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Synopsis

Integrated Information Systems

This Section on Integrated Information Systems contains seven papers all concerned with some aspect of providing accurate, timely, and up to date information to health care professionals. Three of the papers treat the U.S. National Library of Medicine's IAIMS program (Lindberg et al. [1], Miller et al. [2], and Roderer and Clayton [3]). Two papers treat clinical information systems, though each with a quite different perspective (Smith [4], and Bleich and Slack [5]). One paper deals with the evaluation of electronic data exchange (Hasman et al. [6]), and one paper deals with a topic that is not directly concerned with the implementation of information systems, but rather with the issue of preparing medical students for their role in the information-rich, high-technology world in which they will be expected to practice (Rootenberg [7]).

The large-scale research efforts taken on as "grand challenges" by the High Performance Computing and Communications (HPCC) program in the USA promise to accelerate the development of sophisticated health care applications that take advantage of high-speed, high-capacity networks [8]. Proposed HPCC applications in health care include database technology to provide health care providers with access to relevant and timely medical information; database technology for storing, accessing, and transmitting patients' medical records with ample attention paid to security issues; testbed networks for linking hospitals, clinics, physicians, medical schools and libraries to enable health care providers and researchers to share medical data; and the latest imaging technology for use and collaboration by health care providers [9]. As Lindberg et al. point out in their article [1] in this Section, the HPCC will make possible "a system of information access that can transcend the borders of the medical centers to reach out to all engaged in health care activities".

Lindberg et al.'s paper: *IAIMS: an overview from the National Library of Medicine* [1], begins with a brief history of the IAIMS (Integrated Academic Information Management System) initiative. The purpose of the initiative is to improve health science information management at an institution by linking together its information resources. In 1984, the National Library of Medicine (NLM) announced the IAIMS grant program which would provide support for three phases of development (planning, model development and testing, and full-scale implementation). Since that time over 30 awards have been made to 17 institutions. An interesting development is that some IAIMS groups have begun to collaborate across institutional boundaries. In 1989, an IAIMS consortium was established that currently has a dozen members who meet to discuss their experiences and to consider opportunities for sharing their expertise. The authors point out that the IAIMS concept is becoming a generic one, implying sophisticated integration of systems with great potential for improved access to biomedical information.

The second paper in this Section, *Prototyping an institutional IAIMS/UMLS information environment for an academic medical center* by Miller et al. [2], reports on an IAIMS/UMLS project at Yale University. The authors have designed a prototype integrated information environment to investigate the issues involved in taking full advantage of networked information services. Their NetMenu system has been implemented on a single Macintosh with links to local and remote information sources. The paper describes a scenario in which a system such as this might be used by a clinician to access a clinical decision-support system and from there branch out to a variety of other relevant databases. The paper illustrates that integrated information management is more than simply networking a group of computers. It involves, for example, determining which information sources are available and most relevant to the query at hand, and then connecting to and interacting with those sources. These information access and delivery issues continue to be addressed by the UMLS project which is more fully described in a review paper included in this volume [10].

The third paper in this Section, *IAIMS at Columbia-Presbyterian Medical Center: accomplishments and challenges* by Roderer and Clayton [3], describes the IAIMS implementation at their institution. Their network links 18 buildings at several separate locations with heterogeneous computing platforms. On an average day the system is used by over 1,000 individuals. The developers have recognized that a successful system is one that addresses the needs of its users, and from the start, applications have been developed that are designed to meet the needs of practicing clinicians. A good deal of attention has been paid to security issues and an inter-institutional team meets regularly to develop data security policies. In the authors' view the greatest success of the Columbia IAIMS system has been that it makes available information that otherwise would have been difficult if not impossible to access. The example they point to is the patient chart, which, when in electronic form, is available anywhere and at any time for effective and timely use by health care providers.

The fourth and fifth papers in this Section address the design of clinical information systems. Smith's paper, *Design of a clinical information system* [4], is a "How to do it" paper and describes the design and development of an information system at his institution. He argues for an approach that is simple, takes into account the existing functions of the clinical office, and involves users at early stages in the development. In contrast to Bleich and Slack [5], Smith [4] suggests that installing single-user systems is preferable, since they are lower cost, do not involve extensive set-up and maintenance, and ensure data security. Smith's paper [4] encourages physicians to take matters into their own hands and to develop practical, low-cost systems and to learn from others who have taken a similar approach. Bleich and Slack's paper, *Designing a hospital information system: A comparison of interfaced and integrated systems* [5], defines and distinguishes integrated and interfaced hospital information systems. Interfaced systems are by far the most common, according to the authors, and involve multiple databases each run by a separate department within the hospital. Data may be sent from one application to another, and an institution may require that a certain standard interface protocol be used by everyone. An integrated system, on the other hand, is one in which the entire organization uses a single database. Thus, when a change is made in the database, all applications are automatically updated with the new information. The major benefit of a truly integrated system, according to Bleich and Slack, is that it provides added functionality to the hospital system. Since all data are readily available at all times, they can be used for purposes other than those for which they were originally collected.

The Hasman et al. paper, *Inter-institutional information exchange in healthcare* [6], reports on an evaluation of electronic data interchange (EDI) in a project involving several hospitals, general practitioners, and pharmacies in The Netherlands. The standard that was chosen for the project was EDIFACT (Electronic Data Interchange for Administration, Commerce, and Transport). Standard EDI messages were prepared and sent across institutions within the electronic mail system. While the project has not yet yielded conclusive results on cost-benefit issues and positive impact on the delivery of health care, the authors did find that the largest gain was for the general practitioner. Use of the electronic medium over the traditional paper-based mail system meant that the practitioner received the communication more quickly and was able to store the information directly in his or her information system. The quality of the data stored in the information system should increase as well, since no data need to be re-entered. The project reported on here is scheduled to continue with an even greater number of participants in the future.

The last paper in this Section, *Information technologies in US medical schools* by Rootenberg [7], concerns the preparation of medical students for work in a world that makes increasing use of computers for a wide range of information management tasks. The author suggests that, since it is a virtual certainty that hospitals will soon be required by law to use electronic patient care systems, that it is critical that medical students be trained to use computers for the significant information management activities that they will be expected to undertake in their careers. The author interviewed faculty at 92 of the 126 U.S. medical schools to determine how computer technology is taught and used in those schools. He found that in the great majority of schools, the computer is used as an adjunct to lectures, but that very few even require computer literacy of their students. Most respondents were quite willing to discuss the long-term vision that their institution has concerning the use of computers in the curriculum, but at the same time it was clear that a number of obstacles would need to be overcome in order to make the use of computers a truly integral part of the curriculum.

It is clear that the practice of health care is becoming increasingly dependent on the effective use of computers. Interest and activity in the development of electronic patient records has been high for the past several years, as evidenced by the large number of publications in this area (see, for example [11-13]), by the overflow au-

diences at patient record sessions held at national and international conferences such as SCAMC and MEDINFO, and by the establishment of a Computer-based Patient Record Institute (CPRI) at the recommendation of the Institute of Medicine in the U.S. [14]. As Rootenberg points out in his article [7], the electronic patient record is destined to change dramatically the way health care is practiced. The increasing availability of patient and other health care related data in electronic form raises a host of issues, including standards for data exchange, security and quality of the data, design of applications that make use of the data in ways that will benefit the delivery of health care, and the management of and access to the information that is generated. The papers in this Section have all addressed one or more of these important issues.

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