Health Information Systems and Use of Computers in Medical Decision Processes: State of the Art

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Introduction

Since the earliest applications of computers in the administrative offices of hospitals in the 1960s, substantial progress has been made. In these 30 years computerized systems have been progressively introduced in many health applications and today we are participating in a revolution in the way that we view their use, not only for clerical functions but also for helping physicians in taking medical decisions. Another aspect that will greatly affect health care is the increasing need of integration among the various disciplines of medical specialists and researchers. As it is happening in nearly every field of activity, this demand for integration will be satisfied by telecommunication networks, if a minimum set of medical standards are achieved.

Medical Informatics Environment

To identify the various current and future uses of information systems in the health field, a framework was proposed by the Commission of the European Communities in 1986–1987 within the program of Advanced Informatics for Medicine in Europe. This program groups all the information technologies, telecommunications, broadcasting, and allied services as: medical standard coding, medical workstations, networks, biomedical instrumentation, and artificial intelligence. Each of these is considered below.

Medical Standard Coding. Informatics and telematics can help to overcome distances and barriers only if a minimum of standardization is agreed upon by health workers. This is a prerequisite for sharing information in the health process and for improving speed and accuracy in the delivery of information, including mobile health facilities. Such standardization will permit, in addition, the integration of multivendor systems and the transportability of software programs. In the area of medical standard coding, studies are in progress to use semiautomatic programs, as part of an expert system, for encoding transparently from free text inputs (diagnosis and procedures).
Medical Workstations. The realization of medical workstations can dramatically enhance the quality of medical care. In recent years specialized workstations have been under development to satisfy the needs of doctors and nurses, in terms of working by themselves with their own databases or exchanging information with the outside world. The kind of data to be managed from the workstations are: texts, numeric results, graphics, signals, and images. Such a workstation integrates information retrieval, decision support, medical recording, and communication and interfaces all the information services, including managing data from portable patient databases (patient cards).

Networks. Generally speaking, it can be said that virtually all medical transactions are based on an exchange of information, and that the most important issue is the proper managing of databases. To do this it is crucial to communicate among a tremendous number of databases distributed at local, regional, national, and sometimes international levels. Models for distributed databases have been well accepted in informatics and telematics for almost 10 years, and further standardization and enhancement are still continuing. This approach is also needed in the software health application for local and for geographic networks and implementations.

Biomedical Instrumentation. There is no new biomedical instrumentation that does not include or imply an information technology aspect. This is particularly true in imaging systems, portable monitoring, laboratory equipment, signal processing, and robots. The detailed treatment of these subjects would go beyond the purpose of this paper, but we want to mention the importance of having networks able to transmit data, signals, and images at the same time.

Artificial Intelligence. The historical importance of pioneering work in artificial intelligence in the medical field has been generally acknowledged for more than 10 years. Among the first studies and implementations of expert systems, the following projects are to be mentioned: MYCIN (1973) for infection diagnosis and therapy, developed at Stanford (CA, USA) and CASNET/GLAUCOMA (1978) for diagnosis and therapy of glaucoma, developed at Rutgers (NY, USA). A survey made in 1986 by the MEDIS Institute in Munich showed that most of the systems represent prototypes being tested for further development. Only 12% of the systems surveyed were used practically in daily routine. The same study showed that the tasks of existing expert systems in medicine are mainly for diagnosis and therapy, used principally in medical research institutions and university hospitals. A remarkable approach to artificial intelligence applied to a full-size hospital information system has been implemented at Salt Lake City Hospital (UT, USA) under the name of Health Evaluation through Logical Processing (HELP). This is a comprehensive, integrated clinical information system developed over the past 15 years to acquire medical and administrative data and implement medical decision-making strategies. The system has an