Social and Legal Problems of Automation in Medicine

C. Vallbona

Follow this and additional works at: https://epublications.marquette.edu/lnq

Recommended Citation
Social and Legal Problems of Automation in Medicine

C. Vallbona, M.D.*
Houston, Texas

In 1961 in this journal I wrote on electronic automation in medicine, pointing out some of its moral implications. Now I should like to highlight what has been accomplished and demonstrated as practical in this field, and to review some of the social and legal problems related to it.

COMPUTERS IN CLINICAL MEDICINE

Since 1959 the computer's role in medicine has been investigated in:
1. medical diagnosis,
2. record keeping,
3. medical management,
4. laboratory analysis and functional testing,
5. patient monitoring,
6. hospital communication, and
7. utilization of hospital services and facilities.

Medical diagnosis by computer thus far is limited to specialized studies in hematology at Cornell University and in cardiology, especially in congenital heart diseases, at the University of Utah. In some instances the diagnostic acumen of the computer has been superior to that of experts in the specialty; but, in conditions characterized by complex and overlapping groups of signs and symptoms the computer has been less useful. As a matter of fact, in order for the computer to act as an expert diagnostician it needs to know the precise incidence of each symptom and sign in a specific disease and the prevalence and incidence of the specific disease in a given population. Nevertheless, because it can store enormous amounts of medical information which can be processed accurately and recalled rapidly and efficiently, the computer can be a useful diagnostic aid.

By and large, the automatic processing of medical records has been restricted to specific parts of the medical record; for example, the face sheet, lists of diagnoses, clinic visits, and so on. At the present time, only a few hospitals and institutions use the computer to produce the total medical record. The process of transforming all clinical data into numbers acceptable for computer processing is too difficult. New developments at New York University and Roswell Park Hospital have proved that computer processing of English textual information is possible.

The author's research in medical automation is sponsored under grant of NIH (FR-40963). The project is carried out at the General Clinical Research Center for Chronic Illness, supported by NIH grant (FR-102) and VRA grant (RT-4).

*Associate Professor, Departments of Pediatrics, Rehabilitation, and Physiology, Baylor University College of Medicine, Houston, Texas; and Program Director, General Clinical Research Center for Chronic Illness.

The use of computers to initiate treatment procedures automatically in order to correct promptly any changes in a patient's physiologic function. In progress and continued development is the use of computers to have it produce an interpretation of the significance of laboratory data. In this regard, our computer program processes pulmonary function studies, calculates the results, and makes a diagnostic interpretation. Some hospitals (Grace-New Haven Medical Center) use computers to make the simple, but repetitive, calculations necessary in arriving at the results of chemical laboratory tests. As soon as costs become more reasonable this activity will doubtlessly be expanded; and in large medical centers it is likely that centralization, computerized facilities will serve the laboratory needs of all hospitals in the center.

Meanwhile, there is increasing use of physiological instrumentation that monitors patients at the bedside, in diagnostic procedures, and in the operating room. Most systems now used reveal in oscilloscopes the electrocardiogram, respiratory movement, blood pressure, and so on. Some monitoring systems also numerically indicate the vital signs. Thus, it is obvious that connecting the monitor to a computer increases the analytic capabilities of the system. For the computer can give not only the values of the vital signs of a patient at any given time but, in recalling the previous values, show any changes, or trends of change, that would indicate to the physician the need for specific treatment, or change in the treatment program. It may in the future be possible for computers to initiate treatment procedures automatically in order to correct promptly any changes in a patient's physiologic function.

Indeed, it is easy to give a computer simple logical criteria and have it produce an interpretation of the significance of laboratory data. In this regard, the computer program processes pulmonary function studies, calculates the results, and makes a diagnostic interpretation. Some hospitals (Grace-New Haven Medical Center) have computers to make the simple, but repetitive, calculations necessary in arriving at the results of chemical laboratory tests. As soon as costs become more reasonable this activity will doubtlessly be expanded; and in large medical centers it is likely that centralization, computerized facilities will serve the laboratory needs of all hospitals in the center.

Meanwhile, there is increasing use of physiological instrumentation that monitors patients at the bedside, in diagnostic procedures, and in the operating room. Most systems now used reveal in oscilloscopes the electrocardiogram, respiratory movement, blood pressure, and so on. Some monitoring systems also numerically indicate the vital signs. Thus, it is obvious that connecting the monitor to a computer increases the analytic capabilities of the system. For the computer can give not only the values of the vital signs of a patient at any given time but, in recalling the previous values, show any changes, or trends of change, that would indicate to the physician the need for specific treatment, or change in the treatment program. It may in the future be possible for computers to initiate treatment procedures automatically in order to correct promptly any changes in a patient's physiologic function.

In progress and continued development is the use of computers to
expedite communications between the different and separate areas in large hospitals: administrative offices, patient wards, pharmacy, and central supply. Successful experiences at Massachusetts General Hospital and at Children's Hospital in Akron, Ohio, promise significant changes and improvements in many complex, inefficient systems currently used. Apart from utilizing data processing for keeping the accounts of patients' hospital charges, the same equipment is used to obtain information on admissions and releases, or the diagnostic characteristics of patients, and so on.

In addition to the foregoing, there is increasing use in clinical medicine and research of electronic instrumentation not of the computer type. Used to collect in electrical form a patient's medical history and research of electronic instrumentation of this kind is not possible between a patient and a computer. Therefore, in order to preserve this kind of relationship, and in order for the computer system in medicine to be significant and useful, it is only the physician but also the patient's role that is essential.

Were a computer to screen the health history of a patient for insurance coverage or job placement, certain individuals would perhaps be reluctant to reveal the aspect of their past that would jeopardize their securing a policy or a job. A similar problem exists now because the applicant is evaluated by a physician, other than his own, who can learn little of the patient's past and must rely on his examination and laboratory findings. Theoretically, the availability of an adequate and complete patient information system would eliminate such defects in a medical evaluation. Indeed, were all the salient facts of the past history of any person readily available in the nation, assuming previously that everybody procures periodic medical checkups, one would not need to seek a medical examination at a time when it might be emotionally contraindicated. But even were a computer allowed to process all the patient's available medical information and make pronouncements on his health, the patient-computer relationship need not be a hostile one. The computer would only act as an objective outside monitor of the state of health and not be regarded any differently from a weight scale, or an electrocardiograph. That this is the case is suggested by experiences at the Mayo Clinic with a computer program that develops a patient's personality profile based on data received directly by the computer from the patient.

It is likely that computers will be accepted by patients so long as the perspective is proper, namely the computer is an automatic agent used by physicians to broaden the scope of their quest and learning about the patient. But the physician will interpret the computer's data because his humaneness is essential in evaluating the numerous dimensions, as well as the wide variety, of the signs and symptoms of patients.

(b) Computer-patient's family relationship

Thus far our experiences in medical automation do not allow us to generalize; but we have not detected undue apprehension in any patient, or among a patient's family, who knows that computers are used in processing his clinical data. Obviously, when the computer produces "alarming" information based on suspicious data, a patient's family regards it uneasily. This is apt to happen when a malfunctioning bedside monitor indicates a change in a patient's vital signs. Infrequent incidents, however, do not warrant condemnation of a system that mainly provides increased assistance in managing an individual patient's course, especially when it is a life-threatening situation. Nevertheless, engineers of medical monitoring and computer systems must realize that a patient's family, indeed a corps of physicians and related personnel, has almost no patience for equipment failure. Therefore, it is essential for artifacts to be minimized and for adequate backup systems to be made available to prevent and dispel fear of failure.

(c) Computer-physician relationships

Since the introduction of computers to clinical medicine, apparently no physician has been very apprehensive that his own individual role would be replaced by a computer. However significant the job threat of automation in labor and industry, there is little chance it will affect adversely the medical profession. On the contrary, physicians analyzing the fundamental purpose of the computer regard it as a useful and valuable adjunct. But there are innumerable problems to be solved. One is the computer's inability to determine what data are clinically relevant. Another is the inadequacy of statistical and mathematical techniques to analyze most of the clinical data collected at the bedside. A third problem is that computer failures occur more often in the complex computer systems the kind that can be of greater usefulness to the physician. Solution of these problems requires the joint efforts of physicians, computer engineers, statisticians, and mathematicians. Only physicians can be responsible for providing the computer accurate clinical data and for developing ways that test the valid-
ity of the data entered. This will require increased study. But the physician is essential in order to evolve the maximum benefit of computers in medicine.

(d) Computer-hospital and computer-allied professional relationships

Not uncommonly the introduction of computers in hospitals is met with resistance, perhaps even animosity, among hospital personnel. In part, some professional persons regard the computer as a source of job displacement, similar to what has occurred in industry. Obviously any skepticism is increased, and a belief that automation has no place in a hospital is enhanced, when attempts to substitute automatic programs for existing communication systems are unsuccessful and when equipment failures are frequent. But the anxiety of job threat is unfounded. In addition, the ever-increasing complexity of medical care makes it essential that patient care be highly individualized in accordance with individual patient needs. Although it may some day be possible for a computer to be programmed to consider the needs of the patient, it is unlikely that it can also cope with all the human contingencies arising from a patient’s wishes, feelings, and so on. The fulfillment of the latter is extraordinarily important and can be met only with the understanding of human hospital personnel.

Thus, the use of computers in hospitals offers real possibilities in laboratory analyses, procuring and dispensing medicines, medical record keeping, bed allocation, personnel distribution, and so on. Indeed, plans for restructuring hospital facilities in the country are geared to providing centralized computer facilities that will fulfill these needs. The object is not to decrease current hospital expenses by substituting machines for human beings; it is to curb the spiraling costs of hospitalization by increasing the efficiency of patient service. As a matter of fact, the health field may provide increased challenges to personnel displaced from nonmedical jobs by automation; they need to provide increasingly complex medical services to patients while requiring the participation of innumerable professionals and clerical workers.

SHARING CONFIDENTIAL INFORMATION

At the present time, an increasing amount of patient medical information is being entered into punch cards, processed by computers, and preserved in computer files scattered throughout the country. As regional computer facilities in large medical centers are developed, and established the opportunity for the widespread sharing of medical information will become a reality. It is essential that safety measures be programmed into computers in order not to release any patient information to unauthorized personnel nor to release and use any confidential records without a patient’s specific permission. Such provisions can be made. Indeed, it is necessary because secrecy of private and personal information will even be more vulnerable when it is stored in a computerized network of communications. The right of privileged communications must be guaranteed.

But there are special advantages in a system that can facilitate providing and sharing nonpersonal medical data, e.g., diagnostic, laboratory values, and so on. The Professional Activities Study (PAS) of Michigan offers to hospitals throughout the nation a computer service that collects, stores, and processes all the medical information recorded on the face sheet of hospital medical records — thus statistical reports at a minimal cost. Information received from each hospital may be compared with that of the others. In this connection one study revealed that in one hospital the hemoglobin values of patients were consistently low. Furthermore, the incidence of blood transfusions in that hospital was much greater than in the other hospitals participating in the collaborative study. Detection of the discrepancy led to the discovery that the low blood values were due not to an endemic blood disorder but to a faulty laboratory technique in the hospital. Correction of the latter resulted in proper laboratory procedures and a significant decrease in the number of blood transfusions administered.

But relative to an individual patient’s data, who is the proprietor of the data? Is it the patient, or is it the physician who collected it, or the institution where the data was collected? These questions may not seem pertinent at present but they will be as significant as a computer shared national system is available. In addition to having a record in the hospital file, should a patient also not want his data kept in the kind of general file that would assure for his personal good its quick and easy availability when needed by physicians elsewhere? Or, can a hospital require that all its clinical data be entered in a national network of stored information to be shared with other hospitals and physicians? An investigator may claim special rights relative to the data that are part of his accumulative experience for a scientific report. Once data are entered in a large electronic file it would be possible without special preventive measures for investigators to scoop the data and write a report before the original investigator did. While acknowledging the potential risk of electronic snooping one should, of course, consider what the likelihood is that one investigator’s data would be used by another without consent and for exactly the same purpose. Use without permission would be an overt violation of an investigator’s privilege to participate in such a program. But an investigator, assuming some probability of this occurrence, could decide either to withhold his information from the shared system or to take the risk of being scooped. Fortunately, the computerized system would allow him to retrieve his investigational data quickly and to establish their significance. All this should be possible while respecting the patient’s rights and complying with the hospital requirements. The choice of not entering the data would be in defiance of the rights and regulations agreed upon by the patient and hospital and it would penalize him.
also by depriving him of an opportunity to test his original hypotheses quickly and comprehensively.

If large networks of shared information ever become a reality, the acceptance of a code of ethics relative to use of medical information will doubtlessly depend on specific criteria that can consider data as "confidential" or "classified." Furthermore, it is obvious that there will be need to build in safety provisions to prevent stored data from becoming available to unauthorized persons. Programming provisions such as these offer no difficulties. Reaching agreements on what constitutes these provisions, however, may be difficult and set up some major roadblocks.

LEGAL CONSIDERATIONS

As experience is gained in the use of computers in medical record keeping, it becomes essential to establish the legal validity of medical documents prepared by computers. It would be an ordeal to require that a physician sign each "hearsay." Therefore, their criteria no matter how authoritative, must be reviewed often and cannot be taken differentially than warnings in textbooks. A long held legal opinion is that textbook information is to be considered "hearsay."

LIFE OR DEATH DECISIONS

Although computer measurement of survival probability may be possible in the light of a patient's condition, innumerable years will pass before it will have the power tosuggest when a patient should die and when he should live. Indeed, would a computer ever have the kind of information to arrive at such a decision? It is even questionable how a computer's prognosis could alter a patient's management except perhaps in difficult logistic situations resulting from war or civil disaster. In ordinary circumstances, a physician's decision to marshall all available means to assist a critically ill patient should never be subordinated to a computer's pronouncements.

Any patient critically ill, or in a terminal state, has right to be considered in all his dimensions: the extent of physiological deterioration, treatment resources, expected survival, likelihood of permanent sequelae, his contribution to society, cost of treatment — but above all, his inalienable right to survive. In this regard, there is a growing controversy on the wisdom of affording life sustaining treatment to persons suffering from a hopeless terminal pathophysiological condition. Most situations are easily recognized — terminal cancer, a massive stroke in an elder person, and so on. But others are more difficult to assess and often impose tremendous dilemmas in management and treatment.

The continuous development of techniques for life sustainment and their successful application "against all odds" have permitted physicians to gain further insight into the attitudes of patients and their families confronted with a profoundly serious threat to life. In our experience in treating severely and permanently disabled persons, the patient and his family often have expressed in times of impending death, even after years of total disability and suffering, with very few exceptions, an unqualified desire to be spared no effort in trying to preserve their life. On the other hand a "realistic" and cold "objective" analysis of some cases would have resulted in stout evidence against the worthiness of therapeutic efforts. Yet, realistic and objective analyses are precluded at the moment of despair unless the sentiments and rights of all the persons involved are considered. Although a person's rights are immutable, his sentiments may fluctuate considerably. It is up to the physician finally to assess the sentiments as they had been, as they are, and as they will be after the crisis. Let us not live in utopia and think that these assessments can ever be done equally well by a computer.