MEDICAL RECORDS THAT GUIDE AND TEACH
(Concluded)

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IMPLEMENTATION OF MORE COMPREHENSIVE CARE THROUGH THE MEDICAL RECORD AND THE COMPUTER

The organization of the record described above forms a framework that easily accommodates psychiatric, social and demographic problems. Usually these are not documented and followed in an organized manner.

Psychiatric Problems

In the practice of medicine for many physicians, nonorganic problems have been neither challenging nor interesting. Because of this they have never been listed – even though they easily could have been – with the physician using clear descriptive formulations such as "cries easily" or "family difficulties" if he could not use sophisticated psychiatric jargon. Until all psychiatric problems are consistent objects of the physician's attention and are numbered and titled as such, it will not be possible for him to watch them evolve and thereby learn systematically from his own experience. Furthermore, by ignoring them he has never developed an appreciation for patterns of emotional disturbances, his attitude toward modern technics of analysis becoming at best one of anxiety and perplexity and at worst one of disinterest, ignorance and uninformed rejection.

The computer is making a major contribution in this area. The vast amount of research on the Minnesota Multiphasic Personality Inventory (MMPI) and the computerization of the analyses of the MMPI have made it much more likely, where it is employed, that the patient will gain from his physician an immediate sympathetic understanding of the forces with which he or she is struggling, and much inadvertent neglect and inadequate analyses by the medical profession can be avoided. There are many physicians who reject the help of modern technics on the basis that Osler for three hours followed by Freud for three hours could have done better. Even if this were true, modem technics are not competing in that league, but rather they are competing with hasty "off-the-cuff' five-minute analyses by untrained, impatient physicians who live from case to case and who have no systematic means of learning and improving from a highly organized and recorded data base which is kept up to date.

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Demographic Problems

Physicians have for years been preoccupied with episodic illness, with problems only when they efupt into symptoms and only with patients who can get themselves to the doctor. At present it is almost impossible to obtain the history of illness from its earliest stages on a sample of the population, or even on an individual. And except for a few pioneers such as Robbins and Hall,' most of us do not even think of demographic problems, let alone record, understand and deal with them. As they point out, for a 40-year-old woman whose problem list contains only a fractured arm, we have completely neglected the fact that it may be of major medical significance to her that she is 40 and female and over the next ten years her greatest medical risk is cancer of the breast, and for her a yearly breast examination is the most important part of her care. We are so accustomed to dealing with disease only in the individual and only after it becomes explicit, symptomatic or terminal, that we think people are talking about another field when they discuss health hazards from automobiles, smoking, alcohol, diets, smog, family problems, hereditary factors or mental stress – or just being fat or 40 – male or female.

The problem list of the medical record should include demographic problems as well as all others. This will lead to very specific action appropriately timed for preventive procedures and will continually remind us of exactly where in health care our total obligations lie.

Paramedical personnel, such as public-health workers; social workers, psychologists and chemists, are already doing a major portion of the work in this area by collecting data that make it possible to define all sorts of social and demographic problems. Physicians must assume the leadership in providing each patient with a total list of problems, irrespective of who in the medical hierarchy provided the data, and in seeing that therapeutic action reflects some perspective on the total needs of the patient.

When large amounts of demographic data are developed, by means of the computer, a system could be developed whereby input of certain vital statistics on any patient would automatically result in an immediate print-out of his main demographic problems along with the current approaches to their management.

Those who provide total care or who are trying to

PROBLEM LIST

ACTIVE PROBLEMS	RESOLVED PROBLEMS
#1 Accelerated hypertension Retinopathy Renal Disease	
#2 Hypokalcmia – eliology 10 be determined	
63 Vomiting – dehydration (CVP – 0. Hct 40)	
X4 Diarrhea – unknown etiology	
#5 Anemia, 2' 10 renal disease (Problem # 1) (Hct normally 30)	
16	Remote peptic ulcer disease
x7	Cholecystectomy'
#8 Exogenous obesity	
X9 (L) Breast mass ,	
#IO	Hx of chronic alcoholism
XII	Hx of GC rxed
#I2	Personality disorder
# 1 3 Decreased vision (RI eye possible Central retinal artery occlusion	
# I4 Cardiac (MI, continuous. Never before described — Chest wall flow murmur 2' to Problem #9 (PN 12/4/67)	

FIGURE 6. *List of Problems on a 36-Year-Old Woman.*

The management of Problem #3, the dehydration, dramatically improved Problem #1, the accelerated hypertension. The volume indicators and other appropriate variables were followed by means of a flow sheet as intravenous volume expanders were given. Aggressive conventional drug therapy of the marked diastolic hypertension out o[contexl could l&e had serious consequences.

learn how to provide it, and who naturally integrate findings into well formulated problems should not, and usually do not, feel threatened by a request for a complete list. The specialist who is annoyed or made anxious by health issues in his patient beyond the limited area of his mastery may feel threatened by this strict accounting. Through physicians' inefficiency in getting a broad data base, their past neglect of good record-keeping habits and their neglect of quantity of care as they have pointed with pride to quality, they have almost lost their capacity to handle rationally or even to define large-scale tasks of health care.

IMPLICATIONS OF THE PROBLEM-ORIENTED RECORD

The structured, problem-oriented medical record provides a focus for constructive action in a variety of "trouble" areas in medicine: medical problems dealt with out of context; inefficiency in medicine; lack of continuity of care; inapplicability of "basic Science" facts and principles; "off-the-cuff' and undisciplined rounds and conferences; and, finally, meaningful audits in the practice of medicine.

Problems out of Context

Multiple problems may interact and sophisticated understanding and management of any one of them require a knowledge of at least the presence of all of them in SitUiltiOtls such as the patient with heart failure and azotemia, it is apparent that the right treatment for one may be the wrong treatment for the other, and the need for skillful management is obvious. In other situations the interaction may not be so obvious – as in paroxysmal hypertension, dehydration and hypovolemir@ (Fig. 6). and physicians are always risking interpretation and treatment of problems out of context. The medical literature is replete with papers on single entities from series of patients (for example, myocardial infarction, cancer of the colon or pneumonia) in which no complete problem list for each patient was systematically presented. A paper may talk about X per cent mortality for perforated ulcer when, for example, what it should really be saying is Y per cent if heart failure is also on the list or Z per cent if another problem or no others are present. Pneumococcal pneumonia alone may well be a different disease from pneumococcal pneumonia in the presence of azotemia. Potent drugs are administered, and major management decisions made for specific problems taken out of context. It is no wonder that controversies in medicine abound; the present lack of technic for the recording and presentation of data on multiple problems almost guarantees chaos.

Until a well conceived problem list is in evidence, so that each is dealt with in context, the fragmentation of care in today's specialty clinics and wards, on rounds and in conferences will never be considered seriously. One must learn how to move easily from a single-minded focus on one problem to attention to the total list and interrelations of multiple problems, much as a biochemist meticulously purifies and studies an enzyme in a scheme of reactions and then returns to consider its relation to the others. He does not, and could not, get basic data on all the enzymes simultaneously in the interest of total biochemistry or the "art of biochemistry," nor does he work on only one and arbitrarily dismiss the others as of little concern. The essential combination of clarifying single problems and integrating multiple problems is greatly facilitated by a medical record that is structured around a total problem list and titled progress notes. Since the body is a complex group of systems, in each of which abnormalities develop that reverberate through the other systems to varying degrees, the specialist, as a responsible scientist, must know the variables in the total system as they affect his specialized judgment and action. A patient's intuitive demand for a "whole doctor" is completely consistent with the demands that good science and knowledge of all relevant factors. impose upon the specialist, independently of general discussions of "primary" physicians, total care and humanitarian causes.

Fragmentation of single diagnostic entities resulting from listing separately single related findings is not a legitimate complaint against a complete list of problems. If a complete analysis is done on each finding, integration of related ones is an automatic

by-product. Failure to integrate findings into a valid single entity can almost always be traced to incomplete understanding of all the implications of one or all of them. If a beginner puts cardiomegaly, edema, hepatomegaly and shortness of breath as four separate problems, it is his way of clearly admitting that he does not recognize cardiac failure when he sees it. But the important point is that nothing is lost. On the contrary, the interest of more experienced observers is immediately aroused, and some of the patient's problems are combined under a single heading on the original list and are carried one step closer to diagnosis and treatment. The system does not prevent analysis and integration: it merely reveals the extent to which it is performed and it defines the level of sophistication at which the physician functions.

Choice of Problems and Time for Problems

A scientist likes to choose his own problems, determine the time table for action and then spend as much time as necessary. In medicine as now practiced, the patient chooses the problem and initiates the encounter; the physician must react independently of his interests and his moods. Many symptomatic problems demanding immediate care might have had organized care at times specified by a physician in a less acute phase. Since they were never identified in the problem list, they were never followed systematically in numbered, titled progress notes by the too busy doctor, who was dashing off random notes on the acute episode of some other previously neglected situation. A physician should always consciously look at a patient's complete list of problems on the front of the record. If his time is limited he should select priorities, directing attention to those having the greatest potential for moving into the acute phase. The rule should be: when under pressure, do what you do very well; select the problem wisely; and never do all superficially just to get them done. Then the work reflected in each *titled* progress note can result in a precisely defined building block, and all effort can be cumulative. Lack of time is not a legitimate argument against keeping data in order. Form leads to speed in almost all human endeavors. To the extent that physicians are allowed to study patients and direct therapy in the absence of form (orderly data), they obscure the evidence that reveals whether their actions were or were not complete and justified. We cannot build a sound medical structure on a system that would violate such fundamental rules of scientific behavior on the excuse, "lack of time." Disorganization and inefficiency cost time; the principles of data collection that have been accepted by all other areas in science save time in the long run.

Medical students and physicians can be taught to deal with heavy work loads, set priorities, direct paramedical help wisely and learn efficiency. The medical record is an ideal instrument and focus for achieving these educational goals. We should not assess a physician's effectiveness by how much time he does or does not spend with patients or how sophisticated his specialized technics are. Rather, we should judge him on the completeness and accuracy of the data base he requires at the time he starts his work, the speed and the economy with which he obtains his data for his patients, the adequacy in the formulation of all the problems, the effectiveness of the therapy he prescribes and the total quantity of acceptable care that he is able to deliver.

Lack of Continuity of Care

Lack of continuity of care by the same physician is associated with doctors in training and specialists in medical centers and urban areas to a far greater degree than it is with the community physician with a relatively stable practice. There are many factors that attest to this fact, but the most disturbing is that the chief request of our clinic patients when asked for suggestions about the improvement of their care is in effect, "Could you please fix it so that I won't see a different doctor every time I come? They never really understand, some 'pass the buck,' and they all tell you different things." The second disturbing factor indicating this lack of continuity is the inefficiency that can be directly traced to multiple physicians. Tests are repeated unnecessarily, results are not followed up, and large amounts of time are wasted by both the physician and the patient even when the records are adequate. A physician familiar with a good record kept by himself can make sound judgments and decisions in one tenth the time that a physician unfamiliar with the record requires.

A complete medical record is essential to reliable continuity of medical care, even with the same physician. A complete highly structured, problem-oriented medical record will be invaluable to any physician and is essential to the busy one. A table of contents and a good index facilitate greatly the use of any unfamiliar book.

Basic-Science Training, the Physician and the Medical Record

A great deal that physicians labor over such as the Krebs cycle, phage genetics or membrane theory cannot be applied by them (and often by no one) directly to the complex biologic problems that confront them. The simple quantity of molecular biology and theoretical physiology that is now developing can frustrate and overwhelm anyone if it is not coupled with his research or his continuing development. Since the practice of medicine is a research activity when a clinican deals scientifically with unique combinations of multiple interacting problems, it can be coupled to training in basic science either through the facts themselves or through dis-

ciplined approaches to defining problems and handling data.

Collaboration between physicians and basic scientists would occur more frequently if the facts in medical records were structured as they are in scientific documents. It is true, however, that a large body of basic-science facts cannot at present be rigorously correlated with clinical action, and it is also unfortunately true that many basic scientists teaching in medical schools "find it more interesting to explore the fascinating interactions of genetics and chemistry in their uniquely favorable 'non-clinical' material than to bother about 'correlations with' medical and other practical matters."[9] The "infinite elaboration" of details in the laboratory of the basic scientist frequently seems to lead him away from the clinician instead of toward him. Details oriented to specific problems and recorded in an organized manner in clinical charts can do much to make clinical problems attractive to the basic scientist and subject to his advanced technics of investigation and analysis.

Basic-science training could have contributed to clinical performance through the teaching of systematic approaches if the physician had been, as a student, required by the basic scientist to formulate problems and write protocols as well as to perform experiments. It is this capacity to formulate and pursue a problem that distinguishes a good clinician, and a teacher of basic science has failed the physician if he does not teach this discipline but merely dispenses facts through lectures and "cookbook" experiments.

There is one fundamental aspect in the preparation of the physician that the basic scientist is not prepared to teach, Basic scientists are themselves taught to choose and focus on a single or limited number of problems, and they teach neither the philosophy nor the technic for coping with the multiplicity of problems that patients inevitably present. The failure of clinical teachers to develop and articulate an approach to multiple problems has led to a serious discontinuity in the scientific training of the physician. The chaotic medical record is a symptom of this philosophical blind spot. The degree to which we organize the record and elevate it to the level of a scientific document will be a measure of our capacity to develop and teach a workable philosophy of multiple problems.

Medical Rounds and Conferences

In earlier times bedside and autopsy-table teaching predominated, and most of the data used in the discussion were acquired at the bedside. This was a marvelous mechanism to keep physicians and students anchored to the realities of their patients' problems. At present, even though some teaching at the bedside has continued, the collection of data is no longer done exclusively by the physician, and discussion is often a ritual taking place from memory and at random rather than from highly organized problem-oriented manuscripts. This is usually a positive deterrent to rational progress in total patient care. No good scientist would make a judgment or even a recommendation on a single oral presentation of data, nor would he fail to follow up the result. On serious problems scientists usually study their data carefully before meeting with anyone. No scientist would seriously consider medical rounds as frequently conducted as good science, good care or good education. To those involved in care and education, multiple typed copies of well organized problem-oriented records must be at all times available for study and could be the basis for a major change in attending teaching rounds. Such rounds will require that the attending physician study the data beforehand; time that is now spent in presenting cases, determining what went on and giving random displays of erudition will be spent instead in analyzing and criticizing and redirecting the recorded efforts of the physician in solving the patient's problems. The young physician should be taught to anticipate and indeed enjoy such analyses for the rest of his life.

We should be allowed the luxury of conferences, grand rounds or a clinicopathological conference only when the original data are in good order and completely and carefully presented, but certain educational goals cannot be met by this means. How many teachers of medicine labor under the delusion that they can convey to physicians in one hour or a grand rounds the factual content or the wisdom of their 10, 20 or 30 years of personal experience and evolution in a field? A more realistic goal in teaching is to discipline the physician in the most effective application and growth of his own developing store of factual information through his own disciplined study of actual cases. The computer can make an enormous contribution in this area.* Problem-oriented medical records can be made easily accessible to authorized individual physicians or participants in a medical conference, who can then be expected to study the patient's data and analyze the list of problems, the plan and *the progress notes*.† Typed summaries of cases containing only selected data are not sufficient for rigorous analysis and medical education.

It is true that this could be and is being done now at this institution on manually constructed problem-oriented records, but the computer will allow immediate retrieval of all the data in sequence on any given problem, graphic representation of data and relations, multiple copies at distant terminals (also used for teaching rounds) and immediate correlation with large amounts of data on sim-

*The computer-science aspects of these developments are under the direction of Mr. Jan Schultz.

†Mr. Robert Esterlay is investigating technics whereby actual rather than contrived problem-oriented medical records can be used as a major source of teaching material for computer-assisted learning of the medical student.

ilar problems already stored in the computer. Furthermore, when many institutions have similarly developed data banks of patients' records, they can teach and audit one another.

Since the aim is to have the records of current patients readily available, the individual physician or members of a conference can question the doctor in charge of the patient for clarification, pointing out errors or shedding new light on the problems. They may be able to suggest additions to the data base, offering alternatives to the formulation of the problems and the approaches to handling them. By this means a link is forged between education, audit and patient care. Every time someone gets education, a physician will be audited, and at every audit a patient may get better care.

There are those who fear that rigid adherence to the patient's problems will emphasize only the physician's practical knowledge and development and create a tradesman who is dated with the technical expertise of an era, unable to meet new situations in a changing world. The approaches described here will demand of both faculty and student clear thought, a research attitude and a "willingness to apply first principles" to the new situations inherent in the infinite variety of combinations of multiple interacting medical problems. Biologic realities, honestly confronted, facilitate rather than hinder scientific advance. This is the art of medicine.

Lack of Regulatory and Feedback System on the Physician's Own Work

There is no audit by outside authorities on each piece of work as it is completed analagous to what is done in basic science. Basic scientists are monitored by a system that mobilizes the criticism of their peers. Clinical medicine, on the other hand, has tried to substitute qualifying examinations at a single point in a career for a recurring, lifelong audit on each piece of work as it is completed. The strategy and completeness of the physician's own search for data, the depth of analytical capacity in theoretical understanding and therapeutic decisions and the capacity for sustained quality and energy in his daily attack on problems, both esoteric and mundane, are poorly evaluated by any examining procedure that is done at just one point in a physician's career and uses case material besides his own.

Professors of clinical medicine and practicing physicians must be provided with the advantages of an audit whose origin is independent of their own organization.

The medical record can be used in the solution of this audit and feedback problem if we accept certain basic premises:

Premise (1). All the data in the medical record must be identified with a problem to determine whether the data are fundamental to solving the problem and whether factors such as redundancy, unnecessary delays and unjustified decisions are present.

Premise (2). All the data on any given problem must be easily retrieved in sequence and in a completely up-to-date fashion (for example, x-ray and laboratory data must be in the record as soon as they are available). The data are then immediately available to the staff members responsible in a given specialty area for determining whether certain standards for quality are being met. At the outset the staff member will use the same criteria he has always used to assess the quality of management in his area. Eventually, as the data bank grows in both number of patients with a given problem and numbers of variables followed and recorded, new standards for reasonable numbers of tests and good care will emerge.

Premise (3). Development of standards for quality of patient care as outlined in premise (2) may evolve easily when a patient has one or several unrelated problems. Conclusions will be more difficult when there are multiple concomitant problems in the same patient (such as cardiac failure, renal failure and malnutrition) the final solution of any one of which is intimately related to the progress on the others. In these particular cases fixed standards of care do not apply, and quality must be determined on an individual basis within a framework of generally accepted principles. The doctor's role in cases of this type may well be likened to that of an analogue computer, which plots specific points on a curve as a function of the time and type of input and the shape of the curve is not known until the input stops.

Premise (4). The dimensions of the quality-control problem alluded to in premises (2) and (3) can never be assessed until computerization of the data is accomplished. Manual approaches have not, after all these years, resulted in a widely applicable and practical appraisal. It is through discipline, and rapid effective audits and their demands for explicitness in the definition of problems and the orderly organization of the data that computers could make their main contribution to the performance and development of physicians. Physicians will be able to respond more constructively as soon as we give them a total picture of what it is that they are doing for specific problems.

The justification for a reorganization of the medical record by identifying all data with a problem is not and cannot be based on any proof that it will in itself guarantee improved quality of care and education. Titles, chapters and indexes in books, well thought out classification systems in organic chemistry and well established rules for presenting data in scientific manuscripts do not guarantee high quality of the material, and no one expects them to in and of themselves. But neither does anyone expect to use the book, work in the chemical field or

referee manuscripts if it is up to him to take a mass of incomplete and randomly presented data and organize it before he can even start to deal with the matter of quality. It is hard for nonmedical scientists to believe that we have allowed for this long the chaos in everyday medical data because scientists do not usually write papers on several problems simultaneously as doctors do; they have assumed that physicians have a system and immediately go to the second order of business, which is questions about quality of care. But we have not had a system for progress notes on multiple problems, and we therefore should first find it necessary to organize the record as a *basis for beginning* the development of a program of quality control. The basic premises stated above have grown from my convictions that it is already accepted in the field of science that all data should be recorded at the time it is acquired and that before it is submitted for analysis and inclusion in the literature of the field, it should be organized and presented in relation to the problem the data are purported to solve.

There may be considerable urgency in these matters, because large amounts of money have already been spent and allocated to the computerization of single components in the hospital complex such as laboratories and pharmacies, with little regard for problem orienting of data and decisions. This proliferation of automated systems within parts of a hospital complex without provisions for a central role for patients' problems make future evaluation of all these expensive efforts difficult. Such automation may be making highly efficient and accurate specific tests and maneuvers, but often it could merely be facilitating rapid action that is not necessarily solving the patient's problems. Daily reporting of an accurate chemical value, for example, has no particular virtue if the problem at hand requires only a weekly determination or no such determination at all. Some of the most advanced and most expensive automation of laboratories today is not coupled with an equally sophisticated problem-oriented clinical situation, and the value of these sophisticated efforts in terms of patients' problems can never be assessed. Laboratories have relied on the assumption that all determinations that are ordered are indicated, and the frequency of given determinations is never overdone, and what is worse, much money has been spent on systems that were never designed to test this crucial assumption.

At present no system is available whereby a medical teacher or member of an accrediting agency can take a patient's record at random, select one of the patient's problems, see all the data pertinent to that problem in sequence and immediately ascertain whether current medical standards are being applied. Such an inordinate amount of time is now being spent determining what was or was not done, and for what purpose, that on a time basis alone a teacher or auditor is rendered ineffective, and abuses may go uncorrected.

Also at present the details of the relation between patients' problems and hospital resources and costs are very obscure. A medical record maintained by the technic described will make possible a fiscal management audit in which utilization of hospital resources and services involved in the care of the patient are a matter of the medical record and can be identified with each specific problem presented by the patient. This combination of facts (clinical problems, hospital resources and costs) will enable the hospital to establish a dynamic unit cost-accounting system similar to that employed by more sophisticated industries. The advantages of such a system have broad and favorable implications for the general management of a hospital in the areas of fiscal planning, organization of resources, measurement of efficiency and daily management of the institution.

Art in Practice of Medicine

It has been said that preoccupation with the medical record and the computer leads to neglect of the "humanitarian" side and the "art" of medical practice. The most humanitarian thing a physician can do is to precisely know what he is doing, and make the patient as comfortable as he can in the face of problems that he cannot yet solve. There have been major humanitarian and sociologic failings in medicine, but almost all of them can be attributed to our poor behavior as scientists as we have dealt with problems out of context and ignored data relevant to good medical care. It is true that no system will make one kind, thoughtful or sympathetic, but to say that the art of medicine is not dependent on a great deal of discipline and order is to miss perhaps the true understanding of what underlines art in any form. Words of Stravinsky might be applied to our situation: "Human activity must impose limits upon itself. The more art is controlled, limited, worked over, the more it is free." If we accept the limits of discipline and form as we keep data in the medical records the physician's task will be better defined, the role of paramedical personnel and the computer will be clarified, and the art of medicine will gain freedom at the level of interpretation and be released from the constraints that disorder and confusion always impose.

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