Health information and planning systems: The need for consolidation

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INTRODUCTION

In a previous paper, an evaluation was made of the state-of-the-art at that time in the use of the computer in hospitals, and as with any state-of-the-art evaluation, it serves only as a static focal point along a somewhat dynamic continuum. Various problems of using the computer in hospitals (and in the wider framework of health care), as well as some of the then-current issues in hospital automation, were also discussed briefly.

In this paper, it is proposed to focus attention on these issues and problems, with a view to advancing some curative remedies for what seem to be continuing ills, as well as advancing some thoughts on the preventative aspects for future health automation ills.

Finally, the research for this and the previous paper was carried out during visits over the past four years to projects in four countries (U.S.A., Canada, Britain and Australia) and during a continuing project, of which the writer was Project Director, involving eight hospitals in South Saskatchewan, Canada.

The continuing issues/problems of medical automation

Introduction

The five problems that appear to be most prevalent in medical automation (because of their continuing nature more than any other factor), are as follows:

a. the current level of interest of medical personnel in automation, as affected by (b) and (c)
b. the nature of present medical education and by the success or otherwise of computer system analyst/programmer education,
c. the state-of-technology with respect to computer hardware and software for medicine,
d. the medico/legal problems of computerized medical records,
e. the problems of rationalizing research projects into the development of large scale, on-line, real-time computer systems in hospitals (at present) and in health regions in the future.

These problems are discussed now in some detail.

Current level of medical personnel interest

At first glance, this supposed problem does not appear to exist, since a majority of the more successful projects in medical automation are at present headed up by personnel with medical qualifications: Collen at Kaiser Permanente, Lindberg at University of Missouri, Caceres at the U.S. Medical Systems Development Laboratory, Vallbona at TIRR, Lamson at UCLA, and Barnett at MGH are names familiar to the reader.

The above mentioned projects meet some of the generally accepted criteria for judging successes in the area of medical automation, which criteria might be:

• that the system is actually working, not proposed for implementation.
• that the modus operandi and the results are generally accepted by other workers in the field and the user organization.
• that the modus operandi is standalone, not in parallel with a manual system.
• that as pioneer ventures, they serve as beacons for future projects in similar areas, particularly to emphasize that the most successful projects are those where the problem is "... reasonably delineated, heavily oriented towards simple technology and involves individuals who are primarily oriented towards technology"

The latter opinion of Barnett re the orientation primarily towards technology as a predictor of success.
in this area is very pertinent and does not necessarily preempt the "interest of medical personnel" as another necessary ingredient for success. Also, there are a large number of hospital projects aimed specifically at the business operations of the hospital that do not necessarily require full-time medical personnel support, the most impressive of which projects is probably Boston Children's Hospital Medical Centre.

With the foregoing sample of projects in medical automation that have been acclaimed by workers in and outside of the research area, the reader may well ask why the matter is even raised as a problem. As the literature on medical automation since 1964 indicates, there are at least 400 separate projects in progress as at 1969 in different parts of the world, and this number is growing, despite the number of projects that have not been successful. [Should the reader doubt the quoted figure, he is referred to a forthcoming book (Computers in Hospital and Health Systems) by the writer, in which book the bibliography lists over 400 separate projects]. With this number of on-going projects, the relative number of judged or potential successes does seem small. However, the most disturbing features of the large number of projects are:

- that they appear to duplicate work done earlier or similar work at present being undertaken by others.
- that only a very small proportion of the projects are operating without a parallel manual system, i.e., a majority of the projects are, at best, experimental models. It is claimed that the cause of this somewhat sporadic resistance by medical personnel to using the automated systems in the clinical laboratory (which is one of the more successful areas of automation endeavour in automatic data acquisition, storage and retrieval) is "... an array of unrelated instruments that can be more trouble than they are worth. If physicians are offered a good system ... you will find them quite willing to try it..." 19

A more significant cause of the non-implementation of project output is the small numbers of medical personnel who are actively involving themselves in the research studies in the various institutions being studied. Dr. Barnett has indicated some possible causes for this situation when he states that "... the application of computer technology offers hope, but the realization of this hope in the near future [this statement was made in October, 1967] will require a much greater commitment than is presently true on the part of N.I.H. [U. S. National Institute of Health], the medical academic community and the health services community. The critical weaknesses are: (1) lack of imaginative and competent personnel to constitute the task force, and (2) an artificial separation both in N.I.H. and in the academic community between medical practice and medical administration and between research, development, implementation and service..." 20 (emphasis supplied).

Some of the factors mentioned so far are not related specifically to medical education, such as level of N.I.H. funding in the United States of medical automation research and the general quality of computer hardware and software. Both these problem areas will be discussed further on.

At this point, it is relevant to dwell on medical education as it affects the present and future development of computerized health information systems. In late 1967, Dickson noted that "... it is evident that basic knowledge in the area of physiological systems is not deep enough, nor broad enough to set up patient monitoring systems or intensive care units that will have the desired sophistication..." 21 Notwithstanding that this comment is directed towards the state-of-knowledge in a specific area of biomedical endeavor, a similar state of knowledge of medical automation and its problems exists generally in the medical profession. Since computer science is of only recent origin by comparison with medicine, it is safe to assume that a majority of the medical profession have never been required to take a formal course in the elements of medical automation, let alone the specifics of the subject.

The extent of possible remedies might be summarized briefly at this point:

1. It would seem that the computer education of the coming medical profession must commence at the undergraduate level as a required course. The progress being made by the University of Missouri, the University of Oklahoma, Baylor College of Medicine and the University of California at Los Angeles should serve as guidelines in this respect.
2. It would seem that continued efforts by professional bodies such as A.M.A. and A.H.A., through continuing short courses for medical personnel who have graduated, should be supported by government and other funds to enable a large number of courses to be given.
3. It would seem that universities might aid hospitals in their geographical area to commence in-house training within hospitals, regardless of whether the hospitals are training hospitals attached to the universities or not.
4. It would seem that the desirability of bringing together various disciplines to discuss modes of
attack on various problems of medical automation has been proved by conferences such as the international conference held in Washington in September, 1967, by various national conferences such as the New York Academy of Sciences effort in January, 1968 and by a restricted number of conferences (such as FJCC and SJCC) where computer personnel attempt to resolve the continuing hardware/software problems that are discussed further on.

Summary: It is contended that the present level of interest of medical personnel in the automation of the medical environment is dangerously low. It is suggested that, as one of the factors that appear to correlate strongly with ultimate project success is medical personnel leadership, the medical profession should recognize the challenge of automation and upgrade medical education accordingly, a factor discussed in the next section.

Contemporary medical education and systems education

The second problem considered relevant to the present discernible plateau in medical automation research is the current lack of emphasis on the role of automation in the medical curriculum (but not the professional MPH or MHA curriculum), coupled with the general level of application system design expertise currently available. We shall discuss the two problems separately.

Medical education

The general lack of emphasis on the role of the computer in the medical curriculum suggests that the planners of such a curriculum have not yet fully realized that the computer will and is playing an important role in medical care. With a few notable exceptions [University of Missouri, University of Oklahoma, Baylor College of Medicine (Texas) and the University of California at Los Angeles], universities have not adapted to the challenge of the computer in medicine, the general exceptions being those universities involved directly with research either through research units within colleges of medicine or those colleges with affiliations with large health science centres.

With the consequent shortage of medical personnel with computer interests from their academic preparation, and with the present overcrowded syllabus in medical schools all over the globe, little relief can be seen for the present lack of medical personnel interest in automation, except indirectly through that small proportion of the medical profession who are biomedical research workers. One possible solution would seem to lie in the funding of several large medical academic operations, such as those listed above, in the hope that (a) the person with a particular interest in medical automation might be drawn to these centres; (b) the centres might be encouraged to publish even more widely the results of their work.

Another solution would appear to be the limited proliferation of reputable journals such as Computers and Biomedical Research (Academic Press) and Methods of Information in Medicine as media which attempt to span the medical and computer technology gap.

As the foregoing suggests, the reporting of on-going projects has been something less than objective or adequate, and through access to accurate project reports and articles in medical journals, the medical profession may be gently coerced into reading into subject matter which, at present, confuses rather than enlightens.

Systems education

Without considerably extending the length of this paper by paraphrasing the contents of the two recent papers, it is contended that the dangerously low availability of expertise in the systems analysis and design of the hospital business or medical processes will present a serious, continuing hazard to the well-meaning hospital with intentions to automate. The medical/administrative interface of the modern hospital is difficult enough to bridge with adequate knowledge of both domains, but the current systems personnel shortage is forcing hospitals to accept people with little or no knowledge of those domains. There is nothing like a badly designed system to destroy confidence in any sector of industry, but the ever-vigilant opponents of automation in hospitals are particularly effective in their destruction of the reputations of hospital projects that are not meeting objectives.

Thus, there are two basic problems posed here:

- the availability of application systems designers generally
- the lack of relevant systems career preparations at the universities in particular, notwithstanding the excellence and relevance of degree programs in Information Systems at the University of Pennsylvania (MBA Information Systems Option), New York University School of Commerce (Computer Science major) and the University of Maryland Department of Systems Management. As has been indicated, the available media for preparing the systems designers of the future are generally turning out a by-product not adequately prepared for
systems analysis/design in any sector, particularly the health sector.

The possible solutions to the education problem posed have been suggested, and generally it appears that a massive up-grading of systems education at all levels is required. For the conference at which this paper is presented, this is a sobering thought that might be considered at this point.

Hospital administration education

It might be mentioned that the discussion thus far has not referred to the current trends in education for MPH and MHA programs in U.S. and Canadian universities, since it would seem that the professional MPH and MPA programs appear to have recognized the role of the computer in medicine, and no problem is seen to exist.

Summary: It would seem that the current state of medical and systems education does not reflect the need to impart more relevant education to medical personnel and to the systems analyst/designer attempting to match medical needs to existing computer hardware/software technology. This latter aspect is discussed now.

Computer hardware/software technology

At the present moment, the problems posed by the lack of, firstly, suitable input devices; secondly, by large low-cost bulk storage devices and, thirdly, by computer system reliability and cost are as serious as any of the other problems posed so far.

The input problem is causing other problems related to medical/ward personnel satisfaction with hospital information systems to date. It has long been recognized that what the computer industry needs is a reliable, low-cost, graphic display/keyboard terminal, and in the hospital, the requirements of such terminals have been summarized by Hofmann et al.

Another paper by Barnett and Greenes has summarized some of the relevant problems in achieving a working man-machine interface in computerized hospital system, as well as summarizing the 1968 state-of-input/output terminal technology. Essentially, the development of suitable terminal equipment is seen as being 4-5 years down a rather long road.

The availability of generalized software for the hospital information system has not led to a marked trend towards its implementation by the growing number of hospitals involved in the on-line, real-time mode of operation through time sharing. As other workers in other industries have found, generalized software is not easily modified for the particular requirements of those industries.

The gloomy picture of hardware and software inadequacies does not, of course, apply to all areas of hospital automation. In the clinical laboratory, the automation success stories far outweigh the failures for reasons that have much to do with Barnett's evaluation quoted earlier. Essentially, successful laboratory automation projects have been marked by:

- restricted and relatively simple goals
- hardware that is relatively simple and not subject to technological failure
- an adequate feasibility study prior to selection of hardware and development of software systems, such a study being fully documented and its proposals accepted by all the parties concerned.

On the question of the need for a computer language that would enable physicians to use natural language input for data storage and retrieval, the computer manufacturers have not yet indicated any formal interest in developing such a language. In the interests of consuming main core and processing time, it would seem that the current version of the JOSS language in use by the MGH investigators is certainly superior to most high level languages in use in other projects. Because the question of medical personnel leading the development of medical information systems would seem to be a preoccupation to this point, one might hope to see far more flexible languages than FORTRAN, PL/1 or COBOL soon becoming available to aid physician/investigators in developing better systems. Realistically, this development might be expected around 4-5 years up that long road being travelled by the computer terminal developers.

As at 1969, the ball has been long enough at the manufacturer's feet for some results to start appearing. It is perhaps time for Government to adequately fund a private development, given guidelines by workers in the field, perhaps through NIH or through SIGBIO.

Summary: The computer manufacturers have not adapted to the challenge of developing usable hardware and software for other than limited applications of which the laboratory is one. It could be expected that their comparative successes in this area might spur them on to the more pressing problems of hardware and software for the wider concept of the hospital information system in the various areas of patient care, allowing that the patient accounting area has been successfully automated in a number of on-going projects.
Medico-legal problems of the automated medical record

With considerable research effort being expended in the search for an acceptable computerized medical record suitable for medical research and for day-to-day operation of a hospital, there has been very little consideration of the legal aspects of such a record. However, because the public is now more willing to commence litigation against hospitals and practitioners who are negligent or who give the slightest cause to suspect negligence, it is with considerable interest that many hospital administrators watch:

- the rulings of Courts on the legality or otherwise of computerized medical records.
- the actions that hospitals take to maintain the security of medical records in an on-line, real-time environment.

In the first place, hospital records, generally speaking, constitute a source from which information may be obtained, but they are rarely evidence in themselves. At present, the legal process depends in most cases, and certainly in cases heard before juries, on oral testimony. Although there are many classes of documents which, once they have been identified, are admissible as evidence, this principle generally does not apply to records such as hospital records, which are really no more than notes made contemporaneously of matters observed at the time by various persons in the hospital.

Again, there have been many occasions when a doctor or a nurse, when his attention is directed to other parts of his own notes, is forced to admit that his original opinion, expressed in the witness box or in another section of his notes, is wrong. Because it is not possible to cross-examine a document, oral evidence still remains relevant and necessary.15

Again, questions as to signatures on and documentation of records, their maintenance and retention, accuracy of the recorded material (clearly the wrong diagnosis applied to a patient leading to wrong treatment, as perhaps might occur if extensive coding is required of the user, could give rise to a suit for damages), and the confidential nature of records have been discussed by Springer.16

Of particular interest is the protection of security of medical records in a time-shared system environment. The system has to ensure that the system prevents the wrong person from gaining access and that it does not prevent the right person from gaining access. A recent paper by Segall17 is of considerable relevance here.

At this date, there is at least one ruling by an Indiana court on the admissibility of computerized evidence.18

In view of the relevance of such a ruling on the doctrine res ipsa loquitur (which allows a plaintiff to put the burden of proving non-negligence on the defendant), it is repeated here. "As complicated mechanical devices of our modern age achieve perfection, and greater reliance upon them is justified, it follows that the doctrine (res ipsa loquitur) has a broader application ..." (Ball Memorial Hospital vs. Freeman 196 N.E. 274 [Supreme Court, Indiana, 1964]).

Summary: It may be fortuitous that rapid advances in the development of the hospital information system concept have not proceeded rapidly, since a litigation-conscious population might have been well served by a computer system that periodically had hardware and/or software malfunctions. Since other industries using computers have had their share of system malfunctions leading to destruction of operating records or to the production of spurious cheques, it could be expected that hospitals will also have their share of automation woes.

The human life is one expensive commodity that far outweighs an operating record or a spurious cheque, and in the absence of any known court rulings on the admissibility of the computerized medical record, hospital administrators must seek wise counsel before implementing computer systems that have control of living processes, such as in patient monitoring or in the treatment of patients with severe drug allergies.

The reliability of the available hardware/software does not, at present, justify blind faith.

Problems of hospital automation rationalization

As one peruses the literature on research projects that are at present under development, it becomes apparent that many researchers are working in fields that are remarkably similar to those being researched by other workers. It would seem that the health authorities at federal level, by funding small and large projects, have created a situation where the small projects are useful only as demonstration projects, while the larger projects do not seem to be proceeding within the constraints of an overall plan of research for the nation.

The reason for this situation is that there is no overall plan for Hospital/Health Information System development, such as partly exists for Law Enforcement (NCIC System in U.S.A.) or for Education, because:

1. of difficulties in deciding what criteria should be used to assess the merits of alternative projects recommended for funding;
2. the attempts to develop the concept of the advanced “total” information system beyond the concept stage have failed badly to date, since, after many years of seeing project after project, cut back development to something far less grandiose than the “total” concept presupposes, the medical profession, the funding bodies and workers in the field have not yet seen an economical, workable system. The reasons for this continuing situation have been elaborated on elsewhere by Barnett and Greenes, and will not be discussed here.

The most obvious result of this apparent setback is that hospital planners are now attempting, with considerable success, to develop automated systems for smaller functional areas of the hospital, and, at the same time, attempting to relate such development to the “total” information system framework, which has not been adequately documented since Dr. Fred Moore’s pioneer work in 1962. When one considers that the Lockheed company planned for at least four years before the first computer program was written for its production planning and control system, and only then commenced a five-year, five-stage development plan for 1965-69, it seems that our first efforts in large scale medical automation were defying precedent.

Notwithstanding the growing number of middle-sized and large hospitals which are now completely dependent upon computers for parts of their day-to-day operation, it should now be possible to conceive of a standard system design for a certain total bed capacity of a hospital or a group of hospitals, based on the past success stories in certain areas of hospital operation. The USNIH grant\(^1\) to Lockheed to investigate the design of two separate information systems, one mechanical, the other computerized, was ostensibly aimed at rationalizing some of the on-going project development in hospital automation.

The basic requirement of such standardized systems is transferability, and, in this respect, the present non-standard mode of operation of hospitals across the world, their autonomy in many countries and the need to ensure that any standardization does not give any one manufacturer an advantage over his competitors, may all complicate the path to standardization. In the interests of efficiency and economy, it is doubtful whether such standardization can be validly deferred much longer. For one possible benefit that might be reaped by such a move, consider the decision that computer manufacturers might be forced to make with respect to the resources allocated to medical hardware/software development if they were faced with the formidable strength of large groups of hospitals demanding useable hardware/software according to specifications of a government sponsor. One has only to consider that the lack of a united front from CAI researchers has led to a slowing down of CAI hardware development by at least two of the manufacturers, who quite rightly demand that users tell them specifically what they want in hardware.

Summary: The need to rationalize system development in hospital automation has been realized by a number of researchers in the field, and government health authorities have made some tentative moves towards standardization.

It is suggested that the general lack of manufacturer zeal in developing workable, reliable hardware and software for the medical care operations of a hospital might be overcome by a united front from research groups in the field, supported by government directive.

Rationalization for health information systems

Introduction

In the above section, we discussed some of the problems that hospital automation is causing as at 1969. In this section, we discuss the concept of the Health Information System for a community, or for a state (or province) or for a nation. Lest this whole treatise fall apart on the basis of one definition, we define a Health Information System to be a set of procedures and processes aimed collectively at supplying health authority management at various decision making levels with information that is required by those managers to function effectively. Included in the procedures and processes might be combinations of manual and/or electro-mechanical and/or electronic data processing equipment. Depicted in its broadest sense, the schematic in Figure 1 attempts to represent information flow, in one concept of such a system, through community, state (provincial) and national decision making levels. [Figure 1 does not attempt to show all the relevant health care support units that should or could use such an information system at various levels.] Other broad concepts of what constitutes the health information system have been outlined by Bartscht and by Flagle. Since there have been very few attempts to assess inputs, outputs and mechanisms by which such a system might be planned, it is probably relevant to briefly outline some of the present on-going research that is producing information on the health of an individual, albeit in an uncoordinated fashion with respect to other research groups. These research projects outlined are not exhaustive, but representative of attempts to derive meaningful data that could serve as
input in a manner similar to that depicted in Figure 1, to large epidemiological studies of health communities.

The projects referred to are:

(i) the Kaiser Permanente Multiphasic Test Screening System at Oakland, California.
(ii) the Medical System Development Laboratory of the National Centre for Chronic Disease Control of the U.S. Public Health Service system for EKG recording and analysis.
(iii) the on-going record linkage studies in England, Maryland and New York in various health populations.
(iv) the Medical Audit Program and Professional Activity Study (PAS/MAP) of the CPHA.

The Kaiser Permanente multiphasic test screening system

At Kaiser Permanente Medical Centre in Oakland, California, a major research effort in the use of multiphasic test screening for preventative health care has been in progress since 1964. (For a detailed treatment of the form of testing and an assessment of the impact that such multiphasic test screening centres could have on health care, the reader is referred to published papers on the Kaiser Study.23,24 At this moment, there is no other Medical Centre in North America that possesses the test screening facilities and the requisite data processing facilities employed by the Kaiser group, although the proceedings of the 1968 Conference/Workshop on Regional Medical Programs suggests that Tennessee, Missouri, Indiana and Connecticut will soon achieve working systems in various areas of those states. [The matter of whether the optimum mix of tests is in use at Kaiser or whether all the tests given are required will only be answered by a research effort lasting several years, and will not be discussed further here.] As the 1966 Senate hearings23 and the above mentioned conference/workshop24 reveal, several other entities in the U.S.A. are moving in the same direction as Kaiser, a situation that, at some time in the future, will require a linking of information flowing from test screening of large populations in different areas of the U.S.A. Despite the reservations of some physicians who see test screening with automated follow-ups as an encroachment on their professional sanctum sanctorum, there is sufficient reason to expect that only inadequate funding of such efforts, and perhaps a lack of improvement in computer speed and core storage, at reduced cost could halt any impetus arising from Kaiser's development at Oakland.

The Medical Systems Development Laboratory

The Medical Systems Development Laboratory has developed a computer system to measure values of heart rate, amplitudes and durations for wave-forms of the standard 12-lead ECG and to make an English-language translation of these measurements. During the past four years, over 75,000 ECG's have been processed, and it has been shown that, with limited direction from medical personnel, the system is useful in the detection, management and rehabilitation of persons with cardiovascular and associated diseases. Furthermore, the system decreases observer error and variation, reduces ECG costs and conserves scarce physician time for direction patient care.4

More significantly, a plan for a nationwide data pool of computer processed ECG's has been put into effect, with 35 investigative groups participating during the first year, with a combined annual output of 70,000 ECG's and an anticipated 200,000 in the second year. Also, it has been shown that it is feasible to process ECG's and spiromgrams from remote sites using conventional telephone circuits in an on-line, real-time mode, and also that outpatient care and emergency room services are possible.
As research into heart disease is a major concern at this moment, it is not difficult to imagine the effect of a nationwide data pool of information in a research effort; nor is it difficult to tie the impact of such research into the type of multiphasic screening approach in operation at Kaiser and other centres. The whole concept of preventative health care assumes new proportions, particularly if each health region, chosen by criteria as yet not universally agreed on, was financially capable of supporting the screening and data processing facilities required. The Tennessee Mid-South proposals for such a system are indicative of trends in this direction.26

Medical record linkage study

In various areas of the world, particularly in the U.S.A. and England, research into various aspects of comprehensive patient care as revealed by record linkage is proceeding, with the Oxford (England) studies27 and the Maryland Psychiatric Case Register studies,28 probably the best documented. Compared to the two previous research endeavours, this research is typically centered on a smaller population. The fundamental problem experienced in the Italian studies,29 the lack of data in a suitable format or the lack of data at all, has been met in all studies to date, and it is not difficult to postulate that the existence of data at municipal, regional and state level must precede any substantial research findings at a national level. The recent proposal of a research effort by the MRC in England30 is fundamentally the first step in the right direction.

The PAS/MAP system

At a national level, a research effort enabling a medical audit of over 1240 hospitals annually discharging nearly 10 million patients across the U.S.A. (and other parts of the world) has been in progress for some years through the facilities of the Commission on Professional and Hospital Activities, which is an educational and scientific organization sponsored by the American College of Physicians, the American College of Surgeons, the American Hospital Association and the Southwestern Michigan Hospital Association.

Inherent in this system of medical audit (called the PAS/MAP system) are two basic criteria:

- the establishment of a standard relevant to the different treatments being given in hospitals
- accurate reporting of the actual treatment given to the patient during his stay.

Since the participating hospitals, in reporting their monthly statistics to the central computer facility in Michigan, are forced to code their treatments into a fixed format reporting sheet, some measure of standardization is present, but it would be unrealistic to think that all relevant information on a patient treatment can be included on any fixed format coding sheet. For this reason, while the PAS/MAP is a first step towards a nationwide pool of information (since 1240 hospitals is not the full complement of hospitals in U.S.A.), there appears to be a real need to incorporate systems such as PAS/MAP (or the Pittsburgh HUP system) within a national plan of health care funded by the national government, and with all health care units, down to the smallest nursing home or hospital, participating. The possibilities for the rational disposition of the nation's funds for new or improved health facilities in the smallest region, as distinct from the ad hoc methods in vogue in most nations of the world, are apparent here, as are the possibilities of comparison of cost and effectiveness of patient care in different regions. The development of realistic simulation models of health care for the nation looms as a possible output (given sufficient research into the validity and extent of the input parameters of the health care process), enabling long term planning of expensive health care facilities to be undertaken. Some results reported by Centner et al.3 and by Ryan and Dillard32 are significant steps in a move towards the Total Health System Model, as is the steady progress being made in econometric modelling of the health sector by Feldstein,33 Yett and Mann34 and others.

Problems of health information system research rationalization

Introduction

As Elam has noted, "... our problem [in America] is not that we lack technology; we have enough to frighten us all. It is not that we lack a concept of comprehensive health care or that there have not been isolated attempts to practice it. What we do not have is a marriage of technology and comprehensive personal health care, and an assessment of the results (emphasis supplied). ..."36

As has been suggested earlier, the success of Collen's work at Kaiser Permanente (and Jungner's work in Sweden) has led to proposals for similar systems in regional medical programs now developing as a result of Public Law 89-239. One of the most significant of these programs is the Tennessee Mid-South Regional Medical Program described by Elam,36 where researchers are attempting to determine whether comprehensive, family-oriented health care in a neighbor-
hood health centre coordinated with an automated multiphasic screening laboratory will result in improved mortality, morbidity, health service utilization and health attitudes amongst a population. The determination of whether such a program reduces the cost of medical care and, at the same time, whether it improves and restores the family unit, is also proposed.

There are many other on-going developments across the U.S.A. for similar studies to implement the aims of Public Law 89-239. Since these proposals involve the use of health care facilities including hospitals, what are the likely problem areas that might forestall the achievements expected for comprehensive health care using automated health information systems?

The problem areas

The major problem areas are those already discussed in the paper to this point, and essentially they are related to resources—manpower, money, machinery—and to the method of attack.

Manpower—As has been suggested, manpower problems will possibly appear in varying proportions of:

- medical personnel with little or no knowledge of automation, even at such a level as would render the automation of screening programs more meaningful to them.
- systems analyst/programmers with little or no knowledge of medical systems.

If we cannot solve the manpower problems that exist in current isolated hospital projects, there would seem to be little chance of adequately staffing regional developments of health information systems, particularly if all systems require staffing of the order suggested below.

Costs—The financial crunch that has hit all sectors of the economy will worsen the funding situation for medical research programs such as envisioned by Tennessee, Connecticut and other forward-looking states. It is worthwhile recording the actual level of cost of automation in hospitals that have grouped together by studying the Indianapolis Hospital Association report on estimated expenditures, and attempt to relate N repetitions of such a cost to a nationwide hookup of health care systems.

For a computer system capable of supporting thirteen area hospitals (6000 beds plus) and five health agencies, the proposal estimated that

- 79 people would be required in the period 1968-71 to administrate, analyze, design, program and operate the system;
- the system, if commenced in 1966, would cost $9.4 million by the time all aspects of the system were operating in 1971, at which time the operating cost would be $2.4 million per annum.

It is emphasized that the Indianapolis studies are just one of a number of shared hospital computer studies ongoing at this moment in the U.S.A. Assuming that such hardware and people support is capable of performing the data processing tasks of an automated (in the equipment sense) multiphasic test screening laboratory for a region containing hospitals and health agencies, the cost of renting automatic, multichannel analyzers plus the cost of reagents is estimated at being in excess of $0.20 per test, without allowance for labor, space and allied costs.

Hardware—As has been indicated earlier, the hardware required for collecting and processing multiphasic test screening data is already in use at Oakland, but when many hospitals are linked together in remote access to a central facility, the size, speed and cost of direct access storage, plus the input terminal problem posed earlier, would still be present.

Thus, certain elements of a comprehensive health care program can already be automated, while others will depend very much on manufacturer motivation before worthwhile results will appear.

In essence, it would appear that existing systems staffing shortages, coupled with the current limited level of computer expertise in the medical profession and the need to pressure manufacturers to provide reliable working hardware for a large-scale remote access, time shared hospital operation, should lead to the consolidation of all that is good in on-going hospital automation projects into one or two projects supporting a comprehensive health care system.

This consolidation of expertise, funding and pressure on manufacturers by the federal government and by groups such as SIGBIO, would result in the one or two projects being adequately funded and supported with staff and equipment commensurate with the system needs. It would not necessarily mean the future cut-back of funds on all on-going projects, but would probably mean that the rate of increase of new projects might decrease.

At this moment, it is doubtful if subsequent evaluation of the efficiency of such consideration would not indicate

- better use of the available human resources (systems and medical)
- a favourable benefit/cost ratio compared to a proliferation of smaller projects
- that manufacturers reacted appropriately to pressure to design equipment for such systems.
CONCLUSION

Some of the more significant problems and issues in medical automation have been discussed, and related to each other.

It is suggested that current human resource shortages, together with the costs of and working efficiency of large-scale computer hardware facilities, should lead to a consolidation or rationalization of on-going research into medical automation.

The effects of automation within a comprehensive health care system might really be felt if such rationalization led to more efficient use of all resources, financial and others.

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