Module 7 – Hospital and Health Record Computer Applications

The purpose of this module is to provide the user with basic and fundamental knowledge of health care information systems in the healthcare environment with emphasis on applications that relate to the use and storage of patient's health and clinical information. See additional modules including Module 2 which specifically addresses the Patient Master Index application in further detail.

In this unit we will:

- Discuss information systems and applications in general in the health care facility
- Identify the operations within the medical record service that can be computerised
- Identify priorities for implementation using a planned information system strategy

OBJECTIVES:

Upon completion of this unit participants should be able to:

1. Identify general health care applications found in health care facilities
2. identify applications within a medical record department which could be considered for computerisation
3. Discuss the important points relating to a computerised Master Patient Index
4. State the objectives of a computerised admission, discharge and transfer system (ADT)
5. List the daily reports generated by a computerised ADT system
6. Discuss the basic functionality of a data base system as it relates to use in a healthcare facility
7. Discuss advantages and disadvantages of information systems in health facilities in general

Key Definitions:

- **ADT/ATD –** a program used in a healthcare facility that contains information about a patient with regard to facility admission (date and location/bed/ward), transfer information if the patient was moved to another location and the date of discharge which may include whether the patient was transferred to another facility, discharged to home or if the patient expired (died). The use of the term

may be used in either format: ADT or ATD depending on the preference of the facility or requirements of the system itself

- **Clinical Decision Support (CDS) –** a system that assists a clinician in making a diagnosis by gathering data from various internal systems (lab, radiology) and external systems if available

- **EMR/EHR -**the term used to reference a patient's electronic information in a facility. In some cases, electronic health record (EHR) is the preferred term which may contain information other than clinical information but in other situations, EMR or electronic medical record is used to indicate that it is the patient's medical record at a particular facility

- **DBMS –** a database management system is an arrangement of data in "fields" that comprise a record of information on a topic or in healthcare, about a patient or data related to a patient's encounter at a facility. Examples of databases in facilities are the MPI, laboratory data, radiology data and elements of the EMR

- **MPI –** master patient index – a database of patient information that contains demographic data about a patient including the MRN or URN

- **MRN –** medical record number assigned to a patient and remains consistent for all patient encounters at a facility

- **RDBMS –** a database management system that is relational in nature in that data items and fields are related to each other and contain data about a patient or patients

- **URN –** unique record number used in place of MRN in some facilities but is the same and remains unique to the patient for all visits and encounters at a facility

Background:

While the development of automated patient information services to enable the efficient retrieval of information for patient care, statistics, research, reporting and teaching is the aim of many hospitals today, many countries around the world have yet to fully implement such systems. The development and implementation of such systems requires detailed planning and co‑operation between the medical record officer, the computer staff and the hospital administration and must be well planned before systems are purchased and implemented.

Hospital or health care information systems help to streamline processes, increase efficiency and accuracy of information and provide timely access to patient information to those providing care to the patient. Acquiring a computer system for any purpose in any medical facility requires comprehensive and detailed planning with key officials, administrators, and employees at various levels to provide input to the process.

Some considerations before purchasing an information/computer system or application include an evaluation of:

- The ability to supply consistent electricity which includes generators
- Financial support for purchasing and maintain the system
- Availability of space for hardware, networking and wiring
- Experience level of employees with computer systems
- Adequacy of time available to train staff and implement a system
- Available technical expertise to maintain systems
- Facility strategy for planning and implementing systems
- Facility strategy for maintain business continuity in an electronic environment in case of system failures (backup systems and processes in place)
- Existing applications, systems (compatibility)

Once these are sufficiently addressed, the key employees (administration, health officers, medical records and information communication technology staff) should decide on which systems should be purchased first or according to the planned strategy which should identify prioritization of system purchases. (For example, in countries where insurance companies are billed for clinical services, those systems that facilitate billing are prioritized first followed closely by those that capture clinical data and information for the patient's medical record).

Below is a list of functions that can be accomplished by electronic systems in a health care facility:

- Electronic Medical/Health Record and Computerised Medical record (Including:
    - Patient Master Index
    - ADT
    - Order entry (for ordering lab and radiology and other tests, medications, etc.)
    - Pharmacy Services
    - Radiology and other diagnostic imaging services
    - Laboratory services
    - Clinical Decision Support System

- ☐ Financial and Administrative
    - Patient Billing, Accounts receivable and payable functions (includes insurance billing)
    - Patient scheduling systems (for inpatient/outpatient visits, operating room procedures, and some department specific appointments for lab, radiology, etc.)

- ☐ Statistical and Management Reporting
    - Management Reporting (capture and run reports for Ministries of Health, Health Departments, etc.)
    - Statistical reporting such as numbers of admissions, discharges, surgeries, ancillary tests run, etc.

- ☐ Disease and Operations Index (captures coding of diagnoses and procedures for reports both internal and external to the organization).

Much of this functionality is found in a modern Electronic medical record system.(EMR) The Medical Record Institute outlines the following minimum features required of any

Electronic Medical Record: (Waegeman, 1996)

For a hospital or clinic to function smoothly, all of these systems need to and should work together and "talk to" each other through interfaces which facilitate interoperability and information sharing. Additionally, when these systems are implemented, the facility must first devise a plan and strategy for acquiring systems, maintaining the systems and develop processes to maintain the privacy and security of the information contained within all of the systems

Acquiring a system is a large undertaking for a health care facility. Advantages of most of the healthcare systems available today are increased efficiency, streamlined processes, improved accuracy of information, and timeliness of information, improved access and the reporting capability of the systems.

While the advantages usually outweigh the disadvantages, there are disadvantages to be aware of such as increased expense for utilities, probable construction and re-modelling costs, training of employees, ongoing and continuing maintenance costs and the expense of purchasing the system itself (hardware and software, networking and wiring costs) and ensuring data and system security.

Most facilities find, however, that the efficiencies gained from the use of systems far outweigh the disadvantages particularly when considering that the care of the patient can be improved with better systems in place. This is more obvious when specific patient-centered systems such as an entire Electronic Medical Record (EMR) is utilized by a facility.

HEALTH/MEDICAL RECORD SYSTEMS COMPONENTS:

It is important for health care facilities (clinics, hospitals, health centers, health posts) to select the most appropriate system for the needs of the facility in general, but in order to provide good medical care, accurate and timely medical information about the patient is a critical component. There are several medical/health record applications that provide that assistance. However, where an EMR system cannot be implemented in full or where the cost of implementing a complete EMR solution would be prohibitive, the following applications relating to medical record services could be considered for computerisation.

     A.   Patients' master index or Master Patient (Person) Index (MPI)

     B.   Admission, discharge and transfer system (ADT)

     C.   Disease and procedure index

In addition to the applications listed above the following additional applications could also be considered when the above systems are running smoothly.

     .   Record location/tracking system

     .   Appointment scheduling system

     .   Medical record completion system

. Dictated reporting systems (transcription) including Operative and Discharge Summary reports

In this unit we will discuss the first three applications. It is important to note that the points raised in this unit are suggestions for discussion, and not a definitive outline of specifications. Final specifications for any computer system should be developed in conjunction with the computer programmer, systems analyst, hospital administrator, and medical record officer, at a time when the actual type of computer has been determined.

COMPUTERIZED DATABASE SYSTEMS IN GENERAL

The various components required in the PMI, ADT and the Disease and Procedure Index may be designed and implemented using a relational database management system. In this system, a database consists of a table in which information is stored. Each column in the table is used to store a specific data item or a data field related to the patient. Such information could be, for example, Patient ID No., Date of Birth, First Name and Last Name, height and weight.

Each row in the table would then store a collection of these data items. One row for each patient.

ID Number	Name	Date of Birth	Height	Weight
1	Bob Jones	01 Apr 58	183 cm	82 kg
2	Mary Rodgers	22 Nov 81	153 cm	45 kg
3	Sue Williams	06 Jan 57	168 cm	50 kg

A table such as this is easily implemented in a computerised system using a Relational Database Management System. (RDBMS) All patient searches are managed by the RDBMS.   Data would be entered via on screen forms created to place entered data into their respective fields in the table.   This is how all EMRs work. It is the job of the RDBMS to manage input (data entry), output (searches) and perform other maintenance functions. Selection of an appropriate RDBMS must be made after careful consideration of the needs of the user and the data which is required to be captured

A. THE MASTER PATIENT INDEX (MPI) - **Please Refer to Module 2 for additional information**

1. The MPI or PMI (Master Patient Index or Patient's Master Index) system is basically a database containing fields (pieces of patient information) that identify the patient. These elements are described in detail in Module 2. The MPI system also would require software to support access to information by users from terminals located throughout the healthcare facility. The programmes would be designed to enable access to the information held on the MPI file securely and to build or modify information contained in the file, as required by the hospital.

As discussed in Module 2, the patients' master index holds information on all patients who have attended or have been admitted to a hospital. Remember, clinical details are NOT held in this file, only basic information required to IDENTIFY the patient.

As with a manual file a computerised file would be cumulative. That is, new patients would be continually added to the file. However, previous patients are NOT deleted as their details are kept available for future attendance or admission or for any other need to retrieve a patient's medical record.

2. A computerised MPI system consists of a Database Management System. The information in the master file is generally referred to as the "PATIENT'S RECORD" and may be retrieved using the following identifying information entered into a search screen:

. Unique Patient Identifier (URN or MRN)

. Patient's family name only

. Designated identification data, for example, national identification number

This master file would be developed over a period of time through the entry of information already held on index cards from the manual card system or thorough inpatient or outpatient registrations.

3. A facility search programme should enable the operator to locate a patient to determine if that patient has a registration number. Limited information on a number of patients (one patient per line) may be displayed on a screen for review or further action. These can be displayed by:

a) Patient name giving the unique patient identifier (URN or MRN)

b) Unique Patient Identifier (URN or MRN) giving patient name

When the selected patient is identified the full index file information for that selected patient may be displayed on the screen.

When retrieving information, strict security codes should be used to prevent unauthorised access and alterations. Each user should have his/her own user name as well as a password which is assigned by the computer manager and changed periodically.

Only an authorised user should be able to access information relating to a patient and to change, add to, or delete records on the master file.

4. To operate a patients' master index system the following steps should be used:

a) The user logs on to the system using his/her name and password. The programme should then authenticate the user having authorised access to

the patient information by verifying the user's name and MPI password.

b) The user starts the MPI programme

c) The user activates the search function where the user may enter the required information for the search (using the unique patient identifier, etc.)

d) The user should always verify that the patient they are searching for is the correct patient that matches the search criteria.

If no systems exist in a facility, the Master Patient/Person Index should be the first system to be implemented, as it is fundamental to the function of all other system applications.

B.   ADMISSIONS, DISCHARGE/DEATH AND TRANSFER (ADT)

The introduction of this type of system would enable staff to maintain a file on all patients currently in hospital, awaiting admission and recently discharged. It would also enable users around the hospital to have direct access (via a terminal) to the file and would automatically generate bed census and other daily statistics required by the hospital administration.

The objectives of such a system would be to:

• provide an inpatient booking service for patients awaiting admission

• keep records of the bed state and bed allocation

• trace patients for enquiries

• provide daily patient census reports and related statistics

• provide information for the patients' master index (directly linked to the PMI system)

• provide a complete data base for all users of patient identification and location information.

Within such a system a data file could be maintained on all patients that are currently in hospital, awaiting admission or were recently discharged

1.   Bookings for hospital admissions

An appointment is made with the admission office and patient details are recorded on the appropriate form. This information is then keyed into the system via a computer screen or visual display unit (VDU). A check (via the computerised PMI) is made to see if the patient has been in hospital. If he/she has, the hospital number is recorded in the patient's booking file. If the patient has not been in hospital previously, the space for the hospital number is left blank until the time of admission.

An admission date will be allocated automatically unless the date has already been noted and recorded. (Consultation with medical staff will be required before this section of the programme can be developed, as admission policies require determination). The booking file will be checked each day for the following week to enable patients to be notified of their admission date and time.

2. Admissions

a) Booked patients

When a patient who has a file in the "booked admissions" file, arrives for admission, the clerk locates the patient's booking information. He/she proceeds to complete the patient identification information in the computer and allocates a hospital number if the patient has not been in hospital or attended the outpatient department (OPD) previously. The same information is recorded on the front sheet of the patient's medical record.

The patient is sent to the ward and the appropriate departments notified of the admission, e.g. finance, medical records, catering etc.

b) Non‑booked and emergency patients

Patients not previously booked in for admission are either interviewed in the admission office or emergency department. Patient identification information is recorded on the front sheet of the medical record and immediately keyed into the computer via the terminal in the admission office or emergency room. The PMI is checked for previous admissions. If the patient has a hospital number, this is keyed in, if not a new number is issued.

3. Transfers

If a patient is transferred from one ward to another the staff in medical records are to be notified immediately (by phone) to enable them to make the necessary changes in the computer file. (This may instead be done by admission's staff, but medical record staff must be notified).

4. Discharges/Deaths

If a patient is discharged or dies, the nursing staff must notify the medical record staff or discharge office, to enable the computer file to be updated. Date and time of discharge or death is then recorded by the terminal operator.

5. Daily Reports

a) Condition and nursing dependency

Each afternoon the computer operator should print a ward list for each

ward. These can then be distributed to the wards where errors or any change of condition will be noted. The nursing dependency for each patient can also be noted at this time. This printout is then used for the daily bed census and should be returned to the Central Admission area at a designated time each day to enable the keyboard operator to amend the files accordingly.

b) Admission and Discharge list

A daily list of all admissions and discharges for the previous 24 hours can be generated by the computer (via a printer) the following morning. This is required by the medical record and finance departments for their daily operations.

c) Service analysis statistics

On receipt of the medical record the medical record staff should complete a service analysis on the record and record the information on the discharge list. This will then be keyed into the system by the operator to enable documentation of clinical services to be prepared for the administration.

d) Other statistical information

Information regarding post‑operative deaths, autopsies and coroner's cases, plus obstetric information such as deliveries, multiple births, fetal deaths, infant deaths, are also keyed in at this time if not already recorded on file.

e) Suggested daily reports. In some countries and facilities, data must be sent to a Ministry of Health or other Government entity. If systems are in place to capture this data, it is much easier to report the information in a timely way. Some suggestions for reports and distribution are listed in the following table:

Name	Contents	Distribution

Ward Bed Census	Record Number
	Name
	Condition
	Nursing dependency
	Total beds occupied
	   (male) (female)
	Beds available
	   (male) (female)
		To all wards
		Admission office.
		Enquiries

Admission List	Record Number Name Ward Age Doctor	Medical records Finance Deputy Director (clinical) Enquiries
Discharge List	Record Number Name	Medical records Finance

	Ward Status (alive/died) Service	Deputy Director (clinical) Enquiries
<u>Transfer List</u>	Record Number Name Ward from Ward to Admission date	Medical records Finance Deputy Director (clinical) Enquiries
<u>Daily Statistical Return</u>	Ward totals for: Admissions Transfers in Transfers out Discharges Deaths Cumulative monthly Bed days/patient days	Medical records Deputy Director (clinical) Wards
<u>Planned Admission List</u> (for each ward)	Record Number (if known) Name Sex Planned ward Presenting problem Planned operation Doctor Urgency	Medical records Deputy Director Doctor Nursing office
<u>Waiting List</u>		Deputy Director Admissions staff

      f) <u>Monthly Reports:</u> The table that follows contains possible monthly reports available from a system:

Monthly Reports Hospital Service Analysis	
<u>Contents</u>	**<u>Distribution</u>**
Patients in hospital last day of previous month Patients admitted during month Patients discharged this month Total patients in hospital last day this month Total patients discharged over 12 years of age/or age which separates paediatrics from adults Total patients discharged under 12 years of age/or age which separates paediatrics from adults Total number of operations performed	Director Deputy Director (clinical) Patient Care Committee

Total for each clinical service -
      Discharged/Died
      Autopsies
      Coroner's Cases
      Average length of stay
	Administration, Dept. Directors, Finance, others by request

Average daily census Hospital death rate Turnover interval Net autopsy rate Percentage of occupancy Stillbirth (fetal death) rate Maternal death rate Demographic area	

6. Medical Record Completion Program

A "Medical Record Completion Programme" could be developed as a subsystem of the ATD system. This would enable the medical record staff to maintain up to date information on the status of incomplete medical records. The type of information maintained would include:

- whether the medical record been returned to the Medical Record Department

- whether the record is "complete" (all necessary signatures are completed, operative and discharge reports are complete and all other requirements for completion are met)

- completion of coding by the medical record officer

- completion of other functions such as indexing and statistical collections

C. DISEASE AND PROCEDURE INDEX

The third possible application to be discussed in this unit is the disease and procedure index. Although this system would be self‑contained it would also be part of the full set of systems relating to patient administration and information services.

A computerised disease and procedure index should be developed to enable the research role of a hospital to be carried out. This system could contain information relating to diagnoses and procedures, in coded form, to enable the retrieval of individual cases for research. It could use the ATD system as the base records to which disease and procedure codes are added following the completion of the medical record at discharge or death of a patient.

This system could also accommodate information relating to tests performed during hospitalisation for later review of the utilisation of hospital services.

This proposed programme would process the "discharge" area of the ATD master file. In such a system, relevant records in the discharge area are accessed. A specific time limit, however, should be determined regarding transfer from the discharge area to the disease/procedure index. Seven days is the suggested minimum transfer time.

1. **Coding**

   The principal diagnosis and procedure is coded by the Health Information Management Professional/physician/medical record officer or person given this responsibility and the diagnosis/procedure and code numbers are entered into each individual patient's admission record via a terminal. When setting up the database for this system, medical record officers or those responsible for assigning the codes should be involved so that the appropriate codes may be accommodated by the data field. Some codes have alpha numeric codes (numbers and alphabetic characters) and some are only a few digits and some maybe longer and contain decimals and/or dashes, so the system must be able to handle these variations.

2. **Retrieval**

   Such a system could be designed to enable the retrieval and report generation of information on the types of diseases/ procedures treated at a hospital.   It should enable retrieval by:

   - Disease/procedure codes
   - Gender and/or age of patient
   - By physician
   - Hospital number (medical record number)
   - Dates/time periods

   The system should have at least four files:

   i. Code file ‐ containing the ICD –International Classification of Diseases and procedure codes (if used) or other coding system used by the country/region/facility
   ii. Episode master file containing admission details of each episode of care including dates
   iii. Medical records user file – containing user names, passwords, type of access and other administrative descriptors required for users
   iv. Doctor master file – contains names of all attending doctors (can include doctor ID numbers if used)

SUMMARY

The information in this module has been prepared to serve as an indication of some initial computer applications relating to patient information services used a hospital or health care facility.   Specifications for such systems should be carefully planned and developed following discussions with the computer planning team at a time when a decision has been made as to type and capacity of the computer to be installed. Facilities should start with the development of a strategic information systems plan (or use one already developed for system purchasing and implementation). The strategic systems plan should fit into the overall plans and goals of the facility and be revised and

reviewed on an annual basis.

Numerous commercial computer software programmes for medical record/health information services are available and medical record officers are advised to seek further information from literature and computer firms and other medical facilities who have implemented such systems.

REVIEW QUESTIONS

1. List and discuss two advantages of health care systems in a facility.

2. List and discuss the fields (column names) which you might include in a table used to implement a PMI

3. List and discuss two disadvantages of health care systems in a facility.

4. How could or would a medical record officer's job change with the implementation of some or any of these systems?

5. Can you think of other applications that might apply to your job or facility in medical records or another area?

6. What elements would you investigate and review as you plan for the purchase and deployment of an electronic health record system?

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