Integrating health sciences librarians into biomedicine*

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Vanderbilt University Medical Center (VUMC) developed a model training program to prepare current and future health sciences librarians for roles that are integrated into the diverse fabric of the health care professions. As a complement to the traditional and theoretical aspects of a librarian's education, this mixture of supplemental coursework and intensive practical training emphasizes active management of information, problem-solving skills, learning in context, and direct participation in research, while providing the opportunity for advanced academic pursuits. The practical training will take place under the auspices of an established Integrated Advanced Information Management Systems (IAIMS) library that is fully integrated with the Health Center Information Management Unit and Academic Biomedical Informatics Unit. During the planning phase, investigators are analyzing the model's aims and requirements, concentrating on (a) refining the current understanding of the roles health sciences librarians occupy; (b) developing educational strategies that prepare librarians to fulfill expanded roles; and (c) planning for an evaluation process that will support iterative revision and refinement of the model.

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INTRODUCTION

Immediate action is required to bring health sciences librarians into the mainstream of health care. If medical librarians play an active role in this attempt, the potential for future professional growth will be very high. Librarians should utilize their expertise to shape institutional information policy, and must adapt to new kinds of information demands by gaining expertise with systems and subject matter beyond the traditional scope of health sciences librarianship [1-2]. This requires actively seeking out new roles and opportunities, and becoming better at promoting the role of the health sciences librarian [3]. At a time when health sciences centers are seeking to integrate such traditionally distinct enterprises as clinical information systems, financial information systems, scholarly support systems, and information infrastructures [4], the chance for health sciences librarians to redefine their role is great.

The nature of information access, storage, retrieval, and dissemination in health care is changing as it mirrors advances in technology. A concurrent shift in the focus of health sciences librarianship is under way, from managing the containers of information to managing information within the broader context of the institution—including education, research, electronic publication, and institutional planning. Although the health sciences library remains the central conduit of biomedical information, the role of the librarian within the institution is no longer confined to the library [5]. As a result, roles for health sciences librarians are expanding in four broad areas: (1) production of information resources, (2) development of information infrastructure, (3) education, and (4) data management. While demand for restructuring library science education is still being debated, the need for development of portfolio-based careers is apparent.

The principles underlying the Vanderbilt University Medical Center (VUMC) librarian training initiative coincide with the vision expressed in the research policy statement of the Medical Library Association (MLA), Using Scientific Evidence to Improve Information Practice, [6] and affirm Vanderbilt’s commitment to furthering the roles of health sciences librarians. MLA’s policy statement acknowledges

- the realization that the knowledge base of the health sciences library profession can be fruitfully applied to managing information beyond bibliographic data and library collections;
- the understanding that designing, developing, and promoting new health information systems that integrate scientific literature with patient- or case-specific information is an important future role for librarians; and
- the desire to involve health sciences librarians fully in research that is broadly relevant to the organization, including delivery, use, and effects of information on the fundamental activities of health care, biomedical research, and health professionals’ education.

The ongoing information evolution and professional transformation require health sciences librarians to adopt a continuum of learning [7]. Addressing the changing nature of the profession and its relationship to the delivery of health care is “essential if health sciences librarians are to remain indispensable members of the health field and continue to provide high levels of service to the public health” [8]. The VUMC planning grant contributes to both aspects and helps bridge the existing distance between health sciences librarians (as individuals and as a group) and health care professionals.

THE VUMC INITIATIVE

Recognizing the need to support librarians in their changing roles and responsibilities, the VUMC training initiative has focused on creating a model postgraduate and postdoctorate program that emphasizes practical experience as well as the potential for advanced academic pursuits. In addition to targeting individuals who have completed a master’s degree or doctorate in library and information science, the program provides pathways to retrain practicing academic, hospital, and special health sciences librarians. The specific aims of the project are to:

1. refine the current understanding of the roles that health sciences librarians occupy, in order to define potential new roles
2. develop an educational model, consisting of a core curriculum and practical internships, providing a basis for new librarians’ roles
3. plan for evaluation of the education and training program

The initial one-year planning phase described in this paper stresses an iterative approach to research, development, implementation, and continuous revision. We believe that the introduction of quantitative evaluation methods, as well as an iterative approach to curriculum development and training, is one of the necessary requirements to achieve an adaptive, concept-based program.

Through an extensive review of the literature, four major areas were identified as strategically important to the future of health sciences librarianship, and thus to be investigated within the overall project:

1. the increasing need for effective delivery of quality-filtered information
2. the integration of librarians into the health care team
3. the need for librarians to assume more proactive roles in information delivery
4. the need to increase the role of librarians as educators

Effective delivery of quality filtered information

The amount of biomedical information available in the published literature continues to grow [9-11]. In addition, concepts contained within the scientific literature are subject to journal scatter and seepage [12-13]. This abundance of information makes access to relevant data difficult and directly affects the healthcare decision-making process [14]. Users of biomedical information are not a homogeneous group; researchers, practitioners, students, and patients all have very different information needs [15-16].

To handle the expansion of information, librarians increasingly rely on computers and technological advances. Along with traditional bibliographic databases, commonly used electronic resources include factual, numeric, and referral databases, as well as full-text reference material. Such resources are becoming increasingly complex. Biomedical knowledge bases [17-18] and decision support systems are designed to assist with the delivery of health care. The majority of librarians unfortunately do not possess a scientific or technical background upon entering the field [19-20] and thus may be at a disadvantage in understanding or using those technologies. Moreover, end users of electronic information retrieval systems often lack sufficient training in using those systems [21].

In addition to competently handling advanced information technologies, librarians must become more proficient in understanding and anticipating clinical information needs. The traditional library school curriculum has not addressed anticipating information needs. Many health sciences librarians do not have an in-depth understanding of the information needs and information-seeking behavior of healthcare providers. Information needs and information-seeking behavior, however, are integral components of the clinical problem-solving process. Health care providers have significant information needs that are expressed in multiple, and often complex, ways [22]; to understand these needs fully, communication messages must be observed within the normal context of medical discourse. A detailed study of the information needs of active clinicians [23], which used anthropological field-observation methods, found that a considerable portion of clinicians’ information needs are unmet, and in fact are unrecognized even by the clinicians themselves. These results point to the need for biomedical librarians to take an active role in identifying, as well as satisfying, information needs.

Integration of librarians into the health care team

Although the majority of librarians lack a scientific background or biomedical academic preparation, the clinical medical librarian (CML) model has been relatively successful in expanding the role of the librarian to include service as an information consultant for patient care [24-25]. CML programs provide a direct link between health sciences librarianship and clinical practice. The evaluation of biomedical literature, databases, and knowledge bases is used to enhance the educational value of routine clinical activities [26]. The strength of the CML concept lies in the delivery of quality-filtered information that supports health care [27]. While members of the biomedical community are typically enthusiastic about clinical medical components of library service, CML programs have been criticized for being labor-intensive and expensive [28]. To justify the continued provision of personalized service, librarians must market the library more successfully and maximize the benefits of CML programs [29-30].

Proactive roles in information delivery

Biomedical informatics will greatly affect the future of health sciences librarianship, as well as the delivery of health care. Informatics uses information technology to facilitate the effective delivery of health care by fusing the existing biomedical knowledge base with practice [31]. The Association of American Medical Colleges defines the discipline as “a developing body of knowledge and set of techniques concerning the organization and management of information in support of medical research, education, and patient care” [32]. Activities involve information management, artificial intelligence, decision-support analysis, and computer-aided learning and instruction. While the inherent benefits of informatics applications are obvious, their potential has not yet been fully realized [33]. Continued improvement in this application of technology depends on knowledge of the information-related problems experienced by clinicians. Various academic health sciences institutions have created biomedical informatics training programs in an effort to foster continued research in this area [34]. Although degree-granting status and level vary, the internship and fellowship model has been widely adopted among informatics programs.

So far, informatics training programs have primarily targeted physicians and computer scientists, rather than librarians. Including informatics training in librarians’ professional preparation will help bridge the gap between the vast pool of scientific knowledge and the information consumer. To maximize the effective use of biomedical information, biomedical informatics research must be merged with library resource projects [35]. In fact, evolving technologies, combined with changes in the form and content of scientific communication, suggest an increasing convergence between the disciplines of biomedical in-
informatics and health sciences librarianship [36]. This may lead to a greater integration of health practitioners and librarians, if the latter are provided the opportunity to assume a more active role in research and health care activities.

**Increased role as educators**

The VUMC initiative addresses recent changes in the nature of health sciences librarianship that coincide with the restructuring of biomedical education, including the incorporation of problem-based learning (PBL) [37]. PBL is an educational approach in which information is acquired in the same context in which it will be used [38]; this approach places heavier demands upon physical library facilities and library services [39]. As active participants in the problem-based curriculum, health sciences librarians are increasingly involved in biomedical education [40]. The VUMC initiative provides for trainee participation in ongoing educational activities, in which they design appropriate elective courses and teach first- and second-year medical and nursing students as part of regularly scheduled courses. During the planning phase, librarians have been directly involved in educational activities by (a) participating in teaching non-traditional subjects, such as access to computerized information sources, to medical and nursing students at the Vanderbilt University Medical Center, and (b) influencing the future structure of the curriculum through participation in the decision-making process.

**ACTIVITIES DURING THE PLANNING PHASE**

Within the overall project, the one-year planning phase has been dedicated specifically to creating a model postgraduate and postdoctorate training program for health sciences librarians, and to establishing an evaluation plan. Our efforts during the planning phase have been concentrated in several areas:

- refining the current understanding of librarians' roles through the design and implementation of a formal study
- designing training programs for non-degree and degree-seeking candidates
- designing pilot internship rotations for the training program
- identifying an appropriate curriculum for the training program
- designing an iterative program evaluation process

**Refining the current understanding of health sciences librarians' roles**

The first group of activities in the planning phase has been dedicated to establishing a baseline of knowledge concerning the skills currently necessary for health sciences librarians, as well as those perceived to be necessary for the future. For this purpose, we conducted a formal study to (a) provide an up-to-date view of current and expected roles, career paths, and requirements, and (b) create the baseline for the evaluation component of the initiative, allowing the effects of future educational models to be analyzed and evaluated in the subsequent phases of the project. Data-gathering activities during this phase included conducting a series of focus groups, administering two national surveys, and evaluating an extensive information audit conducted as part of the VUMC IAIMS initiative. The surveys were sent to both health sciences librarians and library users.

Data collected during this phase are being used to guide the development of educational models for postgraduate and postdoctoral training of health sciences librarians. The final report summarizing the results will be reviewed by a representative team including health sciences librarians, biomedical informaticians, biomedical educators, health care practitioners, health information systems personnel, and faculty in education and human development.

**Designing training programs for non-degree and degree-seeking candidates**

A series of activities during the planning phase has been aimed at designing a two-tiered training program that will offer a non-degree and a degree option, both of which will have internship rotations as their central feature. In contrast to traditional library school curricula, which have had relatively little connection to actual health care practice, the VUMC design places strong emphasis on learning in the context of established clinical and research programs. The VUMC training program is aimed at preparing health sciences librarians to assume expanded information management roles, historically perceived to be outside the realm of librarianship, in health promotion and education, human resources, public policy, cognitive psychology, and educational leadership. The degree option will allow students to pursue either a master's degree, a Certificate of Advanced Study, or a Ph.D. Students choosing the non-degree option will assess areas in which they need improvement, select from a pool of internship rotations, and choose among workshops and courses to augment areas targeted for skill development.

**Designing pilot internship rotations for the training program**

A paradigm shift in education is under way for library and information professionals, from competency-based to concept-centered approaches, reflecting the impact of technological advances on the profession [41]. The profession demands a broader understand-
ing of the fundamental concepts underlying technology, rather than the mere use of sophisticated applications. While most academic preparation for librarians occurs in the classroom, program constraints limit the breadth and depth of the formal curriculum. One vehicle ideally suited to prepare health sciences librarians to function more effectively is the formal internship program at an institution where new role models have been established. The philosophy traditionally underlying the internship concept has been the notion that the combination of theory and practice provides participants with experience, and enables them to adapt readily to the changing health care environment [42]. Internships have also been seen as a means to expand existing skills in a relatively short period [43].

During the planning phase, we designed a model internship component of the training program. The model is an adaptation of the Human and Organizational Development Internship program at Peabody College at Vanderbilt University. The program design stresses self-directed, active learning, with a particular emphasis on focused observation and questioning, problem-focused learning, goal-directed rotations, and project-based learning assessment. Through this internship model, librarians will not only increase their subject knowledge, but will sharpen meta-skills such as willingness to learn, analytic ability, and adaptability. Such meta-skills are necessary to keep librarians motivated to constantly upgrade their professional capabilities in the face of continual changes in information technology. This type of training is virtually absent from conventional librarian preparation.

We have organized several pilot rotations, which are being undertaken by health sciences librarians. These pilot rotations integrate librarians into projects such as creating a library online assistant, linking medical literature to a physician order-entry system, and implementing a telemedicine outreach project. As part of the pilot rotations, librarians will conduct specific information-needs analyses at each rotation site, gathering data to verify the feasibility of implementing formal internships in that area. Planning phase rotations will have immediate practical benefits, giving librarians new career skills that can also be applied to educating health care providers. More importantly, the rotations will help us evaluate and refine the specific details of format and content over several iterations, ensuring that the model is ready for full implementation at the end of the planning period.

Once the final program design is in place and the formal internships are ready for implementation, librarians will choose among broad categories of internships, such as clinical, research, outreach, and information technology, within which their individual goals and objectives may be explored. To ensure that the program offers internships reflecting the emerging requirements of the profession, each rotation will be mapped to the skill categories identified during our initial data-gathering activities.

One of the key aspects of the VUMC training program design is the tight integration, through internship rotations, of health sciences librarians into activities for which they have a strong procedural affinity. For example, one proposed rotation would have the trainee librarian learn to search actual patient records in population-based mode by using VUMC's new integrated medical record system, first in isolation and later to answer real clinical questions. The trainee would then learn to serve as a consultant to improve access to patient records. The new VUMC patient record system supports complex interactive and batch-oriented queries, for example allowing a physician to obtain a list of all patients whose creatinine levels increased by at least 0.5 mg/dl from a day earlier, and who also underwent an X-ray study involving a contrast medium (reported to cause acute renal failure). Such complex population-based questions involve a variety of document types within the computerized patient records, and creating appropriate and efficient queries requires skills similar to those librarians use when searching the medical literature. An internship based on this concept allows a librarian to interact simultaneously with the group involved in implementing the integrated medical record system—to gain the required proficiency with the technical details—and with the clinician users, to gain an understanding of the clinical information needs that lead to such questions. This type of internship takes advantage of librarians' expertise while providing practical training in the areas of informatics, institutional information management, clinical practice, and information needs and information-seeking behavior. The VUMC librarian training initiative maintains a strong focus on developing and sharpening knowledge bases and skill sets through well-designed, practical internships that integrate librarians into existing clinical and research teams.

Identifying an appropriate curriculum for the training program

In addition to practical internships, the VUMC initiative stresses opportunities for continued academic achievement to supplement the participants' knowledge and experience. Trainees will have the opportunity to take courses that supplement their existing knowledge in areas such as public policy, educational leadership, human resources, program development and evaluation, and health promotion and education. To develop appropriate curricula for both the degree and non-degree tiers of the training program, we
have mapped the top twenty skills identified in our initial data-gathering activities to courses offered at Peabody College. Other, less highly ranked skills have been matched with possible electives and workshops. Once the list of core and recommended courses, electives, and internships has been established, a model curriculum will be finalized.

Designing an iterative program evaluation process

At a time when accountability and cost containment are key concerns, evaluation is a requisite component of any program devoted to the education and training of health sciences librarians. It is necessary to test the validity and effectiveness of a training program to justify its success and continuance. Further, the evaluation process should be ongoing, to ensure constant revision that reflects the changing health sciences information environment. To warrant the program’s continued existence, benefits must be demonstrated in a qualifiable and quantifiable manner.

Capitalizing on the expertise of Peabody College, we are examining existing educational outcomes assessment models to determine appropriate aspects to incorporate into the program evaluation process. The development of the program evaluation plan will follow the guidelines established by Wholey’s [44] evaluability assessment process. Evaluability assessment is defined as a method of clarifying program design by negotiating a consensus among the primary stakeholders (e.g., health sciences librarians, physicians, nurses, hospital administrators) in four areas: (1) defining the program's goals, specific objectives, important side effects, and priority information needs; (2) testing the likelihood that the program goals will be achieved; (3) determining whether relevant program performance data can be gathered at a reasonable cost; and (4) reaching agreement among the intended users of the evaluation about how they will use the information.

The ultimate goal of the program is to provide health care providers with more appropriate and timely information. The specific approach is to conduct an evaluability assessment of how health sciences librarians can improve access to information. The planning phase has identified the skills needed to accomplish the program’s main objectives. The outcomes measured will provide evidence that medical librarians who receive training in this program have acquired the necessary skills and can successfully employ them in clinical or research settings.

We are creating a model evaluation process by using information gathered during the planning phase. The model will be reviewed and refined by experts in education, biomedical education, library and information science education, and biomedical informatics education, as well as by practicing health sciences librarians. The program evaluation model will provide for continuous feedback and subsequent revision.

CONCLUSION

Librarians must assume the initiative and maintain the motivation required to constantly upgrade their professional knowledge base, while fostering the desire and ability on the part of others to seek out new knowledge. In support of these efforts, the VUMC initiative encourages librarians to achieve greater understanding of clinical practice through educational interventions, and increases their ability to train and educate health practitioners. It also enables them to participate as active researchers in areas to which they can contribute their unique skills and expertise, such as the development of hospital information systems that include links to disparate databases, and to take the lead in research activities that result in the creation of knowledge bases of data and information. If librarians can be trained and inspired to meet these goals, the potential for professional growth is very high.

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