

THE AUTOMATED PHYSICIAN'S ASSISTANT

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Some time ago, millions of Americans were transported through the medium of the CBS-TV Morning News to the office of a private physician in Salem, Mo. (population 4,363), to see the Automated Physician's Assistant (APA) in operation. Countless others learned of the program through numerous feature articles in newspapers and magazines. Descriptions even appeared in such diverse publications as "Parade" and a Japanese "Journal of Medical Engineering."

All of this public attention was capped off by the following words, which appeared in a White Paper issued by the Department of Health, Education and Welfare:

"Technological development also offers opportunities for improving the utilization of scarce manpower skills, while also serving other purposes, such as improving the quality of care and the distribution of services. To illustrate: In Salem, Missouri, under the auspices of a Regional Medical Program grant, a general practitioner's office is linked by computer to a university. Patients who come in for a physical participate in feeding information into the computer, through a process similar to self-instruction teaching machines, and nurses add information from tests they perform. A great deal of information is available to the physician by the time he sees the patient's computer-recorded file. Technology, the use of the patient as a participant in the process, and the use of nurses substituting for tasks previously performed by the physicians each can contribute to improving utilization. The Administration will continue to support efforts of this nature."

The Reason For APA

APA was a natural product of its environment. The Medical Center at the University of Missouri-Columbia was established and supported by the state legislature for the purpose of helping to bring modern services to the people of rural Missouri.

One of the concerns in Missouri, as well as other areas of the country, was the apparent maldistribution of physicians and their tendency to locate in areas adjacent to medical centers. The initial plan theorized that imaginative use of technology and communication could result in placing the resources of the medical center as close to the physician as his telephone, wherever he might be located. Consequently, an operational grant provided for development of a number of programs applying technology to medical problems.

These included computer-assisted methods for acquiring a patient's history, automation of diagnostic and laboratory procedures, and plans for storing relevant diagnostic and therapeutic information for rapid retrieval when needed by a physician in the management of his individual patients.

After approximately two years of development, it was decided to attempt the integration of several of the compatible projects into a single physician's office. A mock physician's office was constructed, equipment was installed, and what became popularly known as "Dr. Mock's Office" was put into operation. Here it was found that the elements could be brought together effectively, and the concept of exploring the acceptability of the system in the office of a practicing physician was encouraged.

Early in 1970, a few of the technologically oriented systems were moved to the office of Dr. Billy Jack Bass in Salem, Mo., a town located almost 150 miles from a major medical facility. Dr. Bass remodeled his office so that it would be possible to provide services to his patients using either the automated system or his usual model of providing services. It was at this point that the program became known as the Automated Physician's Assistant.

After almost two years of operation in Salem, the answers to three of the most common questions were clearly and effectively answered: (1) Technology does work in the office of an individual physician; (2) There was clear-cut acceptance of the technology by the patients, office staff, and physician; and (3) Technology was of value in initial screening of new patients, periodic health examinations, and fostering an increased number of measurements and an orderly collection of data.

The Components

The APA system was synthesized from a number of project activities that had been in various stages of development in the Missouri Regional Medical Program during what might be called Phase I of APA.

Keeping in mind the concept of APA as shown in Figure 1, the following constitutes a brief review of some of the major projects, their functioning and present status.

I. Automated Patient History Acquisition System (APHAS)

The APHAS program developed a computer-assisted system for helping patients record their own medical histories and providing a preliminary analysis of complaints prior to physician examination. This differed from some of the other automated approaches in that it made use of both audio to assist patients with reading problems and visuals for those with hearing problems. This program can be said to have advanced the state of the art.

II. Automated Diagnostic Procedures

A. Automated Electrocardiogram in a Rural Area—This project tested and revised the Public Health Service Program in a rural field network. Computer-assisted diagnosis of electrocardiograms is now commercially available and in routine use in approximately 25 hospitals.

B. Mass Screening Radiology—This system was developed to provide computer-assisted diagnosis, generation and storage of standardized radiology reports. Now called Missouri Automated Radiology Service (MARS), it has been adopted for use with a PDP-15 computer, using the MUMPS interpreter, and has received international attention. It is in daily use, is fully supported by the University of Missouri Medical Center, and has developed a patient file of more than 30,000.

C. Multiphasic Clinical Laboratory Testing—The SMA-12 autoanalyzer was used to discover indicators of

latent disease and to identify the most useful tests for those indicators. The project helped to introduce the use of automated blood analysis to essentially all rural areas of Missouri.

III. Computer-Assisted Aids to Differential Diagnosis

A. FACT (Fast Access to Current Text) Bank—This program was designed to supplement the physician's medical library and give him the opportunity to ask specific questions about specific problems and get quick answers. More than one million pages of scholarly and scientific articles from 528 medical journals were microfilmed and stored for fast automatic retrieval. This program had to be terminated short of interconnecting the display mechanism with a computerized depth index.

B. Expanded Consider—This computer program enables the user to key in what symptoms and signs are available and immediately access potential diagnosis. Primary data base is the AMA's Current Medical Terminology, amplified by a prototype data range of the AMA Drug Evaluation (1971). The program is in daily use at the University of Missouri Medical Center. It is particularly valuable as a teaching aid.

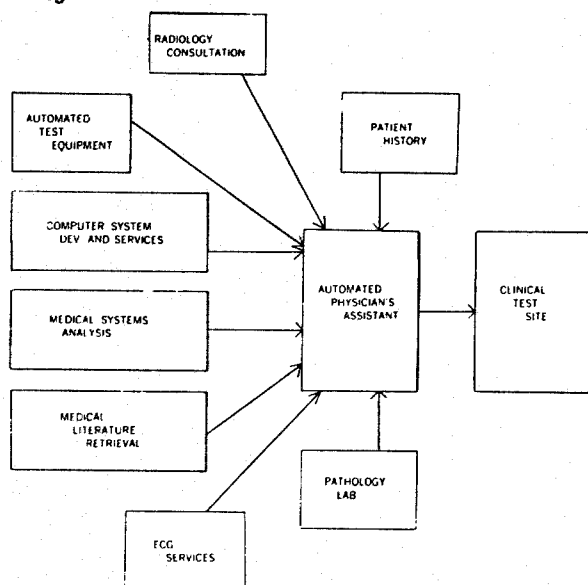


Fig. 1. The APA System

IV. Operational Programs

Supporting the development of all of these projects were three cooperative efforts of the university School of Engineering and the medical center.

A. Bioengineering—In a broad sense this term combines engineering and medical knowledge to design and test devices that aid physicians in diagnosis and treatment of patients. The success of this program has built a lasting bridge between the two disciplines and has influenced engineers to become involved in problems of medical technology.

B. Operations Research and Systems Design (ORSD)—This effort applies industrial engineering principles to solving problems and streamlining various health care patterns. Both bioengineering and ORSD are cooperating in present APA development. This has resulted in the development of a Ph.D. program in health care systems.

C. Data Evaluation, Computer Simulation and Systems (DECS)—This is concerned with the systems problems involved in incorporating the components into one program and developing an integrated patient file. It created extensive simulation computer models, thereby permitting evaluation

of data handling systems without incurring the expense of actual construction. It also demonstrated the need for specific definition of information components. This group is quite active in the program.

Current Status of APA

Despite the fact that the Missouri Regional Medical Program had to terminate its support of the program, the Automated Physician's Assistant is still very much alive and considerable progress has been made in Phase III under one of the authors and Dr. Jay H. Goldman, chairman of the Department of Industrial Engineering at the University of Missouri-Columbia. Support is being furnished through the National Center for Health Services Research and Development. Phase III is concerned with basic issues that must be resolved if technological components are indeed to become effective in real-world health care delivery systems.

The first year of this three-year phase was devoted to the attainment of three major objectives: (1) Development of a methodology for implementing the design of an ambulatory care system; (2) Development of a technique for pre- and post-evaluation of the effect of introducing a change in the component of a health care delivery system; and (3) The development of an integrated system of software services.

Three sites have been selected to participate. Two of these are offices of individual practitioners and, the third, a group of four family practitioners whose offices are located together. Baseline data have been collected at each of the sites, and hardware is now being installed.

The participants at each of the sites have indicated the existing programs in which they have an interest, and, initially, one program will be installed at each of the sites. Programs that seem to have the highest priority are patient education, billing, patient scheduling, a doctor's education package, and a patient history.

Thus, in Phase III, existing programs will be implemented in selected demonstration sites, and an assessment will be made of the impact of these computer aids on the delivery of primary health care.

It has been most satisfying to those at the Missouri Regional Medical Program, who played a prominent role in accelerating its development, to be able to report that the Automated Physician's Assistant is indeed functioning well. It is the belief and hope of those in the program that the present phase will lead to a time when the computer will indeed live up to its promise as a means of providing substantial aid to the physician as he cares for his patients.