A System for Cost and Reimbursement Control in Hospitals

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This paper approaches the design of a regional or statewide hospital rate-setting system as the underpinning of a larger system which permits a regulatory agency to satisfy the requirements of various public laws now on the books or in process. It aims to generate valid interinstitutional monitoring on the three parameters of cost, utilization, and quality review. Such an approach requires the extension of the usual departmental cost and budgeting system to include consideration of the mix of patients treated and the utilization of various resources, including patient days, in the treatment of these patients. A sampling framework for the application of process-based quality studies and the generation of selected performance measurements is also included.

I. INTRODUCTION

There is little doubt that the most generally troublesome feature of recent experience with all aspects of medical care in the United States today is the increase in cost, however defined, of the hospital component of that care. The national experience in the expenses per patient day and per patient stay in hospitals is shown in Table 1.

These data clearly show both the rise of two service unit costs over the 14-year period as well as the change in these expenses around the time of the implementation of Medicare. During this period expenses per day increased 255.8% and costs per stay by a slightly higher rate of 265.8%. Over the past 7 years (Medicare went into operation July 1, 1966), costs per day increased by 138.2% and costs per stay by 157.8%. Another way of stating the findings is that it took 9 years for the per diem costs to double and 3 years for them to triple. Costs per stay followed somewhat the same pattern during the first 6 years, but they increased dramatically in 1966–1967, reflecting the increase in length of stay from 7.9 days in 1966 to 8.3 in 1967 and 8.4 in 1968, again around the time of Medicare. This meant that two inflationary pressures were operating since the cost per day and the number of days of an average stay were both increasing at the same time.

The relative increases of expenditures for hospital care are shown and compared with total medical care expenditures in Table 2. The cost trends illustrated in these two tables are dramatic evidence of a significant rise in real expenses per unit of hospital service whether measured by expenses per day, expenses per average length of stay, or relative expenditures for this component of total medical care expenditures. They fail, however, to determine how much of this cost rise is due to expansion of scientific medical care, to increased salaries for employees, to new personnel, to "inefficient" internal operation, or, finally, to the faults within the total institutional care system, which dictates inefficient and ineffective use of a hospital bed.

II. SPECIFIC ASPECTS OF INCREASING COSTS

With the focus on the expense of providing a day of inpatient hospital care, the experience of one state with a sophisticated expense costing system might offer some
insights and in this way permit those who are concerned to focus their attention on the real issues.

The recent trends of Connecticut’s 35 short-term hospitals (Table 3) seem to indicate that the Medicare bulge is over; costs have been increasing at a slower rate for the nonmaternity patient day for the last 3 years. Whether this decrease would have dropped so dramatically without the actions of the Cost of Living Council is moot, but the trend would seem to indicate a minimal effect of the rulings of that body.

Matching these cost figures with utilization data adds another dimension of the problem of rising hospital costs. Not only has the cost of the service unit (nonma-

**TABLE 1**

| Year | Absolute Value of Total National Expenses per Patient Day and per Patient Stay in Nonfederal, Short-Term General and Other Specific Hospitals, 1960-1973 |
|------|---------------------------------------------------------------------------------------------------------------|
|      | Per patient day ($) | Relative increase (1960 = 100%) | Yearly increase (%) | Per patient stay ($) | Relative increase (1960 = 100%) | Yearly increase (%) |
|------|---------------------|-----------------------------|-----------------|---------------------|-----------------------------|-----------------|
| 1960 | 32.23               | —                           | —               | 244.53              | —                           | —               |
| 1961 | 34.98               | 108.5                       | 8.5             | 267.37              | 109.3                       | 9.3             |
| 1962 | 36.83               | 114.3                       | 5.3             | 279.91              | 114.5                       | 4.6             |
| 1963 | 38.91               | 120.7                       | 5.6             | 299.61              | 122.5                       | 7.0             |
| 1964 | 41.58               | 129.0                       | 6.9             | 320.17              | 130.9                       | 6.9             |
| 1965 | 44.48               | 138.0                       | 7.0             | 346.94              | 141.9                       | 8.4             |
| 1966 | 48.15               | 149.4                       | 8.3             | 380.39              | 155.6                       | 9.6             |
| 1967 | 54.05               | 167.8                       | 12.3            | 448.62              | 183.5                       | 17.9            |
| 1968 | 61.38               | 190.4                       | 13.6            | 515.59              | 210.8                       | 14.9            |
| 1969 | 70.03               | 217.3                       | 14.1            | 581.25              | 237.7                       | 12.7            |
| 1970 | 81.01               | 251.3                       | 15.7            | 668.42              | 281.5                       | 15.0            |
| 1971 | 92.31               | 286.4                       | 13.9            | 738.48              | 302.0                       | 10.5            |
| 1972 | 105.21              | 326.4                       | 14.0            | 831.16              | 339.9                       | 12.5            |
| 1973 | 114.69              | 355.8                       | 9.0             | 894.58              | 365.8                       | 7.6             |

Source: Hospitals, Guide Issues.

**TABLE 2**

| Type of expenditure          | Total (in millions) | Per capita (in millions) | Percent increase per capita (1969-1971) |
|------------------------------|---------------------|--------------------------|----------------------------------------|
| 1969                         | 34,057              | 165.9                    | 22.2                                   |
| 1970                         | 38,850              | 185.6                    |                                        |
| 1971                         | 42,477              | 202.7                    |                                        |

Source: Adapted from D. P. Rice and B. S. Cooper, “National Health Expenditures, 1929-71,” Social Security Bulletin, January, 1972.
TABLE 3
Average Cost per Nonmaternity Patient Day in Connecticut Short-Term General Hospitals, 1960–1973

| Year | Average cost per nonmaternity patient day ($) | Relative increase (%) (1960 base) | Yearly increase (%) |
|------|-----------------------------------------------|----------------------------------|---------------------|
| 1960 | 34.93b                                        | 100.0                            | 0.0                 |
| 1961 | 35.99                                         | 104.5                            | 4.5                 |
| 1962 | 38.40                                         | 111.5                            | 6.7                 |
| 1963 | 40.45                                         | 117.5                            | 5.3                 |
| 1964 | 43.13                                         | 125.3                            | 6.6                 |
| 1965 | 46.33                                         | 134.5                            | 7.4                 |
| 1966 | 50.66                                         | 147.1                            | 9.4                 |
| 1967 | 57.06                                         | 165.7                            | 12.6                |
| 1968 | 65.41                                         | 190.0                            | 14.7                |
| 1969 | 74.61                                         | 216.7                            | 14.1                |
| 1970 | 85.38                                         | 248.0                            | 14.5                |
| 1971 | 98.43                                         | 285.9                            | 15.3                |
| 1972 | 109.98                                        | 314.9                            | 11.7                |
| 1973 | 121.74                                        | 348.5                            | 10.7                |
| 1974 | 133.47                                        | 382.1                            | 9.9                 |

*aSource: Connecticut Hospital Association Annual Cost Analyses.

b35 hospitals.

TABLE 4
Percent Increase or Decrease in Population, Nonmaternity Beds, and Patient Days in Connecticut, 1960–1973

| Year | Population | Beds | Relative increase (%) (1960 base) | Yearly increase (%) | Patient days | Yearly increase (%) |
|------|------------|------|----------------------------------|---------------------|--------------|---------------------|
| 1960 | 2,535,234  | 6806 | 100.0                            | 0.0                 | 2,084,822    | 100.0              | 0.0                |
| 1961 | 6997       | 2,122,258 | 101.7                | 1.7                 |
| 1962 | 7140       | 2,188,967 | 104.9                | 3.1                 |
| 1963 | 7404       | 2,300,793 | 110.3                | 5.1                 |
| 1964 | 7616       | 2,386,035 | 114.4                | 3.7                 |
| 1965 | 7871       | 2,443,621 | 117.2                | 2.4                 |
| 1966 | 7973       | 2,507,331 | 120.2                | 2.6                 |
| 1967 | 8324       | 2,637,401 | 126.5                | 5.2                 |
| 1968 | 8479       | 2,710,226 | 129.9                | 2.8                 |
| 1969 | 8915       | 2,775,330 | 133.1                | 2.4                 |
| 1970 | 9081       | 2,819,970 | 135.2                | 1.6                 |
| 1971 | 9197       | 2,846,594 | 136.5                | 0.9                 |
| 1972 | 9498       | 2,865,596 | 137.5                | 0.6                 |
| 1973 | 9564       | 2,877,883 | 138.0                | 0.4                 |
| 1974 | 9705       | 2,918,194 | 140.0                | 1.4                 |

*aSource: The Connecticut Hospital Association Annual Cost Analyses.
ternity patient day) increased by 248.5% in the 14 years under study but also the units of service used have increased by 40% over that same period (Table 4). Since the population served increased by only 23.1% over the same number of years, this means that each 1000 citizens of the state used 113 more nonmaternity hospital days per year in 1974 than in 1960. Here the effect of Medicare is less obvious; although there was a 5.2% increase in 1967 over 1966, there was a similar increase in 1963 over 1962 without Medicare.

The nonmaternity utilization data, then, illustrate the other facet of the cost problem: the climbing number of hospital days unrelated to the size of the population served. Figure 1 indicates that satisfied demand (nonmaternity hospital days) is increasing at a faster rate than the population and seems to be related more to the number of beds available than to the population served or to payment programs such as Medicare and Medicaid. This experience seems to be a reaffirmation of "Roemer's Law" (6), that the greatest indication for treatment in the hospital is the existence of an available hospital bed.

It is obvious when the rate of increase in nonmaternity days is compared to the population growth that, even if costs per hospital day were controlled, the cost of hospitalization for a given population would still rise from the increasing number of days consumed by that population.

There are two ways, then, to approach a solution to this problem of increasing hospital costs; either attempt to lower the cost of the product or plan to buy fewer units of the product.

Society is, at last, directing its attention to the control of hospital costs with varying success in many levels of government reflected by recent legislation. This paper maintains that this goal can only be addressed through a total systems approach involving all components of the institutional medical care system. Such a system must first be considered conceptually as being responsive, regional, rational, and responsible and should then be legally instituted as a "social utility" system.

The words "social utility" have been used rather than the term "public utility" in order to reflect the unique social role of this system. In a comprehensive review of the

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**FIG. 1.** Percent increase or decrease in population, nonmaternity beds and nonmaternity patient days, and maternity beds and maternity patient days in Connecticut, 1960–1972 (data from Connecticut Hospital Association Reports, New Haven, Conn.)
problem of regulating one component of this system, the hospital, Ann Somers points out that "hospitals do share several characteristics with industries that have been declared public utilities, including some aspects of monopoly, the provision of a basic need, the lack of the ability of the consumer to judge the quality of the service, and the unreliability of competition to provide automatically some degree of public protection" (1).

To these characteristics Klarman adds the "widespread agreement that the number of hospital beds must be limited" (2) by somebody and so must the relatively high capital investment required to provide hospital beds. Both authorities, however, state that the usual public utility model should not be applied to hospitals.

A Responsive System

Rather than having a primary concern with the financial control or public safety which characterizes the public utility model, the social utility concept must be concerned with the ability of the system to respond to the changing and unique "needs" of populations served through the development of new modes for the delivery of these services. The term "social utility" implies a more active participation in the management of the system than is usual in the public utility model which, in essence, has a more passive role responding to and approving programs submitted to it by the electrical, water, and transportation services. This means that the social utility must then have surveillance over the planning efforts in the state or region.

One of the most important factors in applying a public utility model in the medical arena is the fact that unlike gallons of water or kilowatt hours of electricity, medical care is not delivered in standardized units of services, all uniform and measurable, the quality of which is easily assessable (3). The exactitude with which service costs can be controlled is not, then, the central charge of the social utility's charter.

Regional System

Regionalization is basic to any public utility model, be it over power sources, water, or transportation. This characteristic would apply also to the social utility that is building on existing, for the most part ineffectual, regionalization legislation already functioning. This is indeed the main thrust of the recently enacted Public Law 93-614.

Rational System

The rationale of which the social utility is structured should be the needs of the patient. Patients' needs are conceived as being multiple, varying in complexity, and requiring different levels of service at different times. This service must be rendered effectively and efficiently.

Public Responsibility

When one examines the various attempts of all levels of government to control hospital costs, the picture is, at this time, frenetic if cloudy. In one state, the Blue Cross Plans have been forced, however reluctantly, into acting as a control agent for state government.

The State of Pennsylvania, with the appointment of a charismatic, unorthodox, and publicity-wise Insurance Commissioner, adopted the approach of including many control measures in the contract among the five Blue Cross Plans within the state and their participating hospitals. The latest "guidelines" proposed by the Pennsylvania Insurance Department list 67 suggestions including the possibility of transfer-
ring costs of house staff to the attending physicians, assurance of consumer representation on Blue Cross and hospital boards, open-door privileges in all hospitals for all physicians, stepped-up utilization review, participation in hospital statistical services, and a moratorium on all hospital construction.

It is important to note that the State Department of Health was not involved in these contract negotiations; the Insurance Commissioner was; he set the guidelines (4), and it is he who must eventually approve or disapprove the contracts negotiated on these guidelines.

Formal government attempts to change and control the larger medical care system are, at this writing, characterized by conflicts between federal and state programs (5) and the dispersion of the three basic authorities required to implement the social utility model directed toward the assessment of the cost, quality, and accessibility of that care.

A review and analysis of present and proposed public utility legislation suggests that their development will involve four different stages of control and monitoring. For a time these stages will be implemented consecutively, though, as experience is gathered, the total model may be legislated at one time.

The first stage aims at reversing the effect of Roemer's Law (6), illustrated above, through control of the units of production through certificate of need legislation. The granting of such a certificate, though declared unconstitutional in North Carolina, is now required under recent Federal amendments for Medicare reimbursement. At the present time, 25 states and the District of Columbia have enacted such legislation and an additional 4 are considering such a step (7). All but 14 states have signed contracts with the Federal government to implement the review and approval of facilities mandated under Section 1122 of the Social Security Act.

The second increment of state control, adopted in 8 states, pending in 16, and being considered in 4 more (8), is the review, approval, or setting of charges for institutional services. The new Federal Planning Act (Public Law 93-641) will select 6 such states to act as sites for the future development of this increment.

The third stage is the review and monitoring of the quality of institutional care. Though a part of some state bills, the paucity of measurement techniques applicable to a state or regional frame renders the enforcement of this criterion ineffectual. There is some potential for conflict in these provisions with the function of the P.S.R.O. agencies mandated by federal legislation.

The last step in the model is review and monitoring of the effectiveness of that portion of the medical delivery system under the purview of the state. Again, this stage, like the quality stage above, is implied rather than programmed at this time. The word "effectiveness" is, however, contained in most of the laws that have been reviewed. It is obvious that, unless firm measurements of cost, quality, and utilization are available, the assessment of cost effectiveness cannot be grasped. A further extension, and a most important one, is the one of cost benefit measurement which would involve the above three factors, apportioned on a population basis.

It is surprising that these types of control models have been passed without objection from, and indeed in one case with the support of, state medical societies. It is fairly obvious that hospital and nursing home control programs, though a valid first step, will not succeed without a coordinated planning and monitoring effort which must include, eventually, the rest of the medical care system including that of private practice.

Two states have assumed leadership in, at least, the enactment of this type of legis-
lation; they are New Jersey and Rhode Island. Rhode Island, through two recent amendments of its franchising or licensing laws, established a Health Services Council which is an advisory body to the Director of Health, serves as the Hill-Burton Advisory Council, and is responsible, with the C.H.P. "A" Agency, for the certificate of need legislation which covers any capital expansion of an amount exceeding a range of $50,000 to 200,000 depending on the value of the existing premises. This legislation applies to all hospitals and ambulatory care facilities, but not nursing homes, within the state. The rate-review function is carried out by the State Budget Office, within the State Department of Administration, which is a "party" to all contract negotiations between hospitals and Blue Cross (9).

The unique factor in the Rhode Island approach is the reporting of financial, medical, and quality of care information by the hospitals to the Department of Health under the Licensing Act. This information serves as a base for the Department of Administration in carrying out its role in contract negotiations and as the input to monitoring the service and quality parameters of the hospital by the Board of Health. A special body called SEARCH has been set up in the state to provide this information in a meaningful and useful format to the two state agencies and the C.H.P. Agency. Thus, one can see, even though there is no formal Public Utility Commission set up in the state, that three of the functions of such a body are being carried out within state government.

The New Jersey law (10) starts with a clear policy statement: "It is hereby declared to be the public policy of the state that hospital and related health care services of the highest quality, of demonstrated need, efficiently provided and properly utilized at a reasonable cost are of vital concern to the public health."

This statement of purpose, then, places the responsibility on the Commissioner of Health to carry out all four of the stages of control mentioned above. More specifically, it is the commissioner who sets reimbursement rates for state-contracted services and with the Insurance Commissioner determines Blue Cross reimbursement rates.

The Act is unusual for its breadth of coverage. It covers all private and public health facilities including, but not limited to, general and special hospitals, mental hospitals, public health centers, diagnostic centers, rehabilitation centers, extended care facilities, skilled nursing homes, nursing homes, intermediate care facilities, tuberculosis and chronic disease hospitals, boarding houses, health services, and bioanalytical laboratories. It excludes only institutions which provide healing solely by prayer. The Act also covers ambulance services and services by interns and residents in training or by a physician whose compensation is provided through agreement with a health care facility. This may be a substantial breakthrough to examining radiologists' and pathologists' fees and salaries.

We can see, then, that state agencies (do not be misled by the two examples which mention only health departments; in other states separate commissions are being set up) will be involved more and more in the responsibility of monitoring personal health services.

The conflict between state and federal programs is obviously not limited to the P.S.R.O. area of quality measurement. Why is the Federal government going to study 6 out of 16 state cost-control agencies under Public Law 93-641? What about the conflict between state certificate-of-need legislation, the Social Security amendments, and the function of the Health Systems Agencies in the new planning act?

But the real question of the future of the social utility model is not at which level of
government it is mandated but whether any governmental agency can do it all! Although it may be too early to thoroughly evaluate, the New Jersey experience has been anything but effective (11), and recent rulings on the Maryland’s Health Service Cost Commission’s guidelines were referred to as the “largest chunk of gobbledegook” the reviewing judge had ever read (12).

It is the contention of this paper that any attempts to control cost, utilization, or quality of hospital care will fail unless a specific information and monitoring system is designed to provide valid and relevant data on the cost, use, and practice patterns of hospital care.

III. LOGIC OF SYSTEM DESIGN

The basic objective of this system design is to enable a state or regional review body, through the examination of the output of hospitals within that region or state, to monitor the quality of the care and costs and utilization of these institutions in compliance with the requirements of various public laws. Given this primary goal, it is asserted that the critical need is for a method by which hospitals can be characterized in terms of the services which they provide to patients and the resources consumed for each delivery incident. Since the basic problem underlying this task is to build a system which will produce performance and utilization measures comparable from one hospital to another and allow rate setting which is equitable for both consumers and providers, each hospital must be described in terms of the specific services rendered to each patient. This cannot be done simply by describing the operating centers such as laboratory, pharmacy, dietary, and the like no matter how precise are the terms in which costs for such centers are recorded. The hospital renders service to each patient by drawing on these service centers to produce the set of resources necessary for each episode of patient care.

What is required is the ability to describe the unique patient care processes delivered by each hospital and to measure the costs incurred in producing these patient care processes. Experience in the development of the Basic Utilization Review Program (13), the design of methods and procedures for the Connecticut Utilization and Patient Information System (14), and the work of the Psychiatric Utilization Review and Evaluation Project (15) at Yale has demonstrated the ability of the approaches included in this design to identify patient classes which are medically meaningful and for which resource requirements can be described as a stable set of parameters.

The central logic of the system design will be to describe each hospital in terms of the case mix of patient types which it serves. These patient classes will be determined utilizing the AUTOGRP system and procedures described in the references (16). Through capturing patient data from each hospital, files of group statistics characterizing these classes in each institution will be built. These will include on a statistical basis the clinical definition of each group (diagnosis, surgery, complications, age, and the like) as well as the resources consumed as given by charges made for each cost center’s contribution to each patient episode.

The costs of operation of each cost center will be captured through a uniform reporting system, and for each center a ratio of charges to actual costs will be produced. By relating these data to patient group statistics, the share of costs attributable to each patient class for each cost center can be determined. It has been shown (17) that this “case-cost” concept is a meaningful method for the classification of hospital utilization and cost performance. With this approach a state or region will be able to implement equitable rate setting, monitor hospital performance, and at the
same time produce a feedback to each hospital of information for each institution to review and evaluate its own performance and quality criteria.

An accounting system without this essential link to the clinical attributes of patient care processes cannot accomplish the goals of the many rate-review laws. Most of the work involved necessary to the design of uniform accounting systems and their implementation has already been accomplished by others (e.g., the American and the Connecticut Hospital Associations) and systems exist which are capable of capturing the needed accounting data in forms appropriate to the task envisaged. What is missing is a series of procedures which capture patient data in a uniform manner and link these data to cost and revenue data. In this way, the processes of patient care can be understood based on the unique financial transactions of each case and this information used to project and control the costs of health care delivery as well as the rates charged to various third-party payers or individual patients.

To this end, the proposed system attempts to capitalize on existing systems and data sources to the fullest extent possible and to design and implement those systems and procedures necessary to make these compatible. This system envisages that alternatives may be both necessary and desirable for elemental data capture in each hospital. Through building a system which accommodates preexisting systems and procedures, but at the same time satisfies the requirements given earlier, the most effective use can be made of resources.

There exist several approved, uniform accounting systems for hospitals. This design does not include a new system for the purpose of capturing cost and revenue data at the institutional level. This seems to us unnecessary. What is required, however, is that these data be gathered centrally by the regulating body processed according to a uniform methodology and that financial reports be produced in a comparable way. Since the important ingredient necessary to satisfy the basic requirements is the linking of such data to hospital productivity, this system concentrates on this aspect and deals with the critical tasks of: (i) design of a data interface between each institution and central authority; (ii) assurance that the capability for audit exists for each institution; (iii) capture of patient clinical and charging data; (iv) linkage of patient and financial data; (v) provision for uniform, consistent performance analysis; (vi) reports necessary to utilization review and quality assessment; (vii) budgetary analysis and control; (viii) rate-making capability compatible with the needs of hospitals, third-party payers, and the regulatory agency.

For those hospitals which subscribe to either PAS or HUP and thus produce machinable abstracts for patient data, the system requires the appropriate interface with these existing systems. For those that do not, an alternative similar to that which has been installed elsewhere (18) could be used. Finally, special adaptations would be needed to accommodate special hospitals such as chronic and extended care facilities. These adaptations would be simple in structure reflecting the more limited case mix of such facilities as well as their relatively low discharge activity.

IV. OVERVIEW OF SYSTEM DESIGN

The basic premise which underlies the system described in this proposal can be stated as follows:
To relate utilization with both cost and quality of care, it is necessary that measures of the patient care processes employed in each hospital be linked directly to the cost of providing services. Patient care processes must be defined in medically meaningful terms while cost of service is subject to a set of well-defined accounting procedures. Only by linking these two separate processes can costs be brought under control consonant with
quality of care delivered. The quality of care delivered is a function of medical judgment concerning the patient care process, while costs are related via the accounting process to the organizational units for which they are incurred.

Each hospital's "output" is defined in terms of the unique classes of patients with which it deals. The system envisaged here classifies patients according to clinical attributes for which well-defined patient management processes exist. Each patient class is then described in terms of the hospital services and resources consumed in patient care, and these are related directly to the costs of providing these resources and services as defined by the accounting system. Thus, the cost of each case of hospital utilization is used as the basic building block for measurement of hospital utilization and performance and is the basis for comparison and evaluation of such performance. Further, through such information, each hospital as well as the regulatory agency is provided with the basic information needed to initiate and carry forward the process of utilization review and quality assessment.

Only by linking patient data with the accounting system can these objectives be accomplished. An overview of the proposed system illustrating these linkages as well as outlining its capabilities is presented in Section V.

The system includes the following components and capabilities: a uniform accounting and reporting system providing standard data to the regulatory agency on costs and budgets; a set of processes for capturing patient abstracts and charges as inputs to a central statistical system; a system to generate uniform financial reports and budget analysis; a classification and reporting system to provide individual and comparative measures of hospital performance and utilization; a system to provide information to hospitals and regulatory agencies to aid in evaluation of quality of care; an information and reporting system to support a basic rate setting and reimbursement capability equitable to consumers, providers, and third-party payers.

It is divided into an in-hospital component and a centralized, state, or regional component. In addition, it may be viewed as consisting of two subsystems at each level. The first consists of the budgeting and accounting processes within each hospital, the central system for gathering and reporting this information and producing uniform financial statements, the analysis of individual hospital performance, and provision for audit of accounting procedures and results.

The second and primary subsystem is that which provides for the capture of patient data including a chart abstract as well as charge data, the merging of these records, and their assignment to patient classes. Based on these medically meaningful classes, the system links to the accounting system through resource use and to utilization and quality of care review through care criteria and resource requirement standards. In this manner, professional inputs to the process can be obtained and used while at the same time providing for comparison of the outcome of defined patient management processes among all institutions which treat each class of patients. It does no good to compare costs of service by department if the mix of cases is different. One must adjust departmental costs by type of cases served in order to judge cost effectiveness and provide a sound basis for rate setting. At the same time such a system can provide the basis for establishing an incentive structure which relates cost performance to patient care processes through the implementation of the "case-cost" concept.

V. SYSTEM DESCRIPTION

The system which is proposed is shown in outline form in Fig. 2. The left part of the figure includes hospital functions while the right gives those accomplished at the
FIG. 2. System components and work flow.
state or regional level. The upper part describes the accounting and budgeting processes while the lower section deals with the patient data linkages necessary to understand and control utilization and costs. It is this linkage which in our view is essential to the determination of rates in a setting equitable to both providers and consumers.

The accounting subsystem requires the preparation of input data by each hospital on forms provided by the central agency for that purpose but similar to those, for example, provided by the Connecticut Hospital Association (19). We intend to utilize to the fullest possible extent existing systems and procedures in hospitals as long as these are compatible with the requirements of the central system. In each case, one must develop an appropriate interface capability to cause minimum necessary extra burden on individual hospitals. The same philosophy will be employed in producing budget inputs although here one must design a capability which can be adapted as required by each hospital. This system includes a process by which a forecasting method is linked to rates, utilization data, and past budget analyses to provide inputs to each new budget produced.

Data submitted to the central agency are processed in three ways. First, uniform financial statements are prepared; second, budget performance is analyzed relative to these accounting measures; and, third, the relationship of charges to actual costs are determined as an input to the utilization subsystem. Financial reporting capability and budget analysis are provided for individual hospitals, sets of hospitals comparable on services produced, and, in fact, any grouping considered reasonable and desirable.

The patient data processes of each hospital will be used to the extent possible in providing statistical inputs to the system. The data abstracts of both PAS and HUP would be fully compatible with the system. Where possible and appropriate, the necessary interface with existing data processing systems for these inputs will have to be provided. The same situation obtains for the capture of patient charge data and, since PAS and HUP do not provide the necessary detailed capability, some existing systems can be adapted to the needs of this system.

At the state or regional level, statistical patient and charge data will be loaded and merged to provide the patient data file shown. It should be remarked at this point that, unless the central agency wishes otherwise, this file will be purely statistical and contain no individual patient identification. Such identification will only be retained at the hospital level as at present.

A historical file of these data will be produced as an extract of this file and will be used for patient classification to produce a file of group definitions by hospital, by hospital class, and for the region; a file of resource requirements by patient class and by hospital; and to provide input to the utilization review subsystem if this component is included.

As new patient data enter the system, the grouping procedure will assign each record to a group and compare the hospital’s performance with the expected performance based on those hospitals which treat that class of patients and are similar in services available. Group variances will be used to modify group definitions as causes can be determined (e.g., changes in treatment, new procedures used, improvement in resource availability, and the like).

A file describing current group statistics for each patient class will be produced as input to the budget analysis process in the financial reporting subsystem, the screening process in the utilization review subsystem, and the analysis of resource use
process. This latter process relates the patient data with accounting data to produce each hospital's performance in terms of the cost of producing the care required by each patient group. Since a patient group is distinctive in its care requirements, differences in case mix as reflected in the proportional representation of each group in each hospital can be associated with cost differences. In this way, hospital performance can be determined as a function of its use of resources for the unique set of patients which it serves.

To reflect fairly the differences in the availability of resources among hospitals, professional inputs are required in building the resource requirements file. The analysis of historical data may reveal a somewhat different pattern of resources consumed for the same patient class in different hospitals. A hospital's own performance may be consistent in this regard but judged favorable or unfavorable with respect to other institutions. Professional judgment will have to be invoked at this point to rationalize such differences in terms of institutional capability and standards. The important point here is that the central agency has comparative data which permit review and justification at each institution.

The result of comparison of resource requirements with resource use is a set of measures of hospital performance capable of producing the required utilization reports by hospital and comparing hospitals and groups of hospitals. Such measures must be viewed in an adaptive manner as it is to be expected that review and feedback of results will produce, over time, alterations in behavior. Thus, the hospital performance measures file is shown as deriving from both experience and judgment but requiring actual data for verification and/or change.

The performance and utilization reports will serve two basic purposes of this system in addition to providing feedback to the hospitals. First, such information is an essential input to the rate-setting process. The analysis of performance against budget provides one kind of input, but any variances must be accounted for in terms of performance differences as reflected by changes in the inputs to the central patient information system. Justification for alterations in rates cannot be obtained solely on budgetary grounds. The budget variances must be explained in terms of the services delivered to each unique class of patients.

Finally, such information can provide the basis for an incentive system in which favorable variances due to improved performance for particular classes of patients could inure in part to the institution. We believe that the basis for some reasonable incentive policy will derive from this system and consider such a structure important if the state or region is to obtain maximum benefits from its use.

VI. CONCLUSIONS AND RECOMMENDATIONS

We believe that the control of the processes of patient care in terms of quality and cost are inextricably linked and rest upon understanding the patient management process as it is applied appropriately to unique classes of patients. It is not sufficient to deal with utilization review and quality of care as a process separable from the expenditure of manpower, facilities, and equipment in delivering that care. The system envisaged here attempts to establish and use the essential link on a macro level in approaching the problem of controlling such resource consumption according to medically meaningful criteria.

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