Medical Applications of Computers in the Hospital

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The introduction of the computer into the hospital environment has been a slow and frequently unnoticed process. For many years, computers were used in hospitals mainly for financial activities that involved simple, repetitive, numerical procedures such as billing, bookkeeping, and payroll. Often, the only interaction between the computer and the physician occurred when the computer sent a patient an incorrect bill, and the patient complained directly to the physician. More recently, the computer has been used for administrative tasks such as hospital census and bed location. For these functions, at least in the early and middle 1970s, a large mainframe computer was usually the most economical approach to hospital data processing. These systems served the needs of hospital administration and finance and effectively allowed hospitals to survive in the increasingly complex world of medical care reimbursement. The tasks performed were limited and did not require complex interactions between different locations within the hospital. Even when other systems began to be implemented, such as the laboratory systems, the level of complexity was minimal, and the linkages between systems were few.

But times have changed. As the cost of computing and computers has fallen, the power of computers has increased, and many diverse types of computer equipment have proliferated. The tasks that these systems can perform are becoming equally diverse, as users with varied backgrounds gain access to computational resources. In some medical centers, the use of computers as clinical tools is now a common fact of medical practice. Computers are also being incorporated into instruments, such as CT scanners and other radiologic tools, patient monitoring devices, and electrocardiographic machines. As a result, physicians are able to accomplish tasks that could not even be envisioned a few years ago. Computers are now capable of transmitting medical information back and forth and evaluating medical problems.

In some areas, computers are becoming so integrated with medical practice that knowing how to use a computer, even knowing about the hardware or algorithms and understanding a computer program language, is almost mandatory for a medical professional to function within his or her department. In fields such as radiology or pathology, as well as in some clinical areas such as cardiology, computers are already significant to the physician’s daily routines.

While most physicians are aware of many of the applications of computers, most would also say that computers are not yet doing much in the hospital. Nevertheless, when one looks carefully at the hospital setting and closely examines industry trends, it is obvious that computers have a huge effect on the practice of medicine. Although most of the hospital investment in computers remains administrative and financial, major growth is shifting to the use of computers for the direct care of the patient.

With the large influx of different computer systems within Henry Ford Hospital, it is timely to review some of the tasks for which computers are being used clinically at our institution; hence, this issue of the Henry Ford Hospital Medical Journal. Our aim is to provide information about some of the projects under development as well as those in operation that depend on the computer for a major part of their existence.

Most of the articles in this issue center around the use of databases in research and the practice of clinical medicine; implementation ranges from the small Apple home computer to the large mainframe IBM computer. This range demonstrates, as noted by some of the authors, the diversity of implementations, the need for a computer communication system, and the need to understand the use of databases for the practice of medicine with a computer.

In their article entitled “A Microcomputer Database in a Clinical Environment,” Drs. Ownby and Burnett describe their use of a turnkey database system written for microcomputers. Compare this system to the large, custom-written database system used since the 1960s to maintain the Vascular Surgery Registry for Henry Ford Hospital, as reviewed in the paper by Dr. Elliott and colleagues. This system has grown from some of the earliest Hospital computers to the IBM 3031 system currently in use. While both of these groups take advantage of the computer’s capabilities for database management functions, one system uses a small microcomputer and the other a large mainframe computer.

When we move into the use of computers for the practice of clinical medicine rather than for registry-type information, two articles in this issue illustrate the diverse applications that are possible. Drs. Feczko, Ackerman, Halpert, and Simms in “Developing an Integrated Natural Language Database for Gastrointestinal Disease” discuss how they use their gastrointestinal management system (GIMS) for day-to-day case reporting, case inquiry, quality assurance, teaching, and research. Their application is also unusual because it crosses specialties, covering endoscopy, GI.
pathology, and colonoscopy in addition to GI radiology. In “Development of a Nephrology and Hypertension Information System,” Drs. Dumler and Levin describe their experience with both large and small computers to improve patient care in clinical nephrology. They have invested a considerable amount of time and money into a clinical system, and their insights into large and small systems should prove useful for others who are about to make a similar investment.

Databases are not the only application of computers. Drs. Hamid, Sabbah, and Stein in “Computer-assisted Methods for Design Optimization of Cardiac Bioprosthetic Valves” describe a method of computer modeling, while Drs. Adams and Brown carry computer modeling into the field of artificial intelligence, as discussed in “Automating the Expertise of the Neuropsychologist.”

For those who do not want to build their own system, Drs. Burke and Ackerman describe their experience in attempting to specify a second generation management information system for diagnostic radiology. Their article, “Cooperation Between a Radiology Computer Consortium and a Major Computer Manufacturer in the Development of a Radiology Information System,” gives the history of a group in the United States who have written their own radiology management systems, called the “Radiology Information Systems Consortium (RISC),” and describes their successful attempt to help a commercial company, Digital Equipment Corporation, achieve the above goal.

Because so many, diverse projects are underway, a common means of communicating data among the differing systems has become a major topic of discussion. A need for a comprehensive plan to link the various systems and a project to address that need became apparent several years ago. That project has started at Henry Ford Hospital through the introduction of a network, which is described in the article by Drs. Lund, Ackerman, and Martin entitled “Distributed Computing in a Hospital Environment.” The network is just the beginning of a technique to allow many types of databases and computers to share information. It represents to the computer what the phone system represents to the human.

The articles in this issue of the Henry Ford Hospital Medical Journal do not, by any means, exhaustively cover everything that is happening in the computing world at our Hospital, but they do selectively demonstrate some of the needs and applications of medical computing here. Before long, most medical centers throughout the country will turn increasingly to medical computing for quality care at reasonable cost. We are now entering the first door.

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