Combining Medical Information with a Business Data System

Herbert T. Smith, MD, Bernard J. Schroer, PhD, and Joseph D. Bynum
Huntsville, Alabama

The School of Primary Medical Care at the University of Alabama in Huntsville is presently developing and implementing a computerized clinical data system that incorporates data from the Family Practice Center and the community hospital. The system can be used for the problem-oriented medical record, business and billing, the teaching program, community medicine research, and the evaluation of medical students and family practice residents. This paper discusses plans for the total system and the present degree of implementation.

The School of Primary Medical Care at the University of Alabama in Huntsville is presently implementing a computerized clinical data system for storing patient data from its ambulatory medical care facilities. The system collects and stores patient billing information and patient medical data. Patient medical data include a condensed history, a problem list, specific patient complaints and subsequent diagnoses, detailed laboratory results, and information on medication. This paper discusses the goals of the system, the current degree of implementation, and the use of the system in teaching, evaluation, medical data storage, and business administration. Emphasis is placed on the present uses of the system and on-line data retrieval, including application to patient billing, practice management, practice and patient profiles, and research.

Background

In primary medical care, the physician is the patient's first contact with-

in the health care system. He provides continuity of care throughout episodic as well as chronic illness, integrates other medical service needed by the patient, and acts as a personal physician giving personalized care. In the School of Primary Medical Care, three clinics comprise a basic teaching element. The largest clinic, the Family Practice Center, has been in operation since July, 1973, and serves over 3,500 families. The second clinic is the University of Alabama in Huntsville Health Center which opened in September, 1974. Here, students, faculty, and families living in the zip areas surrounding the university campus constitute the 500 families served by the unit. The third clinic, Westside Clinic, is located in a neighborhood center where the population is largely indigent. The clinic serves 65 families and is open for five half-days weekly. Residents also volunteer service there at night in a "Yes Clinic" for teenagers with a wide range of problems such as venereal disease, drug problems, or pregnancy, and in a family planning clinic. The Westside Clinic offers residents exposure to community medicine, and together all three clinics provide undergraduates and residents with essential ambulatory clinic experience in treating a spectrum of

patients from throughout northern Alabama. This introduces them to the range of problems encountered by physicians offering primary health services.

During the development of the clinic program, the School of Primary Medical Care tried to plan a data resource and research information system which would be in accordance with the objectives of its comprehensive medical system and, at the same time, provide an innovative method of supplying students and residents with medical and business methods which they could later use in practice. An attempt was made to envision an economical and effective system that would facilitate good teaching, aid in evaluation of students, residents, and faculty, and offer experience in clinical practice management.[1] In addition, it was felt that the system should provide data that would be useful for environmental and epidemiological studies in the community and in the state. Finally, a system was needed which could process the medical and business data and, at the same time, provide the new family practice specialist with experience in both manual and automated record systems.

The system ultimately developed takes advantage of the latest advances in computer technology programs and hardware to fulfill four objectives: (1) to improve the quality of medical care provided by the clinics, (2) to serve as a medical education tool, (3) to meet administrative needs of the clinics, and (4) to provide a data base for medical research.

System Overview

After an in-depth study of the system requirements, the decision was made to divide the clinical data system

into two modules: administrative and medical. Available clinical software packages were reviewed. One of these, the IBM Clinical Billing System, was already used by the Huntsville Hospital on its IBM system 3 computer. With some minor modification, this system was chosen to serve the clinics.

A review of the administrative module is given in Figure 1. During the patient's first visit to a clinic, an insurance sheet is completed giving the patient name, address, insurance, etc. Then, each time the patient visits the clinic, a charge sheet is completed indicating the patient's complaint, physician diagnosis, treatments, and medications. These forms are forwarded across the street daily to the Huntsville Hospital for keypunching and to update the administrative data base.

An overview of the medical module is given in Figure 2. During the patient's first visit to a clinic, a detailed history questionnaire is completed. This questionnaire is a two-ply form. The second sheet includes keypunch instructions and is forwarded to keypunching, while the original becomes part of the patient's folder. Similarly, the lab sheet is a multiple-ply form with one of the plies used for keypunching. These forms are added to the medical data base. The punched cards from the billing data base are also used to update the medical data base; however, only certain data elements are common to both sets of data.

Data Inputs and Processing

By dividing the system into two modules (Figure 3), two separate data bases are maintained, the administrative data base by the Huntsville Hospital, and the medical data by UAH. The data elements in the administrative data base are those associated with the billing aspects of the three clinics and will not be discussed.

Before the elements of the medical data base could be defined, it was first necessary to redesign the data input forms. Because of the time required for this redesign, the data is being added gradually in segments. The *first segment* contains some data elements from the patient's charge sheet. These data include patient number, date of visit, place of visit, complaint code, receptionist code, diagnosis codes, medication codes, treatment codes,

and physician code. The *second segment* of the data base (presently being added) contains data from the patient history questionnaire. These include: date of birth, zip code, census tract, education, marital status, menstrual history, smoking history, allergies, work status, skin tests, family health and disease history, and immunizations. The *third segment* of the data base will contain the patient's laboratory results, problem list, and medication list. Laboratory results to be stored include urinalysis, chemistry profile, hematology, and electrolyte profile.

All programming is done in FORTRAN. Input/output uses the FORTRAN NTRAN routines. By use of the NTRAN routines, it is possible to block read and write all of a patient's records. For example, a typical block for a patient may consist of a history record, three visit records, and two lab records. The block can be readily expanded as additional records are added. At present, the program employs only one part-time programmer. Since the formulation of the system in 1973, approximately six man-months of programmer time and five hours of computer time have been expended on the medical data base.

Uses of the System

At this stage of development, four areas of use consistent with the stated objectives of the system have been identified: (1) patient billing, including insurance forms and clinical financial reports, (2) practice profiles listing data by time, clinic, physician, and resident, (3) patient profiles listing patients by age, complaint patterns, problems, medications, and frequency of visits, (4) instant access and retrieval via a terminal to data for research projects, special studies, and student and resident training.

Patient Billing

As previously stated, data processing was first introduced to the Family Practice Center through a commercially available clinical billing package. The package has been in use since the summer of 1973, and it has been modified to meet the clinic's requirements. A primary function of the billing system is completion of the appropriate insurance forms. Presently, the package can complete the following insurance forms: Blue Cross/

Blue Shield, Medicare/Medicaid, and an attending physician form. The billing package also generates the following internal management reports: (1) patient billing, (2) insurance billing, including Medicare/Medicaid, (3) accounts receivable record, (4) accounts payable record, (5) individual physician input report (gross charges), and (6) cost accounting reports for patient, treatment, and diagnosis.

Practice Profiles

Practice profiles are an integral part of any well-organized practice and will become more important with increased federal legislation in the health field. With the computer, it is quite easy to tabulate such data for use in the clinics. To date, the following computer reports have been identified and programmed: complaint frequency distributions, problem frequency distributions, medication frequency distributions, and complaint versus problem distributions. Family visit profiles, a high-risk disease registry, and an "E" book complete the present clinical uses of data stored. These reports tabulate data by physician and by clinic on a monthly and yearly basis and provide valuable insight into the overall operation of the clinics. This, in turn, can be used in planning curriculum for the residents and in assessing the need for continuing education.

A potential area of significant use of the medical data base is in order to summarize a patient's medical folder and then make this information readily accessible to the physician via on-line terminal or inclusion in the patient's folder. Possible uses include patient complaint patterns, problem lists, medication lists, charting of selected parameters and comparisons of complaint vs problem vs medication and treatment schedules. In addition, summarizing of selected items would permit setting up a high-risk disease index for recurrent clinic scheduling and a chronic disease registry, both of which would facilitate epidemiological, environmental, and behavioral studies. Finally, one of the additional educational "spin-offs" of this system is the computerized "E" book. Each resident automatically has all patient encounter information and procedures, whether clinic or hospital, recorded under his code number. This

FAMILY PRACTICE CENTER

HUNTSVILLE HOSPITAL

Billing
Data Base

Charge
Sheets

Insurance
Sheets

History
Sheets

Lab
Sheets

Keypunch

IBM
System 3

Patient State-
ments, Insurance
Forms
Internal Reports

UAH   Computer Center

Keypunch

Univac 1108

Medical
Data
Base

Portable
Terminal

Regular Telephone
Lines

Statistical Reports

Figure 1. Administrative Module

Nurse

Physician

Reception Area

- Identify patient complaint & fill out encounter form
- If first visit, fill out billing information form
- Pull patient folder

Patient

Patient

Preliminary Processing Area

- Further identify patient complaint
- Take vital signs

Nurse

Patient

Examining Room

- Examine and treat patient
- Enter problems, medications & charges on encounter form
- Dictate progress notes, problem list, and medication list

Physician

Reception Area

- Make next appointment and financial arrangements

Patient

Patient

Preliminary Processing Area

- Implementation of physician's orders

Nurse

Patient

Laboratory

- Additional test
- Enter results on lab form

Medical Records Area

- Review forms for completeness
- Separate plies
- Transcribe physician's dictation
  Update E-Book

Patient

File Patient folder

Billing information and charge forms to data processing (Huntsville Hospital)

History and lab forms to data processing (UAH)
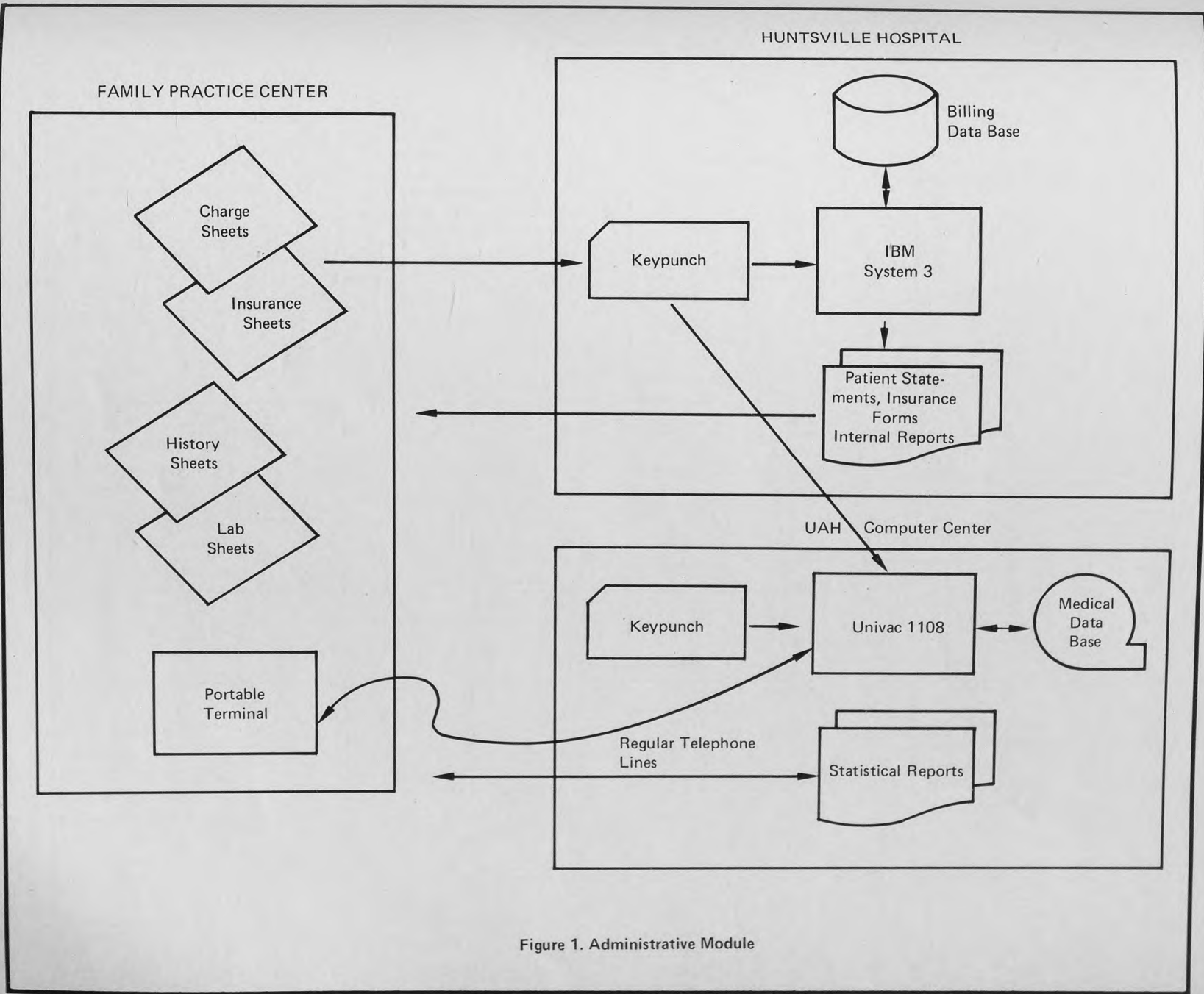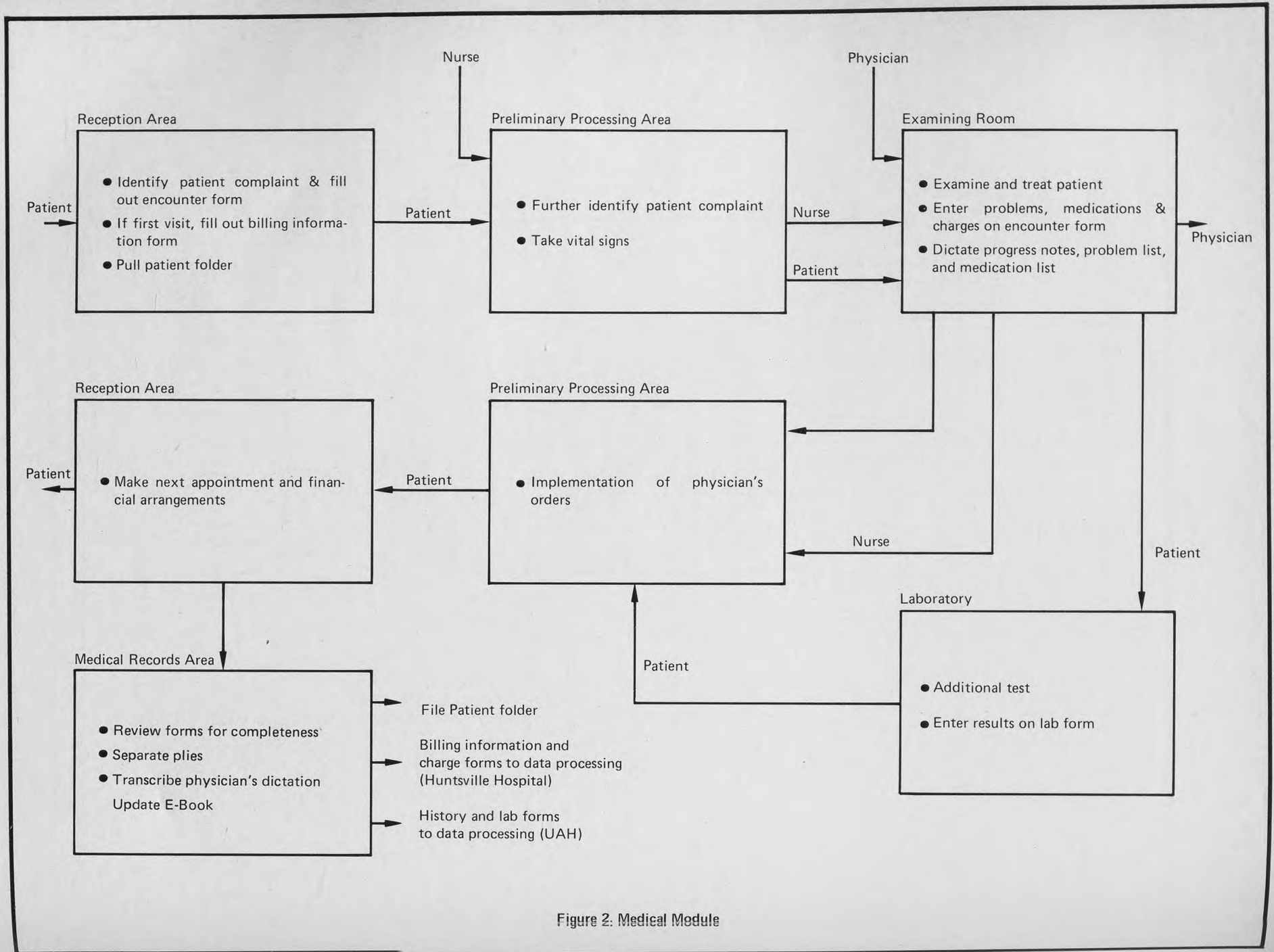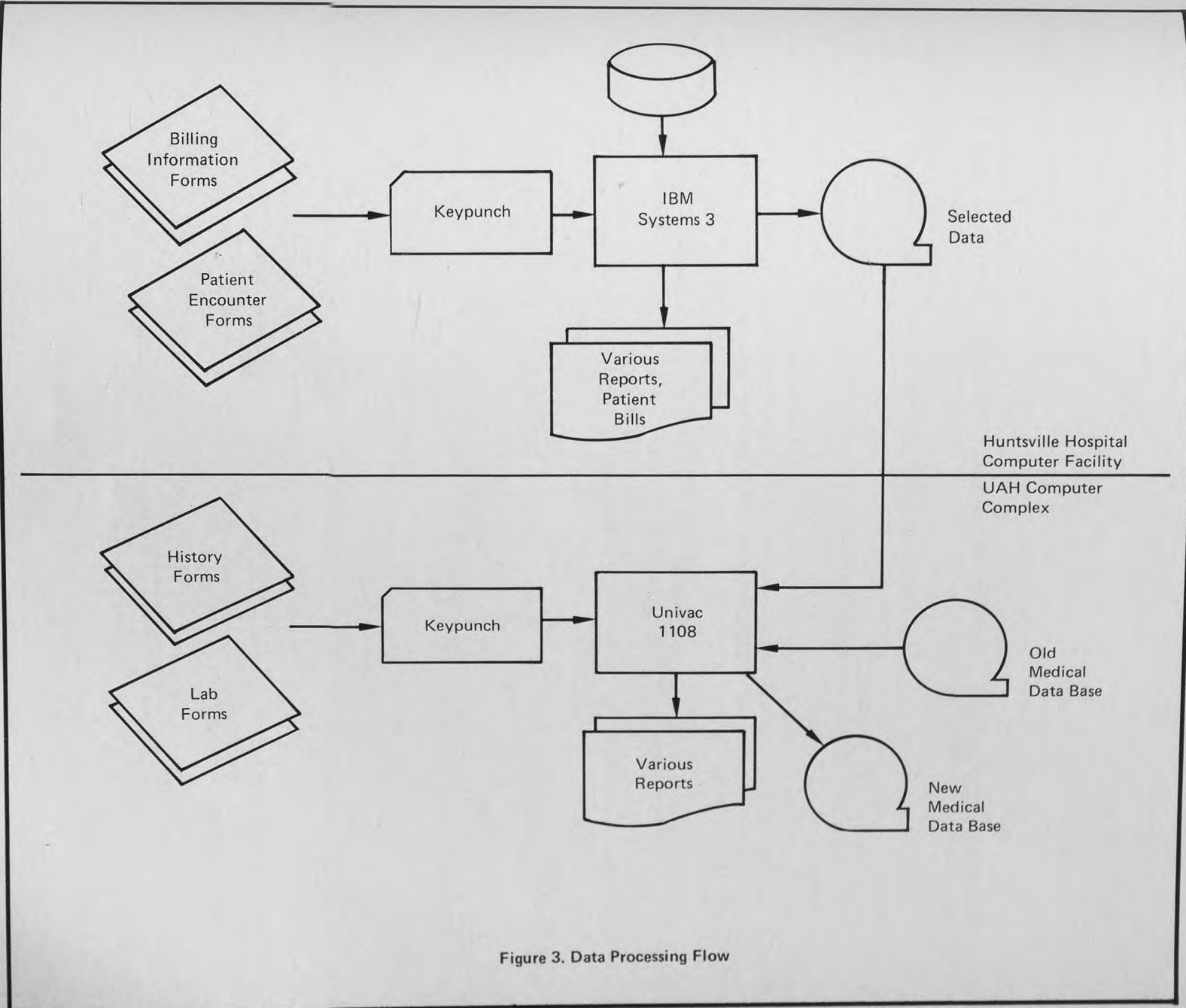
Figure 2: Medical Module

Figure 3. Data Processing Flow

information can be retrieved for evaluation of his longitudinal clinical experience.

On-Line Retrieval

UAH has a close working relationship with the NASA George C. Marshall Space Flight Center in Huntsville. Through this relationship, UAH has acquired an on-line information retrieval system called MIRADS (Marshall Information Retrieval and Display System). MIRADS consists of a software package designed to minimize the user's effort in placing an application on-line and then retrieving his data.

Three steps are required in placing an application in MIRADS: (1) creating a MIRADS format data base, (2) defining a dictionary of the data base, and (3) linking the data base and dictionary in MIRADS. The majority of applications wanting to use MIRADS already have data stored in one form or another. This medical data base must be put into a format to correspond to MIRADS' specifications. A set of sub-routines (labeled MRANDH routines) is available to assist in the reformatting. A dictionary must also be defined for the medical data in the data base including, for each field in the data base, its location retrieval code name, and report heading name defining its dictionary. The final step in placing the user's application in MIRADS is to prepare the necessary control cards for linking the reformatted data base and the dictionary with MIRADS. These control cards call the various MIRADS routines which build the interfaces between the user input/output requests and the data. Control tables are also built describing the data base, the location of data within it, and the association of data with user defined names.

Discussion

Plans for expansion through special software programming include use of the system for patient scheduling, physician and resident clinic work scheduling, supply inventory and ordering, student records, and a test bank for students. This medical-business data collection system provides access to data for wide areas of research in health care delivery and community medicine. Studies have been completed on a pilot recertification project for the family physician, an analysis of resident versus faculty diagnosis, and a study relating depression to other patient complaints. Another project studying hypertension and the effects of treatment has been instituted. The data base information is facilitated by use of problem-oriented medical records modified from the Weed system. Security of computer data is assured by use of an identical medical chart and billing account number as the only identification used in the computer and in storage of the billing data separately from the medical data base.

This system is unique in that studies of data input were made to determine the planned use of the system prior to purchasing software and hardware. This allowed prudent acquisition of necessary programs and equipment. In addition, the broad information base coupled with a billing system provides patient confidentiality, which has been attained in few clinical settings.

Reference

1. Sehnert KW (ed): Journal of Clinical Computing 2(6), 1973