CHAPTER 1

ELECTRONIC HEALTH RECORD
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1.1 Introduction

The rapid advancement of Information Technology and the explosive growth of health information, the Medical Institutions create Electronic Health Record (EHR) systems. An Electronic Health Record refers to comprehensive record of an individual patient health care history in digital format. The Electronic Health Record contains all health information belonging to a patient. Electronic Health Record data is accessed (or) entered electronically by healthcare providers over the person’s lifetime.

Electronic health record [1] is used to store health information of a patient in Health Smart Card by using smart card Reader and computers. It can be made by the Medical Reports of a patient obtained from different health measurement devices. An EHR is able to provide complete, accurate information of patient. The stored health-related information in a health smart card can be accessed by the Electronic Health Record at any time. These are usually accessed by the patient, and can also be accessed by the other specialist through World Wide Web network. EHR systems are increase the physician efficiency and reduce costs and also reduce the medical errors.

The efficiency, productivity, and quality of healthcare institutions depend very much on the information technology, which is used in the patient care process. Itkonen [2] mentioned some words about EHR are, “The future of Information Technology is about developing new relationships between health care practitioners and patients. Information technology programs work collaboratively with doctors to develop new ways of delivering
health care that overcome the deficiencies that set in the traditional doctor patient relationship.”

Electronic Health Record systems improve significant change to contribute the advancement of medicine and also improve the healthcare quality [3] and patient safety. Information of Health Card is able to provide report and decision support of a patient at all points of care with all healthcare professionals, in such a way that the quality of healthcare can be improved. EHR system includes the new useful information that is not available from paper-based records and it also overcomes the problems of paper-based records. EHR system also increases the efficiencies in healthcare administration and expands the research capabilities.

There are quite benefits with EHR, especially in the areas of medical error reduction, compliance, completeness of records, decision support, accurate billing, and even returns on investment.

The electronic health record is a technology touted as a standard of practice for American medicine in the 21st century. This technology brings the medical records and health information from the measurement room to computer hardware and software room for patient record materials, and Internet search capabilities. The EHR system technology based infrastructure that eliminates handwritten clinical data in few years.

An smart health card of a patient’s also contain information about the type of treatment that a patient has been received from a healthcare provider, such as the patient’s medical history, lifestyle, prescribed medication, test results, etc. Usually the patient’s healthcare provider can also access the EHR records and insurance companies, government agencies, other healthcare providers such as nurses, and the medical information bureau may also access the patient’s records [4].
Physician-patient encounter problems are also eliminated by the EHR system. Electronic health data however used to suggest sufficient treatment to the patient from different specialists/physician with the EHR. Physicians with Electronic Record speed up the treatment with the fast accessing of digital data [5], [6]. The health information in electronic health record will be used as right information in the right hands at the right time will support patient health care to make correct health decision.

1.2. History and Evaluation overview of EHR

With the many advances in information technology over the past few years, particularly in healthcare, a number of different forms of electronic health records (EHR) have been developed, and implemented. EHR work has been undertaken by the institutions/countries on different forms of a computerized patient healthcare information system [7].

There are many reasons to change paper record system to an electronic system. The major step in the healthcare is expected to move from a paper to a paperless environment. There are different reasons to encouraging healthcare practitioners to an electronic system is as follows

- Improve the accuracy and quality of data recorded in a health record
- Enhance healthcare practitioners’ access to a patient’s healthcare information enabling it to be shared by all, for the present and continuing care of the patient
- Improve the quality of care as a result of having health information immediately available at all times for patient care
- Improve the efficiency of the health record service, Contain healthcare costs
- A paperless environment will come with the introduction of an electronic health record and eliminate many of the problems in maintaining paper health records.
• EHR maintain privacy and confidentiality

The **World Health Organization (WHO)** highlighted the need for better healthcare services. Which required a change of focus in healthcare in many areas to ensure, if possible, that the implementation of an electronic health record covers healthcare delivery services across a broad spectrum of healthcare.

Evaluation of an Electronic Health Record over the years a number of terms have been used to describe the move from a manual or paper record to generated electronically in different forms. Some of the better-known terms are

* Automated Health Records (AHR)
* Electronic Medical Record (EMR)
* Computer-based Patient Record (CPR) and
* Electronic Health Record (EHR).

### 1.2.1. Automated Health Records (AHR)

The term **Automated Health Records (AHR)** has been used to describe a collection of computer-stored images of traditional health record documents. Typically, these documents are scanned into a computer and the images are stored on memory disks. Most of the focus is in the early 1990’s was on document scanning and storing onto a memory disks. The addressed access, space, and control problems related to paper based records. The Automated Health Records did not address data input/output at patient care level.

### 1.2.2. Electronic Medical Records (EMR)

The **Electronic Medical Record (EMR)** is same as an Automated Health Records. The EMR has been used to describe automated systems based on document imaging or systems, which have been developed within a medical practice/health center. These have been used extensively by general practitioners in many developed countries and include
patient identification details, medications and prescription generation, laboratory results and
in some cases all healthcare information recorded by the doctor during each visit by the patient [8]. In some cases EMR include the electronic medical system within a hospital, which as well as the above includes clinical information entered by the healthcare professional at the point of care.

1.2.3. Computer-based Patient Record (CPR)

The term Computer-based Patient Record (CPR) was introduced in the 1990’s in the USA. This was defined as a collection of health information for one patient linked by a patient identifier. The CPR could include as little as a single episode of care for a patient or healthcare information over an extended period of time [9]. Early CPR’s focused on functions such as medical alerts, medication orders, providing integrated data on a patient’s registration, admission, financial details and recording information from nurses, laboratory, radiology, and pharmacy. Although this form of a computer-based patient record was implemented in a variety of settings the focus on exchanging health information was limited to inpatient facilities.

1.2.4. Electronic Health Record (EHR)

The Electronic Health Record (EHR) includes all information contained in a traditional health record including a patient’s health profile, behavioral and environmental information. The EHR also includes the time, which allows for the inclusion of information across multiple episodes and providers, which will ultimately evolve into a lifetime record [10].

This type of system would require a computer program that captures data at the time and place where healthcare is provided [11], whether at a hospital (or) primary care level over an extended period of time. It would enable healthcare information, such as a person’s allergies, recent test results or prescribing history to be readily available at all times to assist
with decisions on diagnoses, treatment and medication at all levels of healthcare. Ideally it should reflect the entire health history of an individual across his/her lifetime including data from multiple providers from a variety of healthcare settings.

The proposed Electronic Health Record by the World Health Organization (WHO) will have the following parameters:

- Contain all personal health information of an individual patient, from the patient’s first admission or attendance at the hospital.
- Be entered electronically by healthcare providers at the point of care over the patient’s lifetime.
- Information readily available and accessed by all healthcare providers attending to the patient.

The electronic health record decided upon the health information [12] contained in it must be organized primarily to support continuing, efficient, and quality healthcare. It must also continue to meet legal, confidentiality, and retention requirements of the patient, the attending health professional and the healthcare institution.

1.2.5. Overview on Examples uses of EHR Practices

Implementation of some form of Electronic Health Record has been achieved in a number of countries over recent years. Examples of a few EHR practices are as follows:

- In Malaysia, developed a Health Information Management Administration System (HIMAS) using computer covering patient admission, transfer, and separation (ATS), appointment scheduling and a medical records tracing system. The present INFOMED system being used includes the ATS, patient scheduling, and medical records tracking applications, pharmacy ordering, laboratory ordering/reporting,
radiological ordering and reporting, patient accounting and a small system on case-mix.

- In Korea hospitals have implemented an Electronic Medical Record (EMR). They include all inpatient and outpatient healthcare information. For inpatients, data is entered at the bedside using a notebook computer. For outpatients, doctors input data at the point of care via computer terminals. Some test reports which are produced from equipment not yet interfaced to the EMR, are also scanned immediately after discharge enabling users to view them via a monitor.

- An EHR standard is being developed in Indonesia and is mainly concerned with the hospital-based environment even though some data may also come from community healthcare sectors.

- In China, a number of hospitals have successfully introduced the electronic health record.

- The Australian Government is implementing the National Health Information Network (NHIN), called Health Connect – a proposed network aimed at improving the flow of information across the Australian health sector. It is a system involving the electronic collection, storage and exchange of patient health information via a secure network and within privacy safeguards.

- Other countries such as Singapore, Taiwan, Hong Kong and Thailand are also developing electronic health records in one form or another with successful implementation.
1.3. Earlier Literature on EHR system

EHRs began in the 1960s with the COSTAR system, developed by Barnett at the Laboratory of Computer Science at Massachusetts General Hospital [13], [14]. In COSTAR, the medical data for a patient visit are recorded on a paper-based encounter form and then transcribed into the computer system by clerical personnel.

Subsequent efforts at Duke University and the Regenstrief Institute at Indiana University Medical Center [15] have all given rise to robust EHR systems that contain data for thousands of patients. While there is no formal model or standard architecture for EHR systems, these pioneering systems provided a basic model for current hospital-based and ambulatory EHR systems that has been emulated by current products. The electronic record developed at the Regenstrief Institute at Indiana University, where a clinician can view a patient's problem list and laboratory data interactively as flowsheets, allowing easier detection of trends. An ambulatory computer-based record at Boston's Brigham and Women's Hospital also provides a summary screen displaying a "patient-at-a-glance" with a problem list, allergies, and medications. In these systems, like many similar systems, the patient information is accessed either through direct inquiry at a computer terminal or through computer-generated summaries and reports.

A major impediment to the development of a computer-based clinical record system has been the lack of agreement in standards both for the clinical terminology to be used and for the computer technology. The American Society for Testing and Materials (ASTM) recently promulgated a standard to describe the content and structure of a computer-based system, but it is not widely reflected in currently used systems. A consortium of vendors and hospitals, Health Level Seven [16], is developing standards for transmitting billing; admission, discharge, and transfer; order entry; and the reporting of results between a network of computers. Health Level Seven collaborates closely with ASTM and has defined a
standard for the protocol to be used in the communication of laboratory data in an electronic format; many vendors have adopted this standard. The absence of standards for the other sections of the clinical record and the lack of support for standards by the government and professional organizations has resulted in the use of many competing computer operating systems, hardware platforms, user interfaces, and software tools, making every computer-based record system implementation almost hopelessly proprietary. Little attention has been focused on establishing a standard for a system with an "open architecture," a standard that would allow computer hardware and software products of many different manufacturers to function together. Given the diversity of computer technology, such an open architecture will be essential for the dissemination and national adoption of a common computer-based system.

The successful development of the automated medical record in the Dutch system is based largely on the country's progress in four crucial areas. These are the development of a standard clinical vocabulary, effective methods for direct physician interaction with the computer-based system, support of key professional societies, and judicious use of government funding.

1.4. Electronic health record Vs paper record

Electronic health records (EHR’s) offer a number of advantages over the old paper record [17]. They have the potential to improve the quality of patient care, reduce the cost of health care, and expedite the transfer of information. Now we discuss the advantages of EHR’s, reasons for adopting this system. Users and administrators were universally concerned about data loss. Solid plan to prevent such loss was an integral part of the system. In fact, the data loss electronically has been nil.

The paper record will represents at one place where everything can’t be found. One of the attractions of an electronic medical record is that it holds the promise of one-stop-
shopping for all clinical data. The system will be evolving from paper towards electronic media for several more years. So, the users have come to expect the most recent information will be in the EHR and not in the paper report. Information about health is sensitive and can be safeguarded in systems with appropriate security mechanisms far better than paper report. As a community, having an EHR record for every patient can improve both quality and safety.

The physicians reported diminished efficiency using EHR’s when compared to the use of paper-based records. Nurses reported using EHR’s the least and mainly for retrieval of information instead of entering or storing information. Physicians entered their daily progress notes into the EHR, then more time will saved when retrieve information from the patient. At the same time, user interfaces must be modified to improve patient access to their records.

Electronic Health Record includes the old useful functions and overcome the known problems of paper-based records [18] and provides new useful functions that are not available from paper-based records.

1.5. Smart care technology and components of EHR

An Electronic Health Record (EHR) is a medical record relating to the past, present or future physical and mental health, condition of a patient which resides in computers which capture, transmit, receive, store, retrieve, link, and manipulate multimedia data for the primary purpose of providing health care and health-related services.

The contents of the EHR comprises basic demographic data, a record of all patient visits, diagnostic findings including also radiology images, diagnoses and performed procedures, a lifelong medication record, personal risk data e.g. allergies, vaccinations, and clinical referral letters. Medical records have to kept record of all patients of inpatients, outpatients and accident and emergency patients. Medical record system should maintain centralized system. In centralized system, they have to maintain all details of a patient one
medical record like Admissions details, Accident and emergency records, outpatient notes, and discharge list. If the patient's medical record cannot be found or lost by the Electronic Health Record system, duplicate medical records can be prepared and combined with the old records.

Most commercial EHR's are designed to combine data from the large ancillary services such as pharmacy, laboratory, and radiology, with various clinical care components such as nursing plans, medication administration records, and physician orders. The number of integrated components and features involved in any given Medical Centers is dependent upon the data structures and systems implemented by the technical teams. Medical Centers may have a number of ancillary system vendors that are not necessarily integrated into the EHR. Import data from the ancillary systems via a custom interface or may provide interfaces that allow clinicians to access data.

The EHR may incorporate with only a few ancillaries as explained below

1. Administrative System Components
2. Laboratory System Components
3. Radiology System Components
4. Pharmacy System Components
5. Computerized Physician Order Entry & Clinical Documentation

1.5.1 Administrative System Components

The administrative key components of EHR's are Registration, admissions, discharge, and transfer - RADT. These data include vital information for accurate patient identification and assessment, including, but not necessarily limited to name, demographics, next of kin, employer information, chief complaint, patient disposition, etc. The registration portion of an
EHR contains a unique patient identifier, usually consisting of a numeric or alphanumeric sequence that is unidentifiable outside the organization or institution in which it serves. RADI data allows an individual's health information to be aggregated for use in clinical analysis and research.

This unique patient identifier is the core of an EHR which links to all clinical observations, tests, procedures, complaints, evaluations, and diagnoses to the patient. The identifier is sometimes referred to as the medical record number or master patient index.

1.5.2 Laboratory System Components

Laboratory systems are standalone systems that are interfaced to EHR's. Typically, there are laboratory information systems that are used as hubs to integrate orders and results from laboratory instruments, schedules, billing, and other administrative information. Laboratory data is integrated entirely with the EHR frequently. The machines and analyzers are used in the diagnostic laboratory processes that are not easily integrated within the EHR. EHR's are implemented in present design, which allows the user to access the Laboratory information systems from a link within the EHR interface.

1.5.3 Radiology System Components

Radiology information systems are used by radiology departments to tie together patient radiology data e.g., orders, interpretations, patient identification information and images. The typical Radiology information systems will include patient tracking, scheduling, results reporting, and image tracking functions. Radiology information systems are usually used in conjunction with picture archiving communications systems, which manage digital radiography studies. Most Medical Centers have their own Radiology information systems [19].
1.5.4 Pharmacy System Components

Pharmacies are highly automated in Medical Centers and in large hospitals. For automation, pharmacy robots for filling prescriptions or payer formularies are integrated with EHR’s. In inpatient settings more percent of all electronic pharmacy orders are entered in a pharmacy system [20].

1.5.5 Computerized Physician Order Entry & Clinical Documentation

Computerized physician order entry [21] permits clinical providers to electronically order laboratory, pharmacy, and radiology services. Computerized physician order entry systems offer a range of functionality from pharmacy ordering capabilities alone to more sophisticated systems such as complete ancillary service ordering, alerting, customized order sets, and result reporting. Computerized physician order entry and clinical decision support systems to a physician will reduce the medication-related errors. However, the net effect of computerized physician order entry will speed up the process of the clinicians.

Electronic clinical documentation systems enhance the value of EHR’s by providing electronic capture of clinical notes, patient assessments, and clinical reports, such as medication administration records. As with Computerized physician order entry components, successful implementation of a clinical documentation system must coincide with a work flow that may be substantial—as much as more percent of a nurse’s time can be saved [22].

Clinical documentation includes

- Physician, nurse, and other clinical notes
- Flow sheets (vital signs, input and output, problem lists, Medical Administration Records)
- Operative notes, Discharge summaries
Medical devices are integrated into the flow of clinical information and used to generate real-time alerts as the patient’s status changes. Intravenous medication pumps connected to the clinical information system provide automatic dosage verification and documentation for medication management. All physiologic monitoring systems are networked and data on patients is viewable on other clinical information systems in the hospital. From office physician can monitor patient reports using a Web-based viewing system created that provides live waveforms from ICU and monitored bedsides.

1.6. Electronic Health Record components

The health record of an individual that is accessible online from many separate, interoperable automated systems within an electronic network. To facilitate this functionality, the proposed EHR would require five components.

1. Person Identifier
2. Faculty Identifier
3. Provider Identifier
4. Health Information
5. Administrative Information

1.6.1. Person Identifier

Person Identifier is a universal code that uniquely identifies each individual within the health System.
1.6.2. Faculty Identifier

A Faculty Identifier universal code that uniquely identifies each institution or center that provides services within the health system.

1.6.3. Provider Identifier

A Provider Identifier universal code that uniquely identifies each health care provider within the health system.

1.6.4. Health Information

Health data in a standardized format e.g. diagnosis, x-rays, prescriptions that are the result of interactions between individuals and their health care providers.

1.6.5. Administrative Information

Standardized data that support administrative functions, such as billing.

In addition to the above-mentioned identifiers, there has been some information about the inclusion of a device identifier. It would be used to identify major medical devices e.g. EMR’s, X-rays for identification purposes. This would, for example health care providers can trace patients who may have been affected by a device.

1.7. Creation of an Electronic Health Record

The Electronic health Record includes health care notes on the life period of each individual that is created within a computer system in health is facilities and is kept confidentially. This record should be accessible electronically to authorized health care providers for supporting raise of their quality of services. The electronic health record is a secure, shared electronic health information system which will give authorized capital health users convenient, timely access to region-wide patient centered information at the point of care.
Interest in electronic patient-physician communication [23] and patients-as-contributors to their own medical record [24] have accelerated as health care organizations focus their efforts to improve the quality and delivery of care with technology. Millions of patients, thousands of physicians, and multiple institutions and groups offering primary care and specialty care services in many settings (inpatient, outpatient, home care, rehabilitation care, etc.), has continued to invest in clinical information systems to improve quality of care.

The electronic health record is a longitudinal collection of patient-centric, healthcare information; available across providers care settings and time. It is a central component of an integrated health information system. Electronic health records have the potential to save hundreds of hours of time, reduce cost of care, while improving patient safety. An electronic health record is used for getting better decision on treatment circulation and development of curative results and can gather better information for public health and researches.

The Electronic Health Record is used to describe both the information about patient contacts with primary health care as well as subsets information associated with the outcomes of periodic care in electronic patient record.

![Fig 1.1: Creation of Electronic Health Record](image)

Electronic patient record is a document that mostly describes the record of the periodic care provider to a patient by an acute hospital as illustrated in fig 1.1. Other health
care providers may also hold EPRs, ex: specialist units (or) mental health facility. To gain a more accurate appreciation of its complexity and breadth of information, one must recognize the wide range of health information sources. Each time a patient visits a health care provider, data are generated. Fig 1.2 identifies some of the sources of data for an EHR as listed by the Institute of Medicine [25].

![Diagram of EHR sources]

**Fig 1.2: sources of health related data**

Once the data have been collected, they are placed in many repositories or databases that are part of health systems. From these systems, specific pieces of a patient’s information are combined to create a core data set that is made available to other systems. The core data set includes health and administrative data. The systems providing the information are referred to as feeder systems (e.g. laboratory systems). Other systems that use the data are called support systems (e.g. billing systems). To provide a comprehensive EHR, these systems must be linked, thereby allowing access to patient data regardless of their physical location. The fig 1.3 depicts the relationship of these systems.
1.8. Conceptual overview of an Electronic Health Record System

In 1997 the Institute of Medicine (IOM) [25] prepared a report that has become the "most comprehensive study and prepare document for creating an EHR's". The IOM proposed the following attributes/features as benchmarks against which the progress of EHR's and EHR systems could be measured. These features are

1. The EHR contains a problem list that clearly delineates the patient's clinical problems and the current status of each.

2. The EHR encourages and supports the systematic measurement and recording of the patient's health status and functional level to promote more precise and routine assessment of the outcomes of patient care.

3. The EHR states the logical basis for all diagnoses/conclusions of documenting the clinical rationale for decisions about the management of the patient's care.

4. The EHR can be linked with other clinical records of a patient—from various settings and time periods—to provide a longitudinal (i.e. lifelong) record of events that may have influenced a person's health.

Fig 1.3: System Network Interoperability
5. The EHR system addresses patient data confidentiality comprehensively—particularly ensuring that the EHR is accessible only to authorized individuals.

6. The EHR is accessible for use in a timely way at any time by authorized individuals involved in direct patient care.

7. The EHR system allows selective retrieval and formatting of information by users.

8. The EHR system can be linked to both local and remote databases of knowledge, literature and administrative databases and systems so that such information is readily available to assist practitioners in decision-making.

9. The EHR can assist to guide the process of clinical problem solving by providing clinicians with decision analysis tools, clinical reminders, prognostic risk assessment and other clinical aids.

10. The EHR supports structured data of collection and stores information and it adequately supports direct data entry by practitioners.

11. The EHR can help individual practitioners and health care provider institutions manage and evaluate the quality and costs of care.

12. The EHR is sufficiently flexible and expandable to support not only today’s basic information needs but also the evolving needs of each clinical specialty and sub-specialty.

There are few underpinnings that are critical for meeting the above IOM criteria. These underpinnings include a clinical data dictionary, a clinical data repository, and flexible input capabilities, Design a data presentation and automated support. The development of a technical infrastructure is further along with it. These are the main reasons for the inequality. Many organizations have successfully integrated several of these criteria into their systems.

Fig 1.4 represents a simplified conceptual view of the creation and considerations affecting an EHR. The following diagram of the conceptual overview is divided into two
major sections: the left side depicts the components involved in the creation of an EHR, and the right side identifies the users and tools required to access the Network.

The creation of the Health Network (left side) involves the interaction of a person with a health care provider/health faculty. The data are captured, subjected to standards and policies, and will then be stored with identifiers (person, facility and provider) as well as health and administrative data in interoperable databases.

![Diagram of Health Network components and stakeholders](image)

**Fig 1.4: Electronic Health Record System Conceptual overview**

The right side of the Health Network illustrates how various cardholders access the data stored in the databases by using user-friendly interfaces and security levels to protect privacy and confidentiality and various tools. The EHR contains all health information generated by all the health care providers an individual interacts with over that person's lifetime. Each interaction will result in an Incident Record that will reside in a system. When these systems become interoperable, the building of the health info structure begins.

Approaches to implementing EHR systems could be "revolutionary" or "evolutionary". It seems that most jurisdictions are taking an evolutionary approach from either a service perspective like pharmaceutical information networks or an application perspective like Health Smart Card technology.
The University Health Network (UHN) in Ontario [26] is currently has infrastructure and systems to manage administrative data, process admissions, discharges and transfers, support departmental operations, and enter orders and report results for most tests. The current environment combines paper and electronic media to store information that is critical to the provision of patient care. In 1991, the Kaiser Permanente Rocky Mountain Division, initiated an EHR project that encompassed 25 facilities and 350 000 members [27].

1.9. Benefits of an Electronic Health Record

Electronic health records may have numerous benefits. Most significantly, EHRs have the potential to improve health care delivery by allowing timely and accurate access to information by those involved in patient care; reduce medical errors and adverse health events; augment security of patient information; and enhance availability of information to support health system planning and reform as well as research. EHRs that are available to patients can provide them with convenient access to their own health information and facilitate activities such as prescription renewals and appointment booking. The following lists the expected benefits of the implementation of EHR's

- Support patient care and improve its quality
- Enhance productivity of health care professionals and reduce the administrative costs associated with health care delivery and financing
- Support clinical and health service research
- Accommodate future developments in health care technology, policy, management and finance
- Ensure patient data confidentiality at all times.
- Instant and universal access to the patient record
- Easier and quicker navigation through the patient record
- No lost charts
Standardization of care among providers within the organization

Clinical data that is formatted to be easy to read and analyze

Reduction of paperwork, documentation errors, filling activities.

Coding efficiency and efficacy

Alerts for medication errors, drug interactions, patient allergies

Ability to electronically transmit information to other providers (assessments, history, treatments ordered, prescriptions, etc.)

Availability of clinical data for use in quality, risk, utilization,

To be effective, benefits for all of the cardholders involved in implementing EHR system must be realized. Some of these expected benefits include

Provide improved confidentiality and security for all health related data and information.

The EHR is of pivotal importance to an integrated health care delivery system. To support this system, the cardholders within that structure must realize benefits.

1.10. Barriers to accept an electronic health record

Despite all of these benefits, testimonies, and recommendations, EHRs are not a standard in today’s healthcare systems. [28] Even though the IOM’s recommendation to implement EHRs is over 10 years old and it is evident that EHR technology is still a hot topic for discussion in healthcare technology and management journals. The following barriers have kept healthcare leaders discussing EHR technology instead of adopting it: cost, leadership, vendors keeping up with users’ needs, and deficits in the following categories: public policy, standards, security, and a true definition. When considering a move from a manual medical record system to electronic health record, the following are the major steps to follow some of the preliminary steps.
1) Firstly, they require adequate technical background to make the right decisions on an EHR system.

2) They should have a strong background in:
   a) Health information management,
   b) Health informatics and electronic,
   c) Health record implementation.

3) Just not having an information technology (IT) background is not sufficient. They need to understand the health record environment and how manual health records are maintained as well as electronic health record systems.

4) They need to have some knowledge of systems operating in developing countries.

5) In some countries, they have restriction that may affect EHR implementation, such as:
   a) Lack of funds,
   b) Lack of technical support,
   c) Unreliable supply of electricity, and
   d) Lack of trained staff.

   The funds can be organized into the following categories: software, hardware, infrastructure development and maintenance, implementation, education, planning, and administration. Software costs include development or purchase, maintenance, and upgrades over time, while hardware costs include purchase of Workstations. Infrastructure development and maintenance costs include servers, interfaces, workstations, network cables, network maintenance, and help desk operations. [29] Planning costs include development of an implementation plan, identifying measurable outcomes, and choosing meaningful metrics and goals, while implementation costs include training, overtime associated with entering patient data, business disruption during transition, employee resistance to change, and lost productivity.
One of the major problems over the years in many institutions/countries has been inadequate medical record documentation. Problems include incomplete, insufficient or poor documentation and non-use of standard terminology.

A move to an electronic health record will be successful if documentation deficiencies are not addressed and healthcare practitioners educated in good healthcare documentation. To enter all relevant data at the point of care at the time that care is given.

1.11. Object of the present work

This work will focus on Integrated Electronic Health Record System (IEHRS) research and implementation of it for the maintenance of health report using Health Smart card. In order to improve patient care and to make patient information available and accessible to those who need it an Electronic Health Record (EHR) is needed. IEHRS improve patient care reduce medical errors, provide link to medical knowledge and clinical decision support systems, simultaneously access to patient data, greater security, improved legibility communication and more complete documentation. By the research wok on IEHRS, Electronic Health Record's would serve both private and Government sector objectives to transform health care delivery in INDIA.

The basic idea and theme of the present work is to develop an integrated electronic health record system for the measurement of basic biomedical parameters like Blood Pressure monitor (BP) Glucose monitor, Pulse Oxymeter which are essential to any doctor. Later on, these parameters are transmitted to the Personal Computer trough serial communication. Further, they are stored in health smart card.

Where these Health smart card will provide the total history of a patient and analysis. The adaptability of the proposed system for future generation of an Electronic Health Record.
The advantages [30] of proposed work is that

1. Quicker and easier retrieval of data from portable card
2. Deliver better and faster service
3. Decrease paper work and Administrative costs.
4. Increase patient convenience.
5. Improvement in the management of health of care through incentives for improved performance
6. Opportunities in administrative simplification, data transfer, improved security/privacy, decreased fraud
7. Secure access the medical data
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