

Electronic Health Record

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Abstract

Electronic health record is an electronic set of patient records that contain information on a patient's medical history, demographics, laboratory data, medication and other important medical information. Paper records are bulky, retrieving them is labour-intensive and cannot be utilized by multiple departments at the same time. Electronic Health Record data is accessed electronically by healthcare providers. Electronic health record Improve the accuracy, efficiency, quality of health care and data recorded. EHR maintain privacy, confidentiality and reduce medical errors. Electronic Health Record has different forms over the years. AHR, EMR, CPR, EPR are the some of the terms of the e-health record.

Keywords: Electronic health record, AHR, EMR, CPR, EPR

Introduction

The rapid advancement of Information Technology and the explosive growth of health information, the Medical Institutions create Electronic Health Record (EHR) [1]. An Electronic Health Record refers to comprehensive record of a patient health care history in digital format. The Electronic Health Record contains all health information of a patient. Electronic Health Record data is accessed electronically by healthcare providers.

Electronic health record Improve the accuracy, efficiency and quality of data recorded in a health record. Enhance healthcare practitioners' access to information enabling it to be shared by all. EHR Improve the quality of care as a result of having health information immediately available at all times for patient care. 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, reduce medical errors and costs

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 health card of a patient's contains information about the type of treatment, patient's medical history, lifestyle, prescribed medication, test results, etc. the healthcare provider, insurance companies, government agencies, other healthcare providers such as nurses, and the medical information bureau access the patient's records [2]. 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 [3]. The health information [4] 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.

Computer based records take up as much hospital space as the device that accesses them, search is almost instantaneous, and can be accessed by multiple departments at the same time. Computerized systems help reduce medical errors. Systems can check prescriptions against

patient drug allergies, dangerous drug combinations and misunderstandings caused by illegible handwritten prescription.

Evaluation and Earlier Literature on Electronic Health Record

Evaluation of an Electronic Health Record over the years a number of terms have been used to describe the move from a manual/ paper record to electronically in different forms [5]. Some of the better-known terms are

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 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.

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. 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.

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 [6]. 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.

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.

This type of system would require a computer program that captures data at the time and place where healthcare is provided, 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 World Health Organization (WHO) proposed parameters in electronic health record

- Contain all personal health information of an individual patient, from the patient's first admission/ 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.

Earlier Literature

EHRs began in the 1960s with the COSTAR system, developed by Barnett at the Laboratory of Computer Science at Massachusetts General Hospital [7], [8]. 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 have all given rise to robust EHR systems that contain data for thousands of patients. 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.

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) 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 [9], 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;

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.

Health 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 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 incorporate with 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

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, demographics, 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. RADT 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.

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 & other administrative information. Laboratory data is integrated entirely with the EHR frequently. The machines and analyzers used in the diagnostic laboratory processes are integrated with the EHR.

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.

Pharmacy System Components : Pharmacies are highly automated in Medical Centers and in hospitals. For automation, electronic 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 [10].

Computerized Physician Order Entry & Clinical Documentation : Computerized physician order entry [11] permits clinical providers to electronically order laboratory, pharmacy, and radiology services. It 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. Computer order entry and clinical decision support systems to a physician will reduce the medication-related errors and it 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 [12]. 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
- Transcription document management , Medical records abstracts
- Durable powers of attorney for healthcare decisions,
- Medical record/chart tracking, Utilization management

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.

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

Person Identifier is a universal code that uniquely identifies each individual within the health System. A Faculty Identifier universal code that uniquely identifies each institution or center that provides services within the health system. A Provider Identifier universal code that uniquely identifies each health care provider within the health system. 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. Standardized data that support administrative functions, such as billing.

Creation of an Electronic Health Record

The Electronic health Record includes health care notes on the life period of each individual that is created in a computer system is kept confidentially. The ehr is a secure, shared and they are accessed electronically by authorized health care providers. EHR's save hundreds of hours of time, reduce cost of care, while improving patient safety. An ehr are used for getting better decision on treatment and development of curative results and can gather better information for public health and researches.

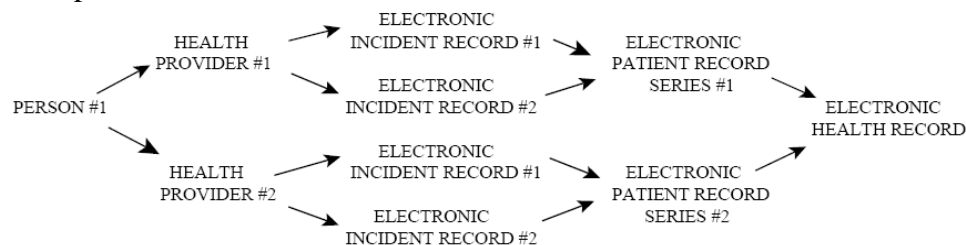


Fig 1: Creation of Electronic Health Record

The EHR 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. 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. Other health care providers

may also hold EPRs, ex: specialist units (or) mental health facility. Each time a patient visits a health care provider, data are generated. Fig.2 identifies some of the sources of data for an EHR as listed by the Institute of Medicine [13].



Fig 2: sources of health related data

Once the data have been collected, they are placed in databases of health systems and store data in Health Smart card [14]. Smart cards can be described as portable integrated devices that store and process data [15]. The patient can carry the health smart card with him/her anywhere and anytime and present it to the doctor at the time of consultation[16][17]. 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 location. The fig 3 depicts the relationship of these systems.

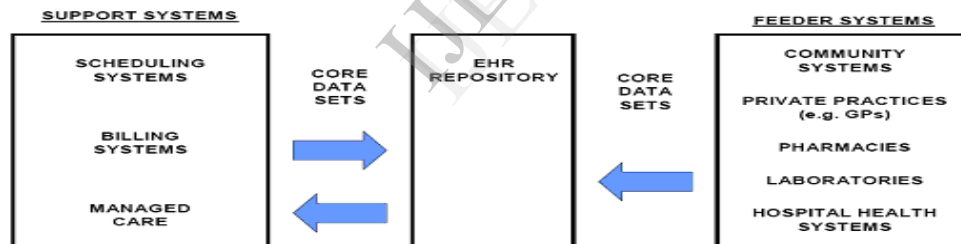


Fig 3: System Network Interoperability

Conceptual overview of an Electronic Health Record System

In 1997 the Institute of Medicine (IOM) 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 of EHR's and EHR systems. Some of the features are

- ❖ The EHR contains the patient's clinical problems and the current status of each.
- ❖ The EHR systems maintain patient data confidentially.
- ❖ The EHR is accessible for use in a timely way at any time by authorized individuals involved in direct patient care.
- ❖ The EHR system allows selective retrieval and formatting of information by users.
- ❖ The EHR can help individual practitioners and health care provider institutions manage and evaluate the quality and costs of care.
- ❖ The EHR can assist to guide in clinical problem solving by providing clinicians with decision analysis, clinical reminders, prognostic risk assessment and other clinical aids

- ❖ 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
- ❖ 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
- ❖ The EHR encourages and supports the systematic measurement and recording of the patient's health status.
- ❖ The EHR system link with 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.

Conceptual view of the creation and considerations affecting an ehr is shown in fig 4. It has 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. 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.

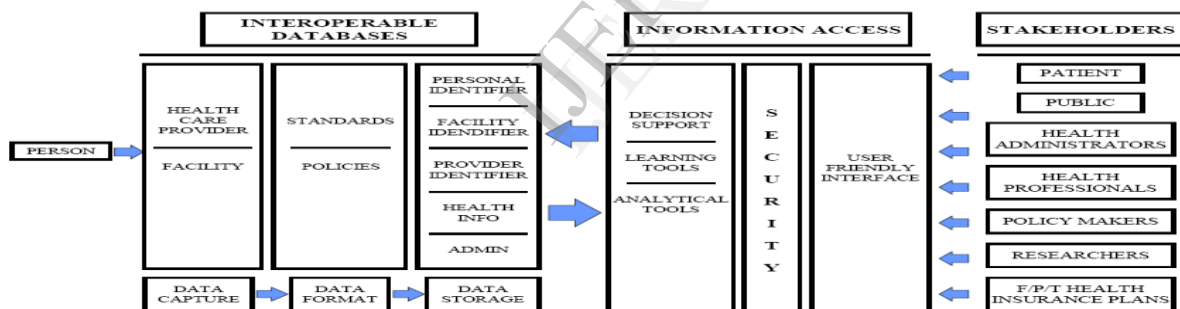


Fig 4: Electronic Health Record System Conceptual overview

Benefits of an Electronic Health Record

Electronic health records may have numerous benefits, some of them are as follows

- Support patient care and improve its quality, Instant and universal access to the patient record and Ensure patient data confidentiality at all times.
- Alerts for medication errors, drug interactions, patient allergies
- Enhance productivity of health care professionals and reduce the administrative costs associated with health care delivery and financing
- Support clinical and health service research, Standardization of care among providers within the organization, Accommodate future developments in health care technology, policy, management and finance
- Clinical data is easy to read and analyze and format.
- Reduction of paperwork, documentation errors, filling activities.
- Ability to electronically transmit information to other providers
- Availability of clinical data for use in quality, risk, utilization.

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