

An Overview of the Medical Informatics Curriculum in Medical Schools

Jeremy U. Espino and Martin G. Levine
Department of Anatomy and Cell Biology
State University of New York- Health Science Center at Brooklyn

As medical schools incorporate medical informatics into their curriculum the problems of implementation arise. Because there are no standards regarding a medical informatics curriculum, medical schools are implementing the subjects in various ways. A survey was undertaken to amass an overview of the medical informatics curriculum nationally.

Of the responding schools, most have aspects of medical informatics incorporated into current courses and utilize existing faculty. Literature searching, clinical decision-making, and Internet are the basic topics in the current curricula. The trend is for medical informatics to be incorporated throughout all four years of medical school. Barriers are the difficulties in faculty training, and slow implementation.

INTRODUCTION

The challenges faced by medicine today are enormous. With the present climate, it is desirable for physicians to graduate with a minimum set of management skills so that they can practice in this new changing environment. The efficient use of medical information is a major part of this skill set.

The idea that medical schools should incorporate topics in information management is not new. In 1984 a panel on the General Professional Education of the Physician (Association of American Medical Colleges) specifically identified medical informatics, including computer applications, as an area in which new educational opportunities needed to be developed so that physicians would be better prepared for the practice of medicine. "Medical Schools should designate an academic unit for institutional leadership in the application of information sciences and computer technology to the general professional education of physicians and promote their effective use."¹

Because there is no clear path to implementation^{2 3} as well as agreement on what constitutes a full medical informatics curriculum, this survey was undertaken. It attempts to amass an overview of the current medical informatics activities at medical schools nationally.

METHODS

The AAMC Curriculum Database 1996-1997 was scanned to create an email database of the curriculum managers at North American medical schools. Not all schools had an email address and were not able to be contacted for the survey. Seventy-nine email addresses were compiled out of the 127 schools. This email database, was utilized to perform a bulk emailing of the survey questions.

Eighteen medical informatics training sites were sent email regarding their input into medical school education.

In addition, the survey questions were posted to the AAMC Medical Education List Server and the usenet sci.med.informatics newsgroup.

Finally, a web based survey form was created to collect data. Respondents were encouraged to utilize it.

RESULTS

Completing the survey questionnaire were twenty-six medical schools and six medical informatics training sites. (Table 1)

Table 1

Medical Schools
Albert Einstein Medical College
Baylor College of Medicine
Brown University
Cornell University Medical College
Harvard Medical School
Johns Hopkins
Loma Linda University
LSU Medical Center
MCP Hahnemann School of Medicine
Morehouse School of Medicine
Mount Sinai Medical School
New York University
North East Ohio University College of Medicine
Oregon Health Sciences University
Stanford University
Tulane
University of Arkansas College of Medicine
University of Florida
University of Minnesota

University of Minnesota
 University of Missouri - Columbia
 University of Nebraska
 University of North Carolina
 University of Rochester
 University of Texas Health Science Center at San Antonio
 University of Wisconsin
 University of Wisconsin
 Wright University

Medical Informatics Training Sites

Stanford University
 University of Missouri
 University of North Carolina
 University of Pittsburgh
 Washington University
 Yale University

The survey results were summarized, as follows:

Are there formal objectives in your medical informatics curriculum? (Figure 1)

Of the twenty-six medical schools responding only one school reported no informatics subjects in the curriculum. Two schools reported informal teaching of medical informatics within existing courses. Nine schools had formal medical informatics objectives in the curriculum longer than one year. Eight schools reported the formalization of objectives for this or next year. Six schools reported an elective only curriculum for medical informatics.

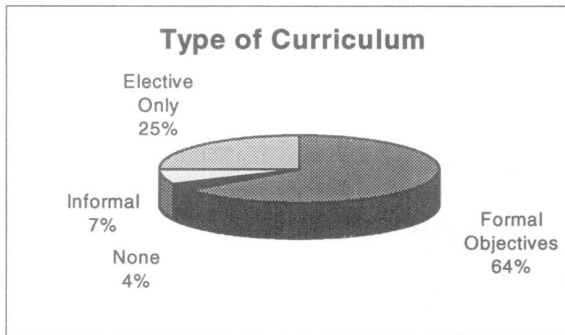


Figure 1

What subjects are taught in your medical informatics curriculum? (Figure 2)

Of the eighteen schools with required objectives, sixteen responded with subject listings. All programs indicated that literature searching and internet use were taught. Clinical decision making involving statistical analysis was indicated fourteen out of sixteen schools. Computer assisted clinical diagnosis and the use of hospital information systems was taught at nine out of sixteen schools. Electronic

patient records, ethics, and security issues were noted in six out of sixteen schools.

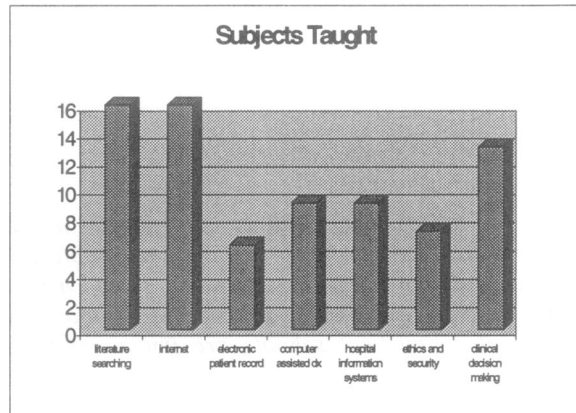


Figure 2

What is the method of instruction? (Figure 3)

Thirteen out of the eighteen schools with required objectives reported where the instruction was taking place. Five of those thirteen had integrated the subjects into existing courses. Four of the thirteen integrated subjects into existing courses and added lecture time for subjects that could not be integrated. Four of the thirteen had separate distinct courses to teach the subject.

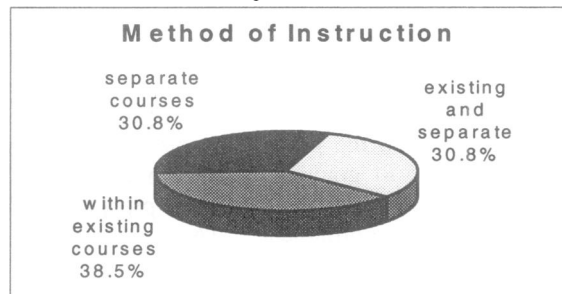


Figure 3

Who teaches the subjects? (Figure 4)

Nine schools out of the all respondents indicated who was teaching the subjects. Six out of the nine utilized existing faculty to teach informatics subjects. Three out of the nine had specific informatics teachers.

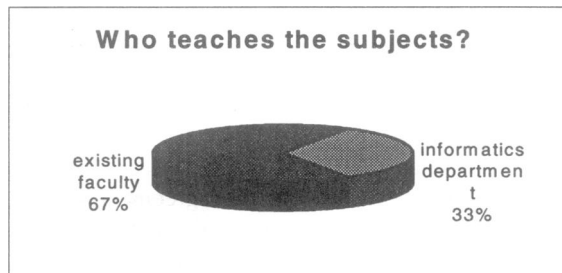


Figure 4

When are these subjects taught? (Figure 5)

Fifteen out of eighteen schools with objectives reported when they taught the subjects. Five schools taught informatics subjects in only the first half or basic science years of medical school. One school taught in the second half or clinical years. Nine schools incorporated informatics into both halves.

The six schools offering an elective only format for medical informatics offered them during the second half of medical school.

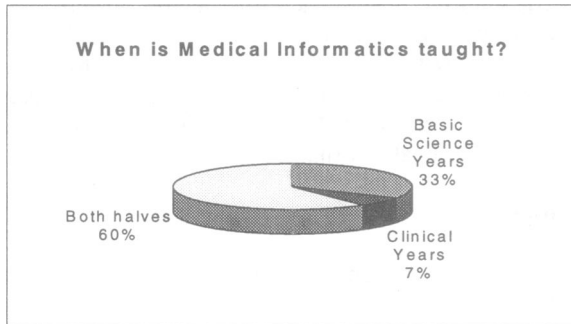


Figure 5

What kinds of problems and/or changes were made in the course since inception?

No clear and general consensus was indicated, therefore individual responses are listed below.

- More tailored to individual needs, interests and skill level.
- Less ambitious and more explicit in terms of individual objectives.
- Increasingly project and or clinical problem focused.
- More hands on training and less goals.
- A "medical informatics" course was taught for two years targeted at mainly literacy/minimum skills. The course was discontinued this year because most students seemed to arrive with minimum basic skills.
- Difficulty implementing all of the objectives.
- Emphasis has been changed toward developing skills in reading literature. Small group presentation of a topic added.
- Lack of faculty training or interest. Not invented here syndrome. Mixture of student experience.
- Each semester seeing more and more evidence of different goals being implemented.
- [Lack of] faculty acceptance and interest.
- Scheduling individual sessions on computers. Email system for students needs to be updated.
- Coordination of Efforts. They don't talk to one another.

What software programs are found to be most useful?

Here again, no general consensus was forthcoming.

- Iliad, QMR, Scientific American, Best Evidence, Pub Med, Cochrane Library, AIM filters Netscape, Powerpoint QMR, Harrison's Internal Medicine, and EMR were noted.

What future plans does your program have?

- Future plans are currently 'on hold'. There is the desire to build more informatics into the beginning of the clinical curriculum. This would probably take the form of 'linkage' between core experiences that take place at separate sites, and the inclusion of exposure to various clinic based systems and decision support.
- Will attempt to use new AAMC medical informatics education objectives.
- Continue to refine and expand topics and course offerings.

DISCUSSION

Most medical schools have an interest in a medical informatics curriculum. In the most recent profile of medical school curriculum from the AAMC (American Association of Medical Colleges) Curriculum Directory, 1996-1997, 116 schools out of 127 (93%) reported incorporation of medical informatics subjects.⁴

The question is, "To what degree are medical schools teaching medical informatics and how?" Medical Informatics is a constantly evolving field and topics may include literature searching, internet use, computer assisted diagnosis, hospital information systems, and electronic patient record. As there are no standards on what makes up an informatics curriculum, medical schools that teach at least one of the aforementioned topics may be considered as teaching medical informatics.

What standard objectives should be made in a medical informatics curriculum? In October of 1997, the AAMC produced a draft report of medical informatics objectives. The draft report was distributed for discussion only, but it is interesting to note that many of the implementation strategies in the report are similar to the strategies employed by the medical schools in this survey. A finalized version of the AAMC report along with an annotated version by the American Medical Informatics Association is expected.

In addition to the AAMC guidelines for a medical informatics curriculum, the specific methods, problems, and successes of individual institutions are valuable information for those putting together an informatics curriculum. Data from this medical

informatics curriculum survey focuses on implementation, objectives, subjects, and problems; major factors in any evolving medical informatics curriculum.

Implementation

Most medical schools are including medical informatics into their curriculum in one form or another. A majority of the schools are doing so by integrating medical informatics topics into current courses alone or accompanied by a separate informatics course. It is important to recognize medical informatics as a tool and skill. Any skill is best learned and retained when put into the context of the material it is to be used in. New York University Medical School demonstrates this approach, as follows:

ANATOMY – Must prepare review article of anatomic variations of chosen structure and the clinical importance using word processor, email, and Medline.

GENETICS – Students required to use email to communicate with faculty, need to use world wide web for getting assignments, doing literature search for a review article, use online database for background info and conferences.

MICROBIOLOGY – Email communication with faculty, hand in and get back criticisms of laboratory write-ups, do literature searching for final review article on selected topics in microbiology, must email document to instructors, must present topics to peers, optional use of computers for presentation – Several students use computer to prepare (Slide Show, Overheads, etc). Use of homegrown database to assist in determining unknown in lab cases

AMBULATORY CARE - Have started PDA (Personal Digital Assistant) for ambulatory care... all students on the clerkship carry PalmPilots...keep schedules, and logging of patients and diagnoses.

Evidence based medicine section of ambulatory care, statistics, make use of statistics packages

Ideally, medical informatics should be incorporated into all four years of medical school. The data from this survey reflects this desire. The skills learned will become second nature just as the skills in physical diagnosis and history taking have become. Computers should be a constant companion in everyday medical practice, in a way that complements rather than replaces personal knowledge and clinical skills.⁵ For example, a future primary care physician has a patient who has a difficult diagnosis. Reluctant to call in a specialist, he/she might consult a assisted clinical diagnosis program to broaden his differential diagnosis and then scan

Medline and the community/local electronic medical record database to look for similar cases. After reviewing a case report on the electronic journals of the Internet, he/she might contact the author by email for further information.

Objectives

Although most schools will readily admit that medical informatics topics are included in their curriculum the development of specific objectives is relatively new. Several schools submitted their objectives to this survey and they may be found at <http://www.interport.net/~fustar>. These objectives mirror those stated in the AAMC draft of objectives from the Medical Informatics Advisory Panel.

Subjects

The implementation of a full range of medical informatics topics in institutions is not widespread. Not all possible informatics topics were covered in this survey, but all schools indicated that their medical informatics curriculum includes literature searching and internet use. The lack of widespread adoption of additional topics such as computer assisted clinical diagnosis, electronic patient record, hospital information systems, and ethics/security issues can be explained.

Medicine has always welcomed new technology, however, elements such as electronic patient record and assisted clinical diagnosis are rare in today's American healthcare system. These medical informatics topics are not new - the earliest references to the application of electronic digital computers to medicine appeared as early as the late 1950s.⁶ However, the advances made in computing and communications over the past decade have made the ideas more feasible in terms of cost and usability. In addition, the presence of a managed care environment necessitates up-to-date clinical, demographic, and administrative information.

Most medical educators desire that their graduates be well prepared for the clinical climate they will practice in, but the most recently trained members of the practicing medical community claim they haven't learned enough about practice management and cost effective medical practice.⁷ Long time doctors are returning to continuing education programs to learn more about medical informatics, and garner degrees in business and/or public administration. There is growing acceptance that the efficient management of medical information is a necessary skill for all medical graduates.

Furthermore, medical education should expose students to key concepts in medical informatics to prepare them for the settings and

responsibilities they will encounter in their future careers.⁸ However, we have to understand that there will be situations where students will encounter difficulties in acquiring informatics skills for whatever reason. At these instances, we must ensure that they have, at least, informatics knowledge. The curriculum objectives from Albert Einstein College of Medicine points out the following, "Medical Informatics skills have greater importance than Medical Informatics knowledge. . . In some cases, we may lack the resources needed to give the student opportunity to acquire a skill. In these cases, we have required knowledge objectives to improve the chance that a student will acquire a skill."

Problems

Several common problems are reported in the survey. Lack of faculty acceptance and interest is a major stumbling block to incorporation of medical informatics into the curriculum. Many faculty are in the midst of reconstructing their courses to incorporate problem based learning. Add medical informatics objectives to the reform and educators might throw up their hands. Educators should be reminded that medical informatics is not about learning the intricacies of computers and programming. Medical informatics curriculum is

about developing and encouraging skills that a physician will need to practice in the future.

CONCLUSION

At this point in time, a definitive medical informatics curriculum for medical schools does not exist, but institutions that are developing objectives have begun to reach a consensus on several points. There is a desire to have medical informatics integrated into all courses throughout all four years of medical school with existing faculty as teachers. The difficulty in implementing a medical informatics curriculum is due primarily to a lack of interested and knowledgeable educators.

As information technology pervades the medical environment, the need to provide medical informatics skills will become more apparent. Within the four years of medical school many advancements and changes occur. This year's first year medical student will graduate in the year 2003. Hospitals are already planning to digitize their clinical information, patient records and diagnostic images, eliminate paper records, and participate in physician owned managed care companies. Our future students must be prepared for these new challenges.

References

- ¹ Muller S. Physicians for the twenty-first century: report of the project panel on the general professional education of the physician and college preparation for medicine. *J Med Edu*, 1984; 59: Part 2.
- ² Mohr JR. Teaching medical informatics: teaching on the seams of disciplines, cultures, traditions. *Methods of Information in Medicine*, 1989;28(4):273-80.
- ³ Florance V, Braude RM, Frisse ME, Fuller S. Educating physicians to use the digital library. *Academic Medicine*, 1995;70(7):597-602.
- ⁴ Varner KS 1996-1997 AAMC Curriculum Directory. AAMC:Washington DC, 1997
- ⁵ Friedman CP. Perspectives on computing and medical education. *Academic Medicine*, 1997;72(6):511.
- ⁶ Collen M. A History of Medical Informatics in the United States. AMIA: Indianapolis,1995
- ⁷ Cantor JC, Baker LC, Hughes RG. Preparedness for practice: young physicians' views of their professional education. *J Am Med Soc*, 13;270:1035-40.
- ⁸ Shortliffe EH. Medical informatics meets medical education. *JAMA*. 273(13):1061, 1064-5, 1995 Apr 5.