Management Services: A Magazine of Planning, Systems, and Controls

Volume 6 | Number 5 Article 4

9-1969

Single Information Flow System for Hospital Data Processing

Belverd Needles Jr.

The single information flow system—as compared with the total systems approach—depends on all data being located in one integrated file to meet all demands. Here's a study of how it might work in a hospital to meet a wide variety of demands—

A SINGLE INFORMATION FLOW SYSTEM FOR HOSPITAL DATA PROCESSING

by Belverd Needles, Jr.
Texas Technological College

MANY DATA processing specialists believe that the single information flow approach to EDP will be the method of the future.[1] Under this approach parallel data processing systems arranged in series would be replaced by a single coordinated system. The object would be to create a complete information pool—rather than specialized pools—from which management could retrieve desired information economically.

This article reports the results of a study[2] of the applicability of the single information flow concept to hospitals—specifically to short-term general hospitals. In order to see whether a general hospital information system could be designed on this basis, the author, first, developed criteria and information requirements for a single information flow system; second, analyzed each function of a short-term general hospital on the basis of these criteria; and, third, conducted intensive studies of two medium-size to large hospitals, interviewing the people representing each function in depth.

The overall conclusion of the study was that the single information flow concept can be applied to hospitals—with certain modifications. The general hospital information system developed as a re-

[1] For example, see A. L. Baumann, Jr., "Single Information Flow Philosophy," *Data Processing Year Book*, American Data Processing Inc., Detroit, 1963; H. B. Joplin, "The Accountant's Role in Management Information Systems," *Journal of Accountancy*, March, 1966; A. F. Moravec, "Basic Concepts for Planning Advanced EDP Systems," *Management Services*, May-June, 1965; and Richard E. Sprague, *Electronic Business Systems*, Ronald Press, New York, 1962.

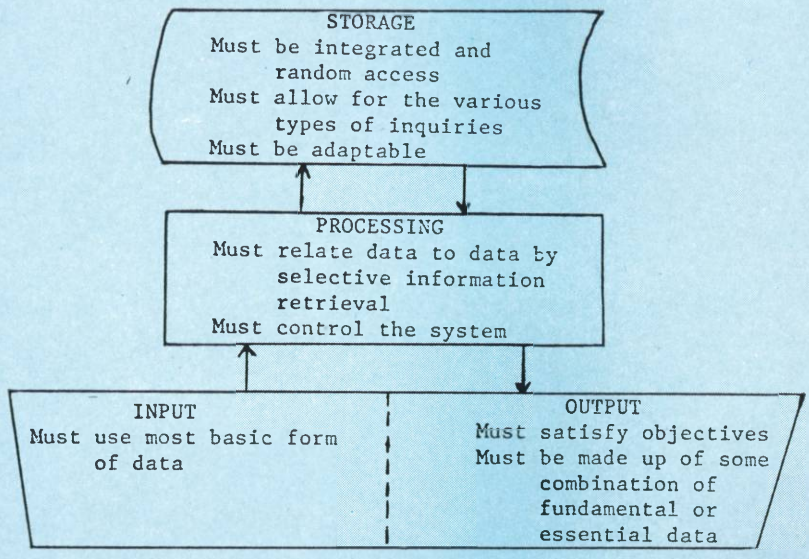
[2] The author is indebted to the American Hospital Association, Chicago, Illinois, for the financial support of the study on which this article is based. However, the conclusions are the author's own and do not represent actual or implied positions of the American Hospital Association.

sult of the study utilizes a single integrated data store for the system as a whole. Not all input to and output from the system needs to be on line, however. On line input and output are desirable for the portion of the system that deals directly with patient billing records. Certain other functions, such as payroll and purchasing, can be handled by supporting systems since it was found that in these areas the cost of on line communication and processing was not justified by timeliness requirements.

The model hospital information system that resulted from this study is described in detail in this article.

EXHIBIT I

Requirements of the Basic Elements Under the Single Information Flow Concept



Single information flow

The single information flow concept of data processing contrasts sharply with the older total systems approach. In the total systems approach the final goal is the application of automated data processing to a conventional accounting system; that is, major functions such as payroll, inventory control, trial balance preparation, and production control are treated as subsystems with separate data files and scheduling.[3]

In a single information flow system all information essential to the conduct of the business would be part of a single, completely interdependent information flow. The shift in thinking of data processing systems designers from the total systems approach to the single information flow concept represents a trend "from the mechanization of mere data handling towards a complete integration of all major information systems within a company into a single operating system."[4]

The goal is to enter a single piece of information into the data processing system only once in its history; from then on it is available to serve all requirements until its usefulness is exhausted.[5] The key to this type of system is a basic understanding of how information is going to be used. Information should be stored in such a way that the relevant—and only the relevant—data can be retrieved in a timely manner when needed.

Distinction between approaches

Success in the single information flow approach requires understanding and acceptance of the basic conceptual difference between it and the total systems approach. This basic difference lies in the relationships among the data in the files. In the total systems approach the files are independent. In the single information flow approach, however, all data in all "files" are so interdependent that separate files do not exist. There is a single large integrated file.

Because of this interdependency of all data, the system must provide for selective information retrieval. It must include random access storage for efficient retrieval of any necessary combination of data. In the total systems approach data in each file are originally arranged in the way that will facilitate preparation of the reports required for each function. In the single information flow approach the same piece of data may be related to several completely different sets of data in different ways. The system must satisfy these different requirements while preserving the integrity of the data.

The requirements of the various elements of the single information flow system—output, input, processing, and storage—are presented in Exhibit 1 above.

Output requirements

Every system is designed for a purpose. The starting place for the design of a system, therefore, is a statement of the objectives or goals of the system. The output of the system should aid in meeting these objectives. Several basic questions must be answered in the design of any system: What information do the various members of the organization need? Why do they need this information? How do

[3] For a more thorough discussion of the characteristics and merits of the two approaches see Moravec, *op. cit.*

[4] L. G. Ifft, "Integration of Data Processing and Its Impact on Accounting," *Management Accounting*, September, 1962, p. 19.

[5] Moravec, *op. cit.*, p. 53.

they expect to use the information?

There is a constraint that limits the absolute amount of data that can be entered into a single information flow system: The system should accept and process only fundamental data which are necessary for the operation of the organization. Secondary data desired by some department must be processed off line. This limit on the amount of data that can enter the system also places a limit on the output. Thus, it is necessary to have some criteria for determining which of the possible outputs related to a certain objective are actually essential. The choice of outputs, in turn, will determine the fundamental inputs necessary to produce those outputs.

Input

The basic requirement in planning the input for the system is that the data must enter the system in their most basic form. This is important in determining the sources of the data and in permitting the use of these data in all ways desired. For instance, the average length of a patient's stay in the hospital would not be entered directly into the system because its components, number of patient days and number of inpatient discharges, are also used in the computation of other indicators such as gross patient revenue and operating expenses per patient day. In addition, these component items may be needed for still other reports without being combined with other measures.

BELVERD E. NEEDLES, Jr., CPA, is an assistant professor of accounting at Texas Technical University. He received both his BBA and his MBA from Texas Technical University, and was awarded his doctorate by the University of Illinois. He has won the manuscript contest conducted by the Illinois National Association of Accountants twice. Mr. Needles was formerly a member of the research staff of the American Hospital Association.

Basically, the data processing function relates pieces of data to each other with the goal of producing the desired output. The data must be integrated in such a way that an efficient way of addressing and retrieving data can be established. Through this process of relating pieces of data to each other, the processing function relates input to output, source to use.

Processing and storage

In order to accomplish its objective, the processing function must have control over its system. Proper controls, including adequate software, ensure that information is delivered when needed in the horizontal distribution to the various departments and that effective feedback is accomplished by filtered vertical distribution of information by exception reports to the proper levels of management. The system should be adaptable to changes in conditions that affect information needs.

In the actual integrating of the essential data the system designer must recognize the needs of the processing function. He also must take into account the interrelationships of the data and the various types of situations in which they might be retrieved, such as for routine reports, specific inquiries, reaction or control reports, and solving of special problems. In setting up the file organization he must consider the need for future expansion of the data store, the need for remembering or forgetting of data, the need for updating of certain accounts, and the need for handling of reports that contain the same information but cover different fiscal periods.

Three steps are required to develop a system which meets the stated requirements. First, the specific output data requirements must be stated. Second, the inputs or data necessary to produce the output must be established. Finally, the output and input characteristics must be described. When these steps have been completed the system designer will have sufficient information for developing a data file and for designing a general system that will generate data for entry into the file.

Included in the system developed in this study as output requirements for the typical hospital were individual insurance reports, Medicare cost reports, other insurance reports such as those for Blue Cross and commercial insurance, internal reports, financial statements, budgeting requirements, and medical records. Also included in the study were the hospital data sharing plans of Hospital Administrative Services, Cost Allocation Program, and Professional Activity Study.[6]

Output characteristics

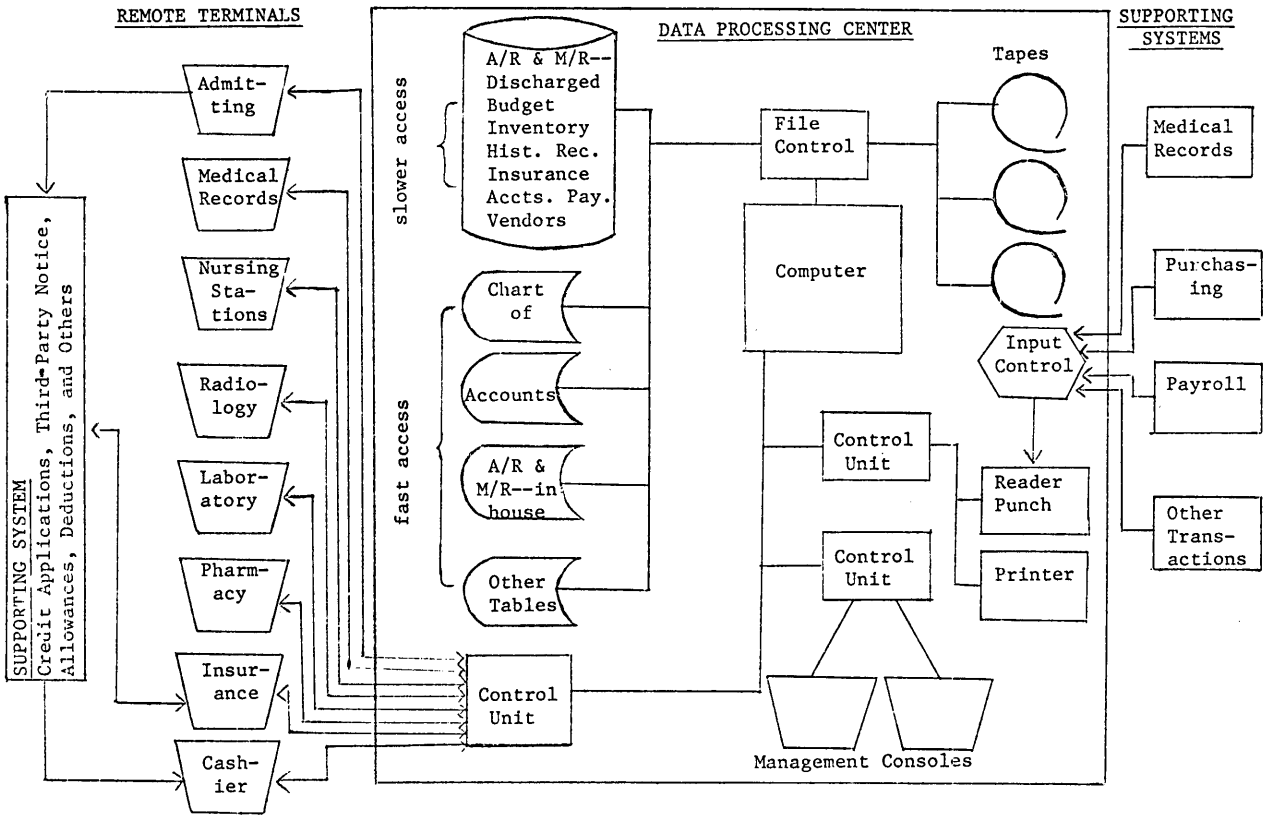
Five categories of characteristics were considered in examining these reports and their data requirements. First, the reasons for the output were considered. In most cases, in this study, the objectives of the output were determined by the authority requesting it. Second, the nature and special characteristics of the output were considered. This category includes all characteristics not specifically covered in the other categories. Examples are the form of presentation required for the output, the relationships among a particular output and other outputs, and an indication of how long and in what form the data should be held.

Third, the response times needed by various functions were studied. Response time is the time a system takes to respond to a given inquiry, that is, the interval between an event and the system's response to that event. The decision to use data transmission links

[6] Hospital Administrative Services and Cost Allocation Program are services of the American Hospital Association; they deal with cost, revenue, and statistical information. The Professional Activity Study is a service of the Commission on Professional and Hospital Activities, Ann Arbor, Michigan; it deals with medical records data.

EXHIBIT 2

General Hospital Information System



was made because of the response time required. Similarly, a decision to use random access file units is often the result of the need to maximize the difference between the value and cost of the required response time.

Possible response times can be divided into six categories:[7]

Immediate – Systems controlling a technical process may need to give a very fast response to certain events. It is unlikely that this type of response will be needed in a hospital system.

Conversational—In this case, the response time must be geared to human reaction time. This response time and the next type of response time listed are the types most often required in a hospital system where terminal units are used.

As soon as convenient—Transactions from terminals which may need to be processed quickly, within minutes or seconds if possible, but are not geared to the speed of a human conversation fall in this category.

Deferred, on line—Jobs from the computer room and/or from distant terminals which can wait in a queue of jobs to be processed in an on line manner on a priority basis are in this category.

Within one day—This classification is for jobs which must be done on a daily basis.

Long-time available – Functions which have no urgency and can take place in a weekly, or longer, batch cycle are in this category.

The fourth and fifth characteristics are the number of output requests per time period and the timing and frequency of the output requests. These characteristics together with the input characteristics aid in determining the features of the system and in estimating the load that will be placed on the system at given times.

Input characteristics

Several input characteristics are important in the single information flow system. The first set of characteristics arises out of the source of the information. The source is the place in the organization where a basic component of information originates through an event or transaction. The event does not have to be financial in nature but can be statistical, as when laundry arrives to be processed and cleaned at the laundry department. Once the source is determined, relevant characteristics should be specified such as how the data are generated, what people are involved, under what conditions the event occurs, and what unique circumstances are present.

The second set of characteristics may be classified under document

[7] For a more complete discussion of these response times see James Martin, *Design of Real-Time Computer Systems*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1967, pp. 43-44.

information. Basically, documents are pieces of memory or data storage for an organization. These pieces of memory can be transferred to relevant people within the organization by routing the documents. The significant characteristics of a document are the data on it and the flow of those data within the organization. The use of documents and the flow of data in many cases will be greatly changed with the single information flow system because of the use of on line communication. These characteristics, when considered with the respective output characteristics, determine the load requirements of the system; when considered with the first two input characteristics, they aid in making such decisions as where input/output terminals should be located and how the supporting systems should be designed.

General system design

The system developed as part of this study is presented in Exhibit 2 on page 30. It consists of remote terminals, supporting systems, and a data processing center containing a single, unified data store set up under a plan that integrates the various information needs of hospitals. It is a summary-level system in that it is meant to be general enough to be applicable to any short-term general hospital, and it is a system designed to be as flexible as possible. The system departs from the single information flow model in that some of the data, those not related directly to patient charging and billing, enter the system through supporting systems rather than through remote terminals. The data storage file, however, is integrated and has a random access configuration.

Input/Output terminals

Remote terminals are located at the admitting office, at the cashier's office, in the medical records department, and at places where charges arise such as nursing stations and professional services departments. The functional analysis indicated that at least a minimum of medical care information (i.e., admitting and current diagnoses, surgical procedures, and discharge date) should be in the patient accounts for insurance purposes. A hospital that incorporates only these minimum requirements into the accounting records might eliminate the medical records terminal and enter this information through nursing station terminals. On the other hand, a hospital might elect to enter the complete medical record of each patient in the form of a case abstract into the accounts. Input terminals in the medical records department would then be essential.

The admitting, cashier, and insurance consoles are directly involved with the accounts receivable and billing procedures. Bed control and patient location are controlled through the admitting terminal. Therefore these terminals should have output capabilities. Admitting personnel must be able to retrieve information concerning patient accounts, and bed control is reported as an output at this terminal. The nursing stations and professional services departments enter daily census data, any charges for services rendered to the patients on the floors or in the departments, and possibly medical care data as mentioned earlier.

The management consoles are essential to realizing the full value of the system and especially of the data storage file. These terminals can be located in such positions as the administrator's office and controller's office as well as the data processing center. They allow management to have direct access to the hospital's records in order to request specific predetermined and programed reports, to make specific inquiries, and to study relationships among various groups of data for such purposes as making budget versus actual comparisons.

The terminals specified here are the minimum required to operate the system; some hospitals may want terminals in other locations as well. The specific capabilities of each terminal, however, must be determined by each hospital to meet its own needs and to fit the environment at the place of installation.[8]

Supporting systems

The proposed system has supporting systems which embrace the following areas:

1. Medical records
2. Purchasing
3. Payroll
4. Other transactions
5. Credit applications, third-party notifications, deductions, and others.

Basically, the purpose of the supporting systems is to route information concerning events, transactions, and the hospital's operations into the data processing center, where they can be entered into data storage. They may also be used to route documents outside the hospital. For instance, the purchasing system sends requisitions and checks to suppliers, and the employees are paid through the payroll system. Intermediaries are notified and confirmations of coverages are received from them through the subsystem that includes third-party notification.

These supporting systems cover hospital information that can be delayed long enough to be processed in the data processing center, thus economizing on costs of hardware, software, and personnel. The supporting system involving credit and insurance is an exception in that it is closely tied to the on line portion of the general system. The purpose of this supporting system is to process the bills

[8] For a summary of experimental systems and terminals in eight hospitals see Arthur E. Rikli, Scott I. Allen, and Samuel N. Alexander, "Study Suggests Value of Shared Computers," *The Modern Hospital*, May, 1966, pp. 100-108. Also see Robert M. Smith, "Better Patient Care—Through Electronics," *Management Services*, May-June, 1968, pp. 52-57.

of patients who have insurance. The hospital should develop classifications of patient status—Medicare, Blue Cross, other insurance, self-pay, or other and eligibility for policy discounts, charity discounts, or any other allowances—so that the admitting personnel can recognize and classify each case at the time of admission. When a patient with insurance is admitted, the admitting personnel will enter the information necessary for preparing a notification of admission for the Social Security Administration, Blue Cross, or other intermediary. The computer will print out this information for the insurance personnel, who will then forward the notice to the proper intermediary. Once the confirmations of insurance benefits have been returned, the specific details will be entered through the insurance terminal unit into the patient's record to be retrieved for billing purposes when the patient is discharged or is billed on an interim basis. It is possible that some time in the future direct communication with the intermediaries may supplant the third party notification part of this system.

The payroll, purchasing (including the inventory system), and other transaction-supporting systems will be available through random access retrieval as soon as they have been entered into storage.

The first phase of the medical records supporting system is relatively standard for most hospitals. The necessary forms are prepared by the admitting office upon admission and go with the patient throughout his stay in the hospital. When he is discharged, the completed set of forms is routed to medical records. Normally, the final diagnosis and other final entries are recorded by the doctor after the forms have reached the library. If the medical records are to be integrated into the data storage plan of the general system, the forms, once completed and sent to medical records, must be coded by

EXHIBIT 3

The General Plan for the Chart of Accounts for Hospitals

A. Overall Numbering System

110-199 Assets
- 110-114 Operating Fund
- 120-122 Specific Purpose Fund
- 130-132 Endowment Fund
- 140-146 Plant Fund
- 150-155 Construction Fund
- 160-199 Other Funds

217-299 Liabilities
- 217 Operating Fund
- 227 Specific Purpose Fund
- 237-238 Endowment Fund
- 247-248 Plant Fund
- 257-258 Construction Fund
- 267-299 Other Funds

219-299 Capital Accounts
- 219 Operating Fund
- 229 Special Purpose Fund
- 239 Endowment Fund
- 249 Plant Fund
- 259 Construction Fund
- 269-299 Other Funds

310-599 Revenue Accounts
- 313-359 Revenue from Patient Services
- 360-399 Revenue from Other Nursing Services
- 402-499 Revenue from Other Services
- 500-539 Deductions from Revenue
- 540-599 Other Revenue

600-999 Expense Accounts
- 600-699 Patient Services
- 700-799 Other Professional Services
- 800-899 Other Services
- 900-979 Fiscal and Administrative Services
- 980-999 Unassigned Expenses

B. Further Subclassification of Balance Sheet Accounts

Third Digit
- 0 Cash
- 1 Investments
- 2 Receivables
- 3 Inventories
- 4 Prepaid Expenses
- 5 Land, Buildings, and Equipment
- 6 Accumulated Depreciation
- 7 Current Liabilities
- 8 Non-Current Liabilities
- 9 Fund Balance

C. Further Subclassification of Revenue and Expense Accounts

- 310-359 Revenue from Patient Services
- 310-339 Medical, Surgical, and Pediatric
- 340-342 Intensive Care
- 343-345 Psychiatric
- 346-349 Newborn and Premature Nurseries

360-399 Revenue from Other Nursing Services
- 360-364 Operating Rooms
- 365-369 Recovery Rooms
- 370-374 Delivery and Labor Rooms
- 375-376 Central Services and Supply
- 377 Intravenous Therapy
- 378-379 Emergency
- 380-389 Other

402-499 Revenue from Other Services
- 402-409 Laboratory
- 410 Blood Bank
- 411 Whole Blood
- 412-413 Electrocardiograph
- 414 Electroencephalograph
- 421-429 Radiology
- 430-434 Pharmacy
- 435 Anesthesiology
- 436 Inhalation Therapy
- 437 Physical Therapy
- 438 Occupational Therapy
- 440-469 Other (e.g. Recreational Therapy, Home Health Care, and Social Service)
- 480-489 Clinics

EXHIBIT 3 (Cont.)

500-539 Deductions from Revenue
- 500-509 Contractual Adjustments
- 510-519 Policy Discounts
- 520-528 Charity Discounts
- 529 Bad Debts
- 530-539 Other (Including Administrative Adjustments)

540-599 Other Revenues
- 540 Tuition
- 541 Telephone
- 542 Meals
- 543 Rooms
- 544 Miscellaneous Supplies Sold
- 545 Purchase Discounts
- 546 Miscellaneous Operating
- 547 Contributions and Grants
- 548 Patient Surcharge or Equalization Charge
- 550-554 Miscellaneous Non-Operating

600-699 Patient Service Expense
- 600-609 Nursing Administration
- 610-639 Medical, Surgical, and Pediatric Nursing Units
- 640-642 Intensive Care Nursing Units
- 643-645 Phychiatric Nursing Units
- 646-649 Newborn and Premature Nursing Units
- 660-664 Operating Rooms
- 665-669 Recovery Rooms
- 670-674 Delivery and Labor Rooms
- 675-676 Central Service and Supply
- 677 Intravenous Therapy
- 678-679 Emergency Service
- 685-699 Nursing Education and Other

702-799 Other Professional Services Expense
- 702-709 Laboratory
- 710 Blood Bank
- 711 Whole Blood
- 712-713 Electrocardiograph
- 714 Electroencephalograph
- 721-729 Radiology
- 730-734 Pharmacy
- 735 Anesthesiology
- 736 Inhalation Therapy
- 737 Physical Therapy
- 738 Occupational Therapy
- 740 Social Service
- 741-769 Other (e.g. Recreational Therapy and Home Health Care)
- 770-772 Medical Services and Staff
- 773-776 Medical Records and Library
- 777-779 Research
- 780-789 Clinics

800-979 Other Services Expense
- 800-829 Dietary
- 830-849 Plant and Equipment
- 850-859 Housekeeping
- 860-869 Laundry and Linen
- 870-879 Personnel Quarters
- 900-979 Administration and General (e.g. Accounting, Admitting, Cashiering, Credits and Collections, Data Processing, Receiving and Stores, Executive Office, Personnel, and Purchasing)

980-999 Unassigned Expenses
- 980-982 Depreciation—Building
- 983-985 Depreciation—Equipment
- 986-989 Insurance
- 990-991 Taxes
- 992-993 Employee Benefits
- 994 Interest
- 995 Loss on Disposal of Fixed Assets
- 996-999 Rentals of Land and Buildings

Adapted from *Chart of Accounts for Hospitals* (American Hospital Association, Chicago, 1966).

a trained librarian in a manner suitable for input.

The exact make-up of the data storage area depends on the specific equipment used as well as on the programing techniques employed. This was not included in the study.[9] However, some generalizations can be offered concerning the type of storage in which various groups of data should be contained and the relationships among the groups of data.

Remote, on line terminals are placed in the functional areas whose operations require response times in the conversational or as-soon-as-convenient categories. The data files for these functions must, therefore, be arranged in random access files for rapid retrieval. The following groups of data should be retrievable with a conversational response time:

1. Chart of accounts for the current fiscal period
2. In-house accounts receivable subsidiary file
3. Charge tables
4. Medical records for in-house patients.

Undoubtedly, there are accounts that do not have a high activity level but do not demand enough storage space to justify splitting the chart of accounts among different types of storage. Revenue accounts, cash, the in-house accounts receivable subsidiary file, and the charge tables all interact in the on line portion of the system. Medical records, if they are included in the random access part of the system, should be associated with the in-house accounts receivable subsidiary file, as should bed control and patient location.

Slower random access on an as-soon-as-convenient basis is required by the following categories of data:

1. Accounts receivable subsidiary file for patients who are discharged but have not paid

[9] For a detailed discussion of this subject see James Martin, *op. cit.*, pp. 485-510.

2. Medical records for discharged patients
3. Operating budget
4. Historical records
5. Insurance coverage files
6. Accounts payable subsidiary file
7. Inventories
8. Other files as needed, such as list of vendors.

A hospital may find it desirable to put the insurance coverage table in the faster-access-storage group, particularly if there are many random inquiries or requests for data in these tables where a conversational response time is desirable. In this system these insurance tables are placed in slower storage because it is assumed that there will be some warning in the form of a discharge notice when a patient is to be discharged. Thus, the coverages for a particular patient can be retrieved from the insurance tables based on the code in his account at the time the discharge notice is received from the nursing station, and the patient's bill can be ready when the patient or person paying the bill reaches the cashier.

Data storage plan

The overall classification scheme—The chart of accounts developed in this study is based on the American Hospital Association's *Chart of Accounts for Hospitals,* already in use in many hospitals. This structure of accounts can be adapted to the needs of this system by means of subclassifications. The general plan of the chart of accounts for hospitals is presented in Exhibit 3 on pages 32 and 33.

Subclassifications—The subclassification of accounts is represented by the fourth and fifth digits of the account number, i.e., the two digits in the tenths and hundredths positions, and is the focal point for determining the basic form in which the data will be in storage.

An important issue is the handling of statistical measures. Hospital statistics, in general, can be divided into two broad groups, operating statistics and allocative statistics. Both types were considered essential to hospital management by those interviewed in the study. The primary purpose of operating statistics is to show a level of activity and thus serve as a gauge of efficiency. Allocative statistics, on the other hand, serve as the basis for allocation of the cost of service departments to revenue departments for cost finding purposes. Exhibit 4 on this page contains a list of the statistics which the study revealed were essential to a short-term general hospital and of the department(s) with which they are associated.

A reasonable way to provide for storage and retrieval of these statistics is by the use of subclassifications of the operating accounts. For revenue accounts, the following subclassifications resulted from the study:

Fourth Digit

.0-.1 Inpatient
.2-.3 Outpatient
.4-.5 Inpatient Statistics
.6-.7 Outpatient Statistics

Fifth Digit

.x1 Self-Pay
.x2 Blue Cross
.x3 Medicare
.x4 Title 19
.x5 Other Welfare
.x6 Workmen's Compensation
.x7 Commercial Insurance
.x8-.19 Others

To illustrate how this classification works, consider the account

EXHIBIT 4

Hospital Statistics and Departments To Which They are Relevant

Operating Statistics

Statistic	Department(s)
Admissions	Patient Services
Discharges	Patient Services
Total Patient Days of Care	Patient Services
Beds	Patient Services
Deliveries	Delivery Room
Newborn Patient Days	Nursery
Bassinets	Nursery
Number of Meals Served	Dietary
Pounds of Laundry	Laundry
Number of Surgical Operations	Operating Room
Radiology Examinations	Radiology
Laboratory Tests	Laboratory
Outpatient Visits	Outpatient
Manhours	For Each Department

Allocative Statistics

Statistic	Departmental or Other Cost Which is to be Allocated
Number of Meals Served	Dietary
Pounds of Laundry	Laundry
Actual Depreciation of Building and Fixed Equipment	Depreciation Expense
Dollar Value or Depreciation of Equipment	Depreciation Expense
Square Footage of Departments	Housekeeping (if hours are not used) Depreciation (if above is not used)
Housekeeping Hours of Service	Housekeeping
Number of Personnel Housed	Housing Facilities
Medical Records Hours of Service	Medical Records
Social Service Hours of Service	Social Service
Nursing Education Hours of Service	Nursing Education
Intern-Resident Hours of Service	Intern-Resident Costs
Requisitions	Central Services and Supply
Pharmacy Costed Requisitions	Pharmacy
Nursing Service Manhours	Nursing Services

number 320.03. This is a revenue account (first digit) for a medical, surgical, or pediatric unit (second and third digits). It represents an inpatient (fourth digit) who has Medicare benefits (fifth digit). The corresponding statistic, Medicare inpatient days, for this account would be found in the account numbered 320.43.

The subclassifications for the fourth digit of the expense accounts are as follows:

.0 Salaries and Wages
.1 Other Direct Expense
.2-.5 Manhours
.6-.7 Other Statistics.

These accounts are subdivided further as follows:

Salaries and Wages
.01 Regular
.02 Paid—Not Worked
.03 Overtime
.04 Fees—Physician

Other Direct Expense
.11 Supplies—Billable
.12 Supplies—Non-Billable
.13 Services Purchased

Manhours
.20-.39 Productive
.40 Paid—Not Worked

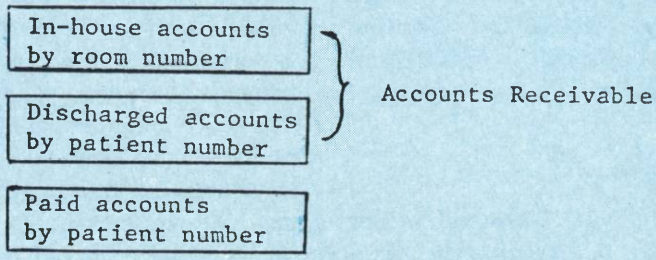
Other Statistics
.60-.79 By Department Served.

When the salaries and wages computations for the pay period are made, the amounts paid and the manhours are posted to the proper accounts by the computer. Some hospitals may want to assign employee benefits such as social security to specific cost centers instead of using an account in the unassigned expenses (992-995), as is done in this classification scheme. In that case, the suggested subclassification can be expanded by using the digits that have not been designated. Similarly, the other direct expense category can be expanded if the hospital desires. The billable supplies account should represent a cost of goods sold.

The twenty positions for the productive manhours category permit the manhours worked to be subdivided by department served in those cases such as housekeeping where allocations are made by the number of hours of service. The same is true of the other statistics accounts, for example, if the number of personnel housed is needed for allocating the personnel quarters expense. Often the other statistics category will not be needed because the statistics are located elsewhere in the system. For instance, the number of laboratory tests is needed, but the statistic is already accumulated by various breakdowns in connection with the related revenue account. In the computation of a productivity figure such as salaries and wages expense per laboratory test, the application programs should retrieve the number of laboratory tests from the revenue accounts.

EXHIBIT 5

Patient Records



Subsidiary accounts

A suitable structure for the patient records subsidiary file is shown in Exhibit 5 above.

The in-house accounts receivable subsidiary file is an integral part of the on line system and should be kept in random access storage with a conversational response time. Discharged patients, on the other hand, do not require the fastest and most expensive storage because the level of activity is not as high as for in-house accounts.

Furthermore, many accounts will be paid by check and thus can be handled on an as-soon-as-convenient basis. The accounts for patients who have paid should be put in less costly magnetic tape storage.

The in-house accounts receivable subsidiary file should be stored by bed number to make it easy to tie in bed control with this file; this also will make it easier to request information from a patient's account because normally the bed number would already be known by the person making the request. The file for discharged patients, however, should be based on the patient number because the bed number is no longer relevant after the patient has been discharged. Whether the hospital should maintain separate subsidiary files for each control account, i.e., Medicare, Blue Cross, self-pay, and other, or whether it should use a comprehensive file with codes in the individual accounts for the four subclassifications is a matter of choice; either procedure can be used.

A large amount of information must be accumulated about each patient. Exhibit 6 on page 36 summarizes the essential data for each patient account in the subsidiary files. Creditworthiness information is not included in the list because of the high percentage of patients who have insurance. When it is needed, this type of information can be handled off line.

The subsidiary files for accounts payable, plant and equipment, inventory, and other accounts are essentially similar to those needed by any business enterprise and thus are not discussed here.

The account classifications that

have been presented are suited to the task of accumulating data from day-to-day operations. A hospital may wish to extend the integrated storage plan to include the areas of medical records, the operating budget, historical records, and other accounts.

Medical records

If the individual hospital wishes to integrate into the system medical care data beyond those which must be available for insurance purposes, these data can be combined with the accounts receivable subsidiary ledger. This avoids redundancy in storage because services can be recorded both for billing purposes and for medical records purposes. For example, when a chest or respiratory X-ray is performed, it is entered into the patient's account together with the charge. When the patient's bill is prepared, the X-ray will be shown. If a doctor inquires what X-rays the patient has had, the same data will be retrieved without the charge.

The storage problem is complicated by the fact that any time a patient re-enters the hospital his previous medical records must be retrieved. It is not feasible to keep the records for discharged patients in random access storage because of their quantity and the low level of activity for these records as a whole. The hospital may wish to enter each patient's record on punch cards or magnetic cards or tape at the time of discharge. The past record could then be re-entered into the patient's current file if necessary.

Operating budget

The general design of the system calls for the operating budget to be kept in random access storage with a response time of as-soon-as-convenient. In order that both volume and efficiency variances can be determined by management, the projections shown in Exhibit 7 on page 37 should be stored on a monthly basis by department.

Projected totals are stored rather than rates because the inclusion of the level of activity makes it possible to compute either the projected rate or the projected total if the other is known.

The classification scheme displayed earlier can be used for storing the budget. Since the budget projections are made for each month of the fiscal year, provision must be made for storing twelve figures for each account number in order to indicate the month. An account in the budget can be distinguished from a current account by the file reference since they will be stored in different files.

For example, budgeted regular salary expense for the dietary department for the first month of the fiscal year would be indicated as follows:

F 8 0 2 . 0 1 0 1

In place of the F would be the file reference number. The next five digits are the normal account number, and the last two digits indicate that the figure stored in this location is for the first month of the fiscal year. The budget for the year-to-date would be obtained

EXHIBIT 6

Essential Data for Each Patient Account

Identification Data:
- Room Number
- Hospital Number
- Name
- Address
- Sex
- Date of Birth
- Bill to (Name and Address)
- Admission Date
- Time
- Doctor
- Blue Cross Number
- Social Security Number
- Other Insurance Company
- Policy Date
- Receivable Classification
- Previous Admission Year

Service, Charge, and Payment Data:
- Accommodations
- Intensive Care
- Self-Care
- Operating Room
- Anesthesia
- Blood Administration
- Pharmacy
- Radiology
- Laboratory
- Medical, Surgical, and Central Supplies
- Physical Therapy
- Occupational Therapy
- Speech Therapy
- Inhalation Therapy
- Other

Medical Data:
- Admitting Diagnosis
- Discharge Date
- Discharge or Current Diagnosis
- Surgical Procedures

Insurance Data:

This section will vary depending on the type of insurance the patient carries. For Blue Cross and most commercial insurance, coverage codes are available. The computer can refer to the codes in the drum storage and compute the payment due from each party. Unique cases must be computed separately by the cashier at discharge. Medicare patients must be handled differently. The data that must be in storage for Medicare are listed below:

Medicare Insurance Data:
- Effective Date—Hospital Insurance
- Effective Date—Medical Insurance
- Hospital Days Remaining—Full
- Hospital Days Remaining—Coinsurance
- Lifetime Reserve Days Remaining
- Medical Plan Deductible—Met or Not Met
- Remaining Inpatient Deductible
- Pints Remaining Blood Deductible
- Extended Care Facility Days Remaining—Full
- Extended Care Facility Days Remaining—Coinsurance
- Three Days Hospital Stay Requirement—Met or Not Met
- 14 Days Transfer Requirement—Met or Not Met
- Home Health Representative Visits Remaining—Hospital Insurance
- Home Health Representative Visits Remaining—Medical Insurance
- Psychiatric Days Remaining

EXHIBIT 7

Operating Budget

Account Classification	Projections
Revenue	Volume of Services
	Total
Deductions from Revenue	Total
Other Revenues	Total
Salaries and Wages Expense	Manhours
	Total
Physicians' Fees	Total
Supplies—Billable	Units or Level of Activity
	Total
Supplies—Non-Billable	Units or Level of Activity
	Total
Unassigned Expenses	Total

on a monthly basis by adding the amounts for the months of the fiscal year which have passed.

Historical records

The historical records of the operations of a hospital can be broken into four groups. These are as follows:

1. The record of operations for the current fiscal year
2. The record of operations for the preceding fiscal year
3. The record of operations for previous years
4. Records of individual transactions and other detailed records.

The system design provides for the first two groups of items to be stored on slower random access storage. Their classification can follow the scheme discussed for the operating budget. The file number will indicate which group of records is involved, and the last two digits of the number will indicate which month is involved. Year-to-date totals can be obtained by adding the totals for the previous months. For the current month, the total will be accumulated in the current account.

Records for years earlier than the preceding one will be stored on magnetic tape. Individual transactions and other control items also will be kept on magnetic tape for future use in checking and auditing. The structure and use of these tape files should be carefully worked out by the individual hospital in consultation with the hospital's auditors.

The chart of accounts for current operations presented in this article provides for the minimum data a hospital must accumulate to fulfill its reporting requirements. The storage plan, however, has been developed in a way that allows management flexibility in the application of the plan to specific operations. The addition of accounts depends on the needs of the hospital. Management must balance additional storage costs against additional benefits.

Implications

Several generalizations useful to those interested in applying this type of system to organizations can be stated. First, the data storage plan is successful in integrating most of the various data needs of the hospital organization. Second, all data do not have to enter the system from the source through remote terminals. The need for remote terminals depends on required response times, levels of activity, and interfunctional relationships. If certain functions do not require remote communication, the advantages of integrated data storage do not have to be foregone. Supporting systems can be developed for these functions to communicate data quickly enough for data processing.

Third, the computer system can be used for handling routine decisions, controls, and reports in hospitals without special batch runs. Insurance benefits can be computed automatically by placing coverage files in random access storage; the accounts receivable subsidiary file can be scanned for delinquent accounts; daily censuses can be prepared automatically, and patients can be automatically charged for rooms; effective bed and patient location control can be maintained by the admitting office; and information for third-party notices can be automatically printed out in the insurance department.

Fourth, the data storage plan is flexible. In addition to the adaptations and expansions already mentioned, the system can be useful in providing routine departmental analyses, in aiding the making of decisions that cross organizational lines, and in meeting unexpected information needs.

Fifth, the communication network embodied in the system can reduce the manhours spent in communication in addition to improving medical care and utilization of hospital facilities. Specific examples are the communication of services rendered and charges directly into the patient's account in accounts receivable, the automatic communication of information for insurance notices and subsequent entry of confirmed benefits, the entering and retrieving of certain medical data from the patient accounts, the retrieval of information through management consoles, and the maintenance of patient location and bed control. Other examples of potential uses of the communication capabilities of the system are the ordering of laboratory tests, X-ray examinations, inhalation therapy, and intravenous therapy through terminal units in the nursing units and the transmitting of the results of laboratory tests and X-rays to the places where they are needed. The scheduling and communicating of doctors' orders also can be programed into the system.