MANAGING A RADIOLOGY DEPARTMENT:
A THREE DIMENSIONAL PROBLEM

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The authors designed, implemented and installed an on-line computer system which combines conventional appointment management with "real time" schedule monitoring. A by-product of the system is the automatic production of a bill or receipt, a work ticket, a mailing label, and a "super bill". The on-line patient file provides the basis for a computer accounts receivable reporting, follow-up statements, and management reports. The production and tracking of diagnostic interpretations are facilitated by the system. One year after installation there has been a marked improvement in patient and referring doctor relationship, increased revenues, and reduced personnel requirements.

In the management of a Radiology system, one is faced with three unknowns: number of patients type/number of examinations, and schedule (time). Since these values cannot be controlled or predicted, an overall objective is a system which could provide the continuously accurate information necessary to respond and manage the utilization of the facilities and staff and provide greater patient satisfaction.

One of the first steps in the design of such a system is to clearly state the goals and objectives. The goals and objectives of this system are:

* Meet schedules, but if slippage occurs, re-schedule waiting patients and inform the patients of such re-scheduling.
* Allow override for emergency or special care patients.
* Ensure that the referring physician receives accurate reports without delay.
* Render bills promptly and accurately.
* Eliminate repetitive clerical tasks.
* Effect cost savings by increasing the productivity of employees by enabling them to absorb the growing workloads.
* Enhance control over patient charges and account information.
* Flexible to meet future expansion.
* Accommodate modifications quickly and without disruption.
* Schedule staff appropriately.
* Capable of selecting an individual patient from a large file with a minimum of elapsed time.
* Generate an accounts receivable summary to include, at a minimum, aging of patients' accounts, total receivables, total of active accounts and a collection ratio report.
* Provide management reports as needed to include such things as overall statistics, utilization of facilities, referring physician analysis, average waiting times, etc.
* Vendor support throughout implementation and on a continuing basis after conversion.
* Appropriate training for personnel in the operation of the system and related equipment.
* Vendor capable and committed to keep equipment and software current.
The system is a schedule-driven system which tracks the patient's process through the completion of the scheduled event and produces bills, receipts, flash cards, universal insurance forms (super bill), jacket labels, at the place and time that they are required.

The basic input to the system is the recording of an appointment. A conventional schedule function reserves appointments for the 20% of the patients scheduled in advance. As walk-in patients appear at the reception desk, they, too, are scheduled for the first available facility. The scheduling process requires minimal clerical activity; simply the basic patient data and the examination(s) to be performed, as well as the charges for the service.

Once the appointment has been recorded, that information is immediately available to the technical center where a monitor displays continuously up-to-the-minute information about the patients in the queue for each of the available facilities. Subsequent input to the system takes place at the crucial points in the patient's progress, from the preparation of a bill or receipt, the recording of the beginning and the completion of the examination, the patient's discharge from the facility, and the production of the diagnostic report.

The system records the time of each event, and tracks and records the status of the schedule for each examination room. The patient's file contains all the data to drive the Accounts Receivable system and to produce the statistical reports reflecting facility utilization and schedule fulfillment.

Effective scheduling requires finding the appropriate intersection of the exam requirements, the availability of facilities and the patient's preference. The system's scheduling algorithm makes use of table of exam parameters which includes length of exam, preparation time required, daily or hourly constraints and a list of facilities where the exam can be performed. If more than one exam is to be scheduled, the algorithms will select only those times and locations which satisfy the requirements of all.

Once the appointment has been booked, the information is accessible at any location in the facility. The technical center staff will see that patient in the queue display, anyone can interrogate the system to review the schedule or find out when the patient is scheduled. The schedule information is recorded in the patient's file as the first step in the process.

A key element in the design of this system is the use of tables, or dictionaries, to define the facility and its services. These are easily modified by the user, without programming intervention, and can be displayed or printed for easy reference. The exam code table has already been mentioned. In addition, there are tables defining services, facilities and referring physicians.

The registration and billing process keys off the schedule information. Because all patient files are maintained on-line, redundant data entry is eliminated. To insure the integrity of those files, the system checks for duplicate or similar names.

The system produces a printed receipt, or bill, the patient's account reflects the charge and receipt, and the daily receipts journal is updated.

At the technical center, the constantly refreshed queue monitor displays the status of activity in each room, the patients waiting in each queue and the relation of current to scheduled events.

The technical staff uses the monitor key board to record the movement of patients into and out of the examination rooms. As a by-product of recording the start of the exam, the system produces a multi-purpose form (including a work ticket, flash card and 'super-bill'). Concluding the exam logs the patient's name in a diagnostic report control file.

Diagnostic reports are produced at word processing terminals which can communicate with the main computer. In response to the operator's request, the system transfers relevant data about patients whose reports have been dictated. The operator types only the report content; the system automatically types the rest of the report. The system tracks these requests from the word-processing terminals and produces a control report listing all patients who have been examined with an indication of their report status. Using an exception processing technique, the control clerk notes the completion of the typed report and the system logs that event in the patient file.

The system's accounting options include all the components of a conventional Billing/Accounts Receivable system; including making adjustments, recording receipts, printing statements and producing receivables reports.

The major activity in the accounting department is running the daily reconciliation report to insure that actual receipts match what has been recorded in the system. Specialized reporting and inquiry functions provide the means of locating discrepancies.

An important characteristic of the system is the automatic maintenance of audit trail journals. Every transaction - charge, receipt,
or adjustment is posted simultaneously to the patient file and the audit trail file. (An extension of the system could permit automatic posting to a general ledger as well.)

The following reports provide information for managing the billing and collection process, and the daily operations of the department. Among the operations reports, two are especially relevant to the tracking process described here.

Print Billing Statistics
Referring Doctor Report
Transaction Code Search Report
Delinquent Patients Report
Aged Accounts Receivable Report
Service Statistics Report
Daily List of Patients Seen

The "Daily List of Patients Seen" is used as a control report to insure that results have been dictated for every case.

The Service Statistics Report is a detailed list, showing for each patient, the scheduled appointment and the time at which each of the following events took place: appointment booked, bill prepared, examination begun, examination completed, patient discharged.

The report computes average waiting times and is used to refine the scheduling parameters and to review the service delivery patterns.

In summary, some important system characteristics should be emphasized:

- Training requirements are minimal; options are invoked by selection from a menu, and data is entered in response to questions.
- User defined tables permit customization without technical assistance.
- The system design and the implementation techniques allow for easy extension.
- The software is portable and can be installed on a variety of hardware configurations.
- All patients are scheduled. The patient's appointment reflects on-line conditions of availability of personnel and facilities.
- The Front Desk/Reception Area can change appointment times, verify appointments easily and notify the referring physicians of any conflict of appointments. Patients have enjoyed greater satisfaction as there is someone to answer their questions regarding appointments, delays, fees, etc.
- Interviewers can verify patient information during their process.

The Central Technical Core is constantly informed which patients are scheduled, which patients have arrived and for which examinations, and if rooms are running ahead or behind schedule. On-line realignment of rooms and patients can be made when necessary.

- Technicians can be assigned breaks and lunch consistent with activity.
- Inquiries regarding patient status are easily answered.
- The system has provided opportunities for management to alter working patterns in the Business Office.
- The Business Office staff has been reduced four fulltime employees to one. All billing inquiries are handled on-line. As a result of more timely and accurate billing, cash flow has increased.
- The system has eliminated the necessity to maintain multiple files of bills, receipts, etc.
- The financial system is auditable and satisfies the multiple agencies requirements.
- A unification of all departmental systems has been accomplished; the system coordinated the interaction among staff, resources and patients.
- With the development of the data base, repetitive clerical tasks have been eliminated.
- The Diagnostic Reporting System has increased productivity 30-40 percent and provides control techniques to insure that reports have been completed.

The system has resulted in more productive use of personnel and facilities. The Department has been able to absorb a significant increase in workload and improve our services to the patients and referring physicians.

The success of this installation was a combination of the ability of management to define its objectives and current problems, and the competence of the computer personnel to support tailoring the software and recommend the appropriate hardware.