SPECIAL ARTICLE

MEDICAL RECORDS THAT GUIDE AND TEACH

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acceptance and use of paramedical personnel and a more positive attitude about the computer in medi-
cine. Eventually, for every physician all these areas will be an obligatory part of his professional envi-
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<no text to translate>
Figure 2. Second, Randomly Taken from the File of Two Physicians Constantly Conducting a Busy General Practice in a Small Town in Maine, Showing the Approaches Advocated.

The internship training of these doctors was based upon problem-oriented medical records and note. One may not necessarily agree with the medical opinions, but the manner in which each problem is formulated, prioritized and related to the other problems makes it possible for one to assess grading equally in terms of the physician's thoroughness and analytical capacity.

There have been minor, but useful, modifications in form since the time of the training internship of these particular practitioners since nine years ago. In the initial plan, we not only mention the title of each problem in context, facilitating even more rapid recall of the physician's approach to a particular situation. It will also be noted that problems #8 - "Hepatic Hemorrhage" and #9 - "Diabetic Nephropathy" were not listed at the time of admission even though they were known. All significant problems should be recorded as soon as they are known, noting, but not categorizing, the problems known or recognized in progress notes should follow a form similar to that seen in Figures 3 and 4, in which the physicians first discuss the problem from the patient's point of view (subjective, Sx), then state all appropriate objective data (Obg) pertinent to the patient's problem, note control treatment (Obs), give any new interpretation (Int) and, finally, discuss the plans for the next interval.

fields are far more advanced and immediately applicable than many realize and concern with them is neither premature nor impractical.

New Techniques Must Be Adopted

Among physicians there has been uncertain adherence to tradition in the first phase of medical action, which is the collection of data, upon which complete formulation and management of all the patient's problems depends.

Routine completeness is expected of physicians in the history and physical examination regardless of specific indications, whereas initial laboratory determinations are arbitrarily relegated to an "only-when-indicated" category. Sudden clinical disease may thereby be missed. Extravagance is then paradoxically demonstrated by the ordering of excessive and inappropriately selected follow-up laboratory and x-ray examinations for the problems clinically evident. Thoroughness and order in the whole process decrease drastically and indiscriminately as work pressures build up, so that finally among physicians there is a remarkable spectrum of behavior from the compulsively elaborate to the sketchy and haphazard.

In the field of medicine it has never been clearly determined what the minimum, effective initial data base needs to be.

In the face of the confusion concerning the necessary quantity of data, the initial collection of data could be made as systematic and complete as possible. The only limitations should be the discomfort, danger and expense to the patient! If useful histori- cial data can be acquired and stored cheaply, completely and accurately by new computers and interactive viewing techniques without the use of expensive physician time, they should be seriously considered. That this is already so is strongly suggested by the work of Slack,14 and by results of present efforts in our clinic using trained interviewers and computerized approaches to the recording and printing of narrative, historical data. By such measures every patient can be guaranteed a minimal recorded data base of historical information routinely acquired by a trained interviewer or by direct patient interaction with an organized series of branching questions presented on a television screen terminal. The doctor will always be expected to read this information into the computer, filling in fields where indicated and integrating it with that which he himself elicited.

In this way, recorded historical data will not be based on a sin-
ple encounter with anyone, and lucky physicians, who represent a wide spectrum of abilities, habits of thoroughness, attitudes and levels of efficiency, will not risk important omissions. Paramedical personnel, armed with questions and interviewing techniques, and with multichannel analyzers, pulmonary-function tests, electronic instruments for studying all systems (particularly the cardiovascular system), and simple means to assess the musculoskeletal system can create a sound data base rapidly and accurately. At this institution there has been developed a computerized physical examination whose performance requires a high level of thoroughness and precision, but a significant part of it can be performed by paramedical personnel. The "print-outs" from the computer of both the interview and the physical examination are in readable narrative form with only the positive findings printed out under the appropriate system.

This work has been under the direction of Dr. Charles Berger and Mr. Eugene Levy.

Heuristic Facts
- 50 mg. RH facts - not significantly.
- RPR test negative.
- Blood film, blood smear, urine, etc.
- Rh factor present, negative.
- Rh factor, negative.
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very limited number of problems, pursuing each until he finds a solution, the physician is asked to accept the obligation of multiple problems in a given clinical situation and yet to give each the single-minded attention that is fundamental to development and mobilizing his enthusiasm and skill. The university education, a physician receives suggests that his attitude should be scientific in focus, but the multiplicity of tasks that confront him during his clinical training often defeats this goal. He can act as a scientist, however, if he is able to organize the problems of each patient in a way that enables him to deal with them systematically. It is here that an organized approach to the medical record can help. Present the physician has to read the entire record (often illegible and handwritten) and then sort the data in his mind if he is to know all the patient’s difficulties and the extent to which each has been analyzed. There is no evidence that he does this reliably and consistently, and others using the record lose their way, and problems yet neglected, missed entirely or treated out of context (Fig. 1). One solution to a certain degree can be found in each case, and in the absence of a specific problem the physician must take a more complete picture of the whole if he is to see it in context. The patient’s problem is not the problem in its composition, but is a dynamic “table of contents” of the patient’s chart, which could be updated at any time. Separate problems all found
Figure 5. "This figure was drawn by a Physician on a General-Medicine Ward at the Time the Data Were Acquired. Not a Reprint.

This represents the course of a patient with a history of tuberculosis, and a pneumonia who appeared with acute respiratory failure, cardiac failure, pleuritic pain, and septicaemia. One day operation was done out of the data and decisions, but one has no objection to rapidly summarizing the course of this complicated infectious process, as seen through the eyes of this physician.

This chart should not be limited to patients with acute problems. More chronic difficulties are best understood and managed in relation of multiple variables over time - short, week or month. Patients with hypoxicemia, delirium, and fever diseases are among the many who require well structured and sophisticated care here.
to be part of the same entity or diagnosis may be combined. The list is separated into active and inactive problems, and in this way, those of immediate importance are easily discernible, and a compact history of each patient is embodied in the complete list. Once such a list has been established all subsequent orders, plans, progress notes and numerical data can be recorded under the numbered and titled problem to which they are specifically related (Fig. 2-4). For example, if we know that the patient has a persistent indwelling catheter, it is so stated, if we are not sure, we honestly state the problem as "abdominal pain" and immediately update it on the original note to perforated ulcer only when the evidence allows. Lists of "impressions" and guesses fail to convey the exact level of resolution of a problem and may result in premature interpretation of diagnostic action. Students must be taught to acquire a capacity for the "sustained middle-headedness" and the tolerance for ambiguity that Whitehead considered so essential when difficult unexplained findings are dealt with. A diagnosis is a step forward only when it can be sustained by the evidence at hand.

Inherent in the problem-oriented approach to data organization in the medical record is the necessity for completeness in the formulation of the problem list and careful analysis and follow-through on each problem as revealed in the titled progress notes, requiring that the proper data be collected and that the conclusions drawn from this data are logical and relevant. The precision of titled, problem-oriented progress notes and conclusions is directly related to the precision and integrity with which the problems are initially defined. The uncertainties inherent in complex biologic systems make titled progress notes the most crucial part of the medical record. There are never right or wrong single decisions in difficult cases, there are only intelligent and logical or unintelligent or illogical series of decisions carefully or carelessly followed.

For certain problems a narrative progress note is not adequate for relating multiple variables. Data involving physical findings, vital signs, laboratory values, medications, intakes and outputs can lead to sound interpretations and decisions only if they are organized (by means of a "flow sheet") to reveal closely temporally correlated (Fig. 5). How often do younger physicians see older ones flip through a record, exposed on a single laboratory value, call at random for orders in a "stream-of-consciousness" way and give an essay beginning with "in my experience"? Time relations are ignored, crucial data are never brought to light, and wrong decisions forever go unrecognized, because no tracks or logic pathways are discernible in the randomly recorded data.

Flow sheets can be used to facilitate the comprehension and interpretation of multiple interrelated and changing variables. On certain fast moving problems the flow sheet may be the only progress note. The time required initially in setting up a proper flow sheet is small compared to that wasted unraveling and reassembling disorganized and misplaced data. One major goal of clinical teaching should be to designate the problems that should have a flow sheet, the variables that should be included and the frequency with which they should be followed.

When the procedure, outlined above has been done manually, a basis for computerization will have been provided, and when physiological monitoring data on a given problem will be instantaneously retrievable in sequence and a physician will be able to focus on one case at a time, seeing the flow of data over extended periods. He will then be prepared to relate that fully digested problem to the other problems by returning to his up-to-date problem list.

Since a complete and accurate list of problems should play a central part in the understanding and management of individual patients and groups of patients, storage of this portion of the medical record in the computer should receive high priority to give immediate access to the list of problems for care of the individual patient and for statistical study on groups of patients.

It would seem most logical to have the physician enter the problem statements directly into the computer. Work at this institution's after analysis of large numbers of manually recorded problems, has demonstrated the feasibility of using logically grouped displays of such problems on a television screen terminal. The physician makes a choice and, in some situations, will be led through further displays requiring more careful delineation of the problem. For example, he will first be required to state whether the problem in a given organ system is an etiologic diagnosis, a physiologic finding (such as heart failure), a symptom or a laboratory finding (such as an abnormal electrocardiogram). It he chooses heart failure he will be required in the next display, which appears automatically, to say whether compensated or decompensated, biventricular, right or left side. These previously prepared displays enable easy coding and yet give freedom of expression to the physician. This method is a tacit teacher because it requires the physician to formulate his problems consistently, completely and accurately. A large number of such precisely defined problems will provide the necessary data base to allow reliable work by statisticians to be undertaken.

It can readily be seen that all narrative data presently in the medical record can be structured, and in the future all narrative data may be enterered through series of displays, guaranteeing a thoroughness, retrievability, efficiency and economy important to the scientific analysis of a type of datum that has hitherto been handled in a very antiquated manner.
IMPLEMENTATION OF MORE COMPREHENSIVE CARE THROUGH THE MEDICAL RECORD AND THE COMPUTER

The organization of the record described above facilitates the accommodation of psychiatric, social and demographic problems. Usually these are not documented and followed in an organized fashion.

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 could almost have been — with the physician using clear descriptive formulations such as "cries easily," "family difficulties," if he could not use sophisticated psychiatric jargon. Until all psychiatric problems are concrete 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 techniques of analysis becoming at best one of anxiety and perplexity and at worst one of disinhibited, ignorant and transformed 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 is 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 techniques on the basis that Osler for three hours followed by Freud for three hours could have done better. Even if this were true, modern techniques 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.

Demographic Problems

Physicians have for years been preoccupied with episodic illness, with problems only when they erupt 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 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, Hereford 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 focused 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 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 scores in his patient beyond the limited area of his specialty 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 routinely 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 List

Active Problems

1. Accelerated hypertension

2. Diabetes mellitus

3. Varicose veins

4. Diaphragm—unknown etiology

5. Snoring

6. Chest pain

7. Renal pelvic ulcer disease

8. Exogenous obesity

9. Breast mass

10. Increased risk of CHD

11. Pneumonia

12. Personality disorder

13. Decreased vision (R) eye possible central nervous system involvement

14. Cerebral arteriosclerosis

15. Cardiac (M) continuous, never before described — chest, wall, motor

To Problem 9 (prn 12/4/67)

Resolved Problems

1. Biliousness

2. Dehydration

3. Dyspnea

4. Early morning headache

5. Insomnia

6. Painful ears

7. Rectal prolapse

8. Osteoarthritis

9. Chronic post-nasal discharge

10. Contact CENTRAL nervous system involvement

11. Thyroid disease

12. Bronchitis

13. Depressed mood

14. Skin abscess

15. Erythema nodosum

To Problem 15 (2/20/67)

Figure 8. List of Problems on a 35-Year-Old Woman.

The management of Problem 8, the dehydration, has been addressed for the other problems. The physician's chief problem at this time is the patient's high blood pressure. The patient has been treated with thiazide diuretics, and the problem has not been controlled. The patient has been referred to another physician for further evaluation.

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 situations such as this, the patient with heart failure and anemia is particularly difficult. The right treatment for one may be the wrong treatment for the other, and the need for skilled management is obvious. In other situations the interaction may not be so obvious, and in paroxysmal hypertension, dehydration and hypovolemia (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, now 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 in 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 anemia. 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 from a single-minded focus on one problem to attention to the total list and interrelations of multiple problems, much as a biochemist meticulously follows the metabolic pathway 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 no critical concern. The extent of combination of clarifying single problems and integrating multiple problems is greatly facilitated by a medical problem list and title grouped 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 care.

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 list 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 the implications of one or all of them. If a beginner puts customarily, 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. The important point is that nothing is lost. On the contrary, the interest of more experienced observers is immediately aroused, and some of the diagnostic problems that are constructed around a single heading on the original list and are carried one step closer to diagnosis and treatment. The system does require 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-zoods. Many symptomatric 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 directing on random notes on the acute episode of some other previously neglected situation. A physician should always consciously look at a patient's complete prior chart 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 immediate relief. The rule should be: when under pressure, do what you do very well; select the problem wisely, and never do all at once. Just 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 as the exact, lack of time." Deorganization and inefficient cost time; the principles of data collection that have been accepted by all other areas in science same time in the long run.

Medical students and physicians can be taught to deal with busy work loads; set priorities, direct parameters to learn efficiency. The medical record is an ideal instrument and focus for achieving these educational goals. We should not assert a physician's effectiveness by how much time he does or does not spend with patients or how sophisticated his specialized techniques are. Rather, we should assign to him the correctness and currency of the data base he requires at the time he starts his work, the speed and the economy with which he deals with his patients, the accuracy and 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 point of interest 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, come '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 can.

A complete medical record is essential to reliable continuity of medical care, even with the same physician. In effect, the patient-oriented medical record will be invaluable to any physician and is essential to the busy one. A table of contents and an 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, phase labilities or molechate theory cannot be applied by them (and often by one) directly to the complex biologic problems that confront them. The simple quantity of molecular biology and theoretical physics 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 clinician 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 disciplined 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 combined with clinical action, and it is also unfortunately true that many basic scientists teaching in medical schools "find it more interesting to explore the fundamental interactions of genetics and chemistry in their uniquely favorable 'non-clinical' material than to bother about 'correlations with' medical and other practical matters." The "infinite elaboration" of data 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 techniques of investigation and analysis.

Basic-science training could have contributed to clinical progress through the teaching of systematic approaches if the physicians 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 "cook book" 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 technique 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 phenomenological 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, yet he would feel no obligation to follow up the result. On serious problems, scientists usually study their data carefully before meeting with any one. No scientist would seriously consider medical models as frequently contested 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 literature. Teaching rounds. Such rounds will require that the attending physician study the data beforehand, that time is now spent in presenting cases, determining what went on and giving random displays of emotion 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 instead excuse 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 those 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 mere 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 usable 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 most likely will not 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 similar 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 handle 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 ignore the technician who is dealing with the technical expertise of an era, unable to meet new situations in a changing world. The approaches described here are not intended to destroy or replace medical education and student clinical 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 contorted, 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 analogous to what is done in basic science. Basic scientists are

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1 The computer-science aspects of these developments are under the direction of Dr. J. C. Schloemer.

2 The rapid progress in computer technology is far beyond actual progress in the immediate problem-oriented medical records can be used as a major source of teaching material for computer-assisted marking of the medical document.

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monitored by a system that monitors 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 extrinsic 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 for a given specialty area for determining whether certain standards for quality are being met.

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. Considerations 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, x-ray 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 computer steps.

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 effectiveness 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 improvement in the quality of medical practice. 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 has been supported by a good deal of overt and covert but also a good deal of covert, 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 though-out classification systems in organic chemistry and well-established roles for presenting data in scientific manuscripts do not guarantee high quality of the material, and no one expects them to 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 used for nonscientific 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 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 accepted in the literature of the field, it should be organized and presented in relation to the problem that the data are pertinent 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 simple components of 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 giving, 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 immediate amount of time is not 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 always 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: 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 underlies art in any form. Words of Stenverski 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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