any community ignore requests to participate in a survey if they are not interested in the topic, are not involved with the area being studied, have nothing to contribute, are simply too busy, or are not interested in the incentive [9]. Based on some of the responses, there is a need for a much greater level of awareness about the topic and guidance in how information professionals can become involved with patient safety efforts.

KEY FINDINGS

■ The culture of safety has not permeated the library community in the sense of leaders and administrators

* Presented as a poster session at the Fifth Annual Wisconsin Patient Safety Forum Meeting; Oconomowoc, Wisconsin; November 12–13, 2003.

† The National Patient Safety Foundation Website may be viewed at http://www.npsf.org.

‡ The National Quality Forum Website may be viewed at http://www.qualityforum.org.

§ The Massachusetts Coalition for the Prevention of Medical Errors may be viewed at http://www.macoalition.org.

** The Virginians Improving Patient Care and Safety (VIPCS) may be viewed at http://www.vipcs.org.

Figure 1
Activities in which information professionals are included

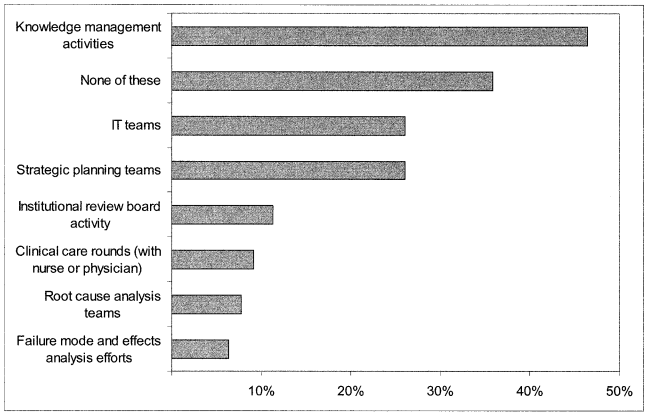

Table 1
Queried email discussion lists

List	Subscriber numbers (approximate)
Medical librarians discussion group	1,800
Illinois Chapter of the Special Libraries Association (SLA)	330
Biomedical and Life Sciences division of SLA	230
Aliahealth Australian/New Zealand Medical Librarians	350

seeing librarians as having a crucial role in improving safety.

- Leadership in health care organizations is not proactive about recruiting librarians to take part in the safety work of their organizations.
- Information professionals and librarians responding to the survey are aware of the importance of patient safety initiatives.
- Some information professionals are proactively becoming involved with safety initiatives—particularly promoting the role of evidence-based medical decisions.
- Information professionals have interesting opportunities to define their roles in and contributions to this vitally important area.

Of the survey participants, 47.4% worked in teaching hospitals, 21.4% in nonteaching hospitals, 11.6% in academic medical centers, 6.4% in health care–related organizations (such as pharmaceutical companies), and 5.8% in other health care environments (such as a not-for-profit organization). Thirteen persons (7.5%) selected ''Other'' and identified work places such as medical professional associations and law firms.

Current activities by librarians related to safety were explored. Only 4 of the 142 respondents believed they had no role in patient safety initiatives. Of the respondents, 83.1% responded to ad hoc inquiries on patient safety. A significant number—48% and 46%, respectively—created resource guides (e.g., Websites, brochures, and guides to articles or books) for patients and practitioners and provided training for practitioners who wished to increase their skills.

Only twenty persons (14% of persons responding) created and maintained knowledgebases of incidents and institutional responses. While they might still be sensitive about dealing with errors and incidents, information professionals could use their skills in organizing information, making it easy for the information to be analyzed and shared. This true knowledge-management effort has profound implications for organizational learning (Figure 1). The last five activities in Figure 1 are proactive roles for information professionals in minimizing error and promoting safety.

Responses indicated that opportunities for information professionals to learn about safety were not robust. Of the survey participants, 58.5% indicated that the library staff did not participate in organization-sponsored events designed to increase understanding of patient safety practices or in meetings outside of the workplace on this topic. Sixty-four percent of survey participants indicated that their supervisor did not talk with them about their work in the context of safety.

However, the authors find that the library community seems to have made inroads into a major issue that is difficult for many departments—that of openly discussing errors. The impact of the errors considered by this set of respondents might be less than catastrophic, and hence broaching the subject is easier. However, the openness to learning from mistakes is a key attribute of a culture of safety [10]. It is encouraging that the library community has accepted this review-and-improvement process as a normal way of working.

A parallel point is that 67% of respondents indicate that weaknesses in library services and products are openly discussed with a goal of making improvements. In a microcosm, information centers have organized themselves to be learning organizations. Stringent and ongoing process review with a goal of continuous learning and improvement is a hallmark of the learning organization.

Six areas percolate to the top when reviewing the narrative answers to the question asking librarians about ''what keeps them up at night?'' regarding safety and the information transfer process at their institutions. Whereas the results might not be fully representative of the profession as a whole, the authors believe that the results can provide a snapshot of areas of concern for librarians and their roles in safety.

The six general areas of concern relate to:

- Culture: inbred notions, norms, and philosophies of the organization that affect how work is done
- Leadership: relationships between leaders and administrators in the librarian's organization and the library staff
- Process: the ways certain tasks are accomplished and the defined ways of doing them
- Research skills: the impact of real or perceived expertise by clinicians in online and Web-based research on the process of information identification and use

Figure 2
Examples illustrating current ways that librarians and clinicians are working together to improve safety

- Involvement with instituting a personal digital assistant (PDA) program to assist in answering questions at the point of care
- Updates to hospital policy and procedures to reflect current thinking
- Role on the clinical team for information professionals by proactively providing point-to-point dissemination of patient safety information
- Active clinical librarianship program that affects how clinicians find and utilize relevant evidence
- Literature search activity for patient safety initiatives, practice guidelines review, and root cause analysis
- Personal relationships with patient safety officers, risk management, and other quality personnel to establish an effective information exchange relationship
- Involvement in root cause analysis efforts
- Participation on the medication errors reduction team
- Effort to make library resources available to the clinical team, 24/7

- Individual responsibilities and skills: the individual professional's competencies and the ways they affect the professional's safety role
- Resources/access issues and time factors: blunt end factors such as budget, technology, personnel, and collection items

DISCUSSION

Librarians and information professionals should have an integral role in patient safety efforts. Results of this exploratory study indicate a level of comfort with discussing errors with an eye toward improvement. An innovative and proactive relationship between librarians and those responsible for patient safety initiatives should be nurtured to most effectively identify, acquire, and disseminate information to support system improvements, learning organization behaviors, and clinical decisions, so that the information dimensions of patient safety are fully integrated and leveraged (Figure 2). Such a relationship will also encourage the creative thinking, feedback loops, and constructive dialogue needed to alter the status quo and mental models about the library profession that inhibit change. Value and ROI for such initiatives will ultimately be measured by a reduction in the number of days patients are hospitalized, fewer legal actions, and improved diagnostic and treatment strategies as a result of access to accurate and timely information.

Further study is required for a deeper understanding of the actual role of information professionals with respect to patient safety and perceptions regarding the interplay among information professionals, organization leadership, and patients. More probing about how librarians view the value of their experience and training in contributing to patient safety programs would be beneficial. For communicating best practices, it is important to learn about initiatives that are led by the library versus those which the library has been invited to participate in, and it is important to describe the culture of those organizations, documenting what the library has done that helped the parent institution perceive the library's value in a patient safety initiative. This activity would help to draw a clear connection between information work and patient safety improvements. It would also provide the industry with models to expand upon in recruiting the information sector and to assist in identifying metrics from which to measure the impact of these activities on the outcomes of safety initiatives.

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