The e-Health scenario with latest trends in EMR applications: A Review of EMR techniques with healthcare framework

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Abstract:
Over the past few years, information systems have become increasingly important in healthcare delivery. The use of computers in a wide range of medical applications and healthcare management is one potential alternative to reducing the overall costs of healthcare delivery. Further, the use of sophisticated decision support systems is envisaged to improve quality of clinical decision making.
The paper discusses what medical informatics is, the definition of EMR, efforts required for extraction of patient data from heterogonous EHRs. Gain new knowledge within secure distributed systems and software agents. Based on experimental work and some of the pilot studies a system has been designed and developed in the field of EMR & EHR

Keywords— medical informatics, ehealth, e-records, health informatics, EMR, EPR

I. INTRODUCTION

The health of a nation is the product of many factors and forces that combine and interact. Information on health care and nutrition, access to safe drinking water, public and private health care infrastructure, access to preventive health and medical care and the health insurance are among the contributing factors.

The advances in medical science and biomedical engineering on one side and Information and Communication Technology (ICT) on the other are offering wide opportunities for improved health care. [1]

In the healthcare industry there are some areas where leading-edge ICT developments are employed and developments at the leading-edge will be important. In other areas the health system is some way behind other industries in the adoption and application of information management and information systems. In general, the situation seems to be one of relatively slow progress through the evolving computing paradigms of functional computing, enterprise computing and network computing. Some functions are highly automated, but integrated enterprise computing in hospitals and clinics is still rather rare. As a result, linking and integrating the healthcare system (network computing) remains a major challenge. [2]

The Internet has a greater potential to fundamentally transform both the structure and the core processes of medicine than any new technology we have seen in the past fifty years. Professional resistance to adoption of the technology and political problems associated with protecting the confidentiality of patient records pose the two biggest hurdles to fully realizing this potential.

So, vision of the health care information infrastructure is possible using technologies that support the sharing of medical **e-records** while maintaining patient privacy. Revolutionizing Health Care through Information Technology that contained comprehensive findings regarding the potential of information technology (IT) to reduce medical errors, lower costs, and improve patient care. It also recommended a technological framework for transitioning from manual, paper-based health records to a modern, computerized electronic records infrastructure. [3]

II. WHAT IS MEDICAL INFORMATICS?

Health Information systems have nationalities. All the HIS in the world have a common goal: to support healthcare professionals in improving overall efficiency, cost effectiveness and ultimately the quality of patient care. However, they differ widely in the implementation. The growing trend towards shared care requires that these systems be able to share their data. The objective is to propose a generic system that will provide integrated access to all the information and knowledge necessary to treat patients. [4]

Medical informatics is the field concerned with "the cognitive, information processing, and communication tasks of medical practice, education, and research, including the information science and technology to support these tasks (as reported in Greenes and Shortliffe, (1990)". [1]

III. WHAT IS ELECTRONIC MEDICAL RECORD (EMR)?

According to the Medical Records Institute, the electronic patient record is a "computer-stored collection of health information about one person linked by a person identifier." The institute further identifies five distinct levels of computerization for patient information systems:

- Level 1: in this level, health organizations are still depending on paper-based medical records
- Level 2: Here, the goal is to digitize the medical record and create an electronically available record;
- Level 3: the electronic medical record is the upgraded version of the computerized medical record
- Level 4: here, the electronic patient record combines several enterprise-based electronic medical records concerning one patient and assembles a record that goes beyond the enterprise-based retention period; and
- Level 5: the more comprehensive collection of an individual's health information is the electronic health record [5, 6].

A. Features

The universal features that **EPRs** should have lifelong records for every person, online access to patient records

for practitioners and genuinely seamless care resulting from the above two features.

- Integrates information from many sources; from blood pressure monitors to complex imaging systems
- Provides a single access point for relevant, concise, accurate and active data about a patient to authorized users in different locations. These records may be available for:

1. Patient care
2. Administration
3. Clinical Audit
4. Financial Audit
5. Research
6. Education

- The UI features are easily configurable to meet the varying demands of each medical practitioner. [4]

B. Evaluation

We try and to answer the following questions while evaluating our system:

- Will the evaluation provide a comprehensive and objective assessment of the achievement of goals?
- Will it form the basis for continued improvement in the application and use of information?
- Will the evaluation be realistic?
- Will the findings of the evaluation be accurate?
- Will it convey technically adequate information about the features that determine the worth or merit of the system being evaluated? [9]

IV. OBJECTIVES OF EMR

"**ehealth** is not an evolutionary concept but a revolutionary concept and at the heart of every revolution, there is the need for a sudden massive change, at the core of which is the human mind."

By taking into consideration "Health for All," we'll discuss some objectives for which **e-record** has originated.

- To develop a generic approach to integrate the various components to provide decision support, using the existing health information systems, imaging systems, case bases, clinical guidelines and protocols, and modeling and simulation tools as shown in figure 1.[6,7]

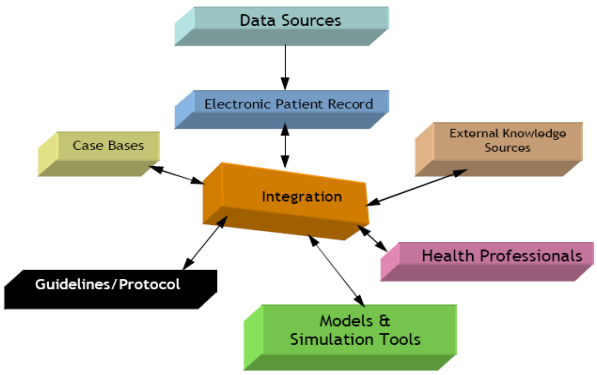

Figure1: overview of the Information Architecture of the System.[4]

- **EPR** is not homogenous. It is taken from a altitude of sources. The data which feeds or populates the EPR already resides in a variety of highly heterogeneous and autonomous information systems and simply integrating this data does not necessarily result in a valid EPR. Clinical data may be entered using a multiplicity of methods such as keyboard, voice recognition software, touch screens, scanners or from medical instrumentation such as blood pressure monitors, ECG machines, laboratory analyzers or imaging devices. We will have to develop a middle-ware client-server component-based approach, acting as an intermediary as shown in figure 2.[10,11]

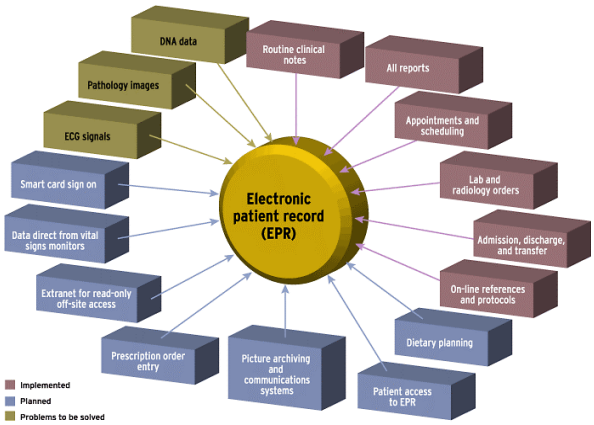

Figure 2: EPR with functions that have been incorporated & those that have not in the current crop of HIS.[4]

A. What are advantages of EMR?

- Efficiency isn't the only benefit. For individual patients, access to good care becomes easier and safer when records can easily be shared. Important information -- such as blood type, prescribed drugs, medical conditions and other aspects of our medical history -- can be accounted for much more quickly. At the very least, an existing electronic medical record (EMR) can save time at the doctor's office. At most, quick access to our records can be lifesaving if an emergency occurs and answers to those questions are needed during the emergency decision-making process.
- Second advantage is safety. In the past, the way a doctor obtained your health history was by asking you. Each time you visited a new doctor's office, you filled out forms about your history, including previous surgeries, or the drugs you take on a regular basis. If you forgot a piece of information, or if you didn't write it down because it seemed unimportant to you, then your doctor didn't have that piece of your medical puzzle to work with. However, when doctors share records electronically, your new doctor only needs to ask your name, birthdates, and possibly another piece of identifying information. He can then pull up your records from their electronic storage space. All of the information he needs to see will be there in full.
- In the past, when a doctor closed his practice, retired, moved, or even died, patient records could easily get lost or relocated, making it impossible for patients to get the records they needed to take to a new doctor. Keeping these records electronically, especially in the cases where patients can also gain access to them, means the patient won't be left without the records he may need.

V. eHealth & TODAY'S SCENARIO

A. eHealth

eHealth is an overarching term used today to describe the application of information and communications technologies in the health sector. It encompasses a whole

range of purposes from purely administrative through to health care delivery. For example: within the hospital care setting, eHealth refers to electronic patient administration systems; laboratory and radiology information systems; electronic messaging systems; and, telemedicine -- teleconsults, telepathology, and teledermatology.

A fundamental building block of all these applications is the Electronic Health Record, which allows the sharing of necessary information between care providers across medical disciplines and institutions. Other important uses of eHealth are found in the areas of continuous medical education and public health awareness and education.

B. Today's Scenario

Let's now consider the different options available as far as the healthcare service provider software & healthcare tertiary caregivers are concerned:

- The patient is mobile and its health travels with him. Healthcare services should be available pervasively, integrated into the patient's environment.
- Mobile Grids can provide an infrastructure for an efficient development, provision and maintenance of complex e-health applications.
- Recent advances in information and communication technologies (ICT), miniaturization of sensor devices and computers, as well as the wider availability of connectivity and wireless networks gives rise to a number of services and applications involving wirelessly connected sensors and actuators in a body area network (BAN), personal area network (PAN) or in the environment.
- Connectivity between medical sensors/devices, gateways/hubs and healthcare services is present.
- Health professionals rely on accurate data coming from certified devices. Patient safety is most important, but privacy is also taken care of, as required by legislation (EU Directive 46/95, HIPAA, etc.), e.g. personal health data can be used based on patient consent, only for certain purposes, on a need-to-know basis by certain healthcare providers (e.g. a doctor that has a care relationship with the patient).

Keeping with the pace of cutting edge technology, the major drift has occurred in terms of business logic as eHealth scenario is concerned. Now cloud computing & mobile computing are the most hap things. These technologies are in, so we will have to reconsider the traditional ways of using EHR or EMR, the process of remolding has began & we are currently doing a exp. on the data modeling & the results are quite interesting. As the Indian Govt. is also promoting to use the HL7 standards, the stiffness in the solution is reducing to a greater extent. We will be discussing the Indian scenario later when the article progresses.

VI. EMR & ITS IMPLICATIONS

Although the concept of EMR is relatively old, still it has to recoup & the scope for research & area of activity is wide as compared to the other allied healthcare apps. The aspect of implication lies in the implementation; this is universal as far as the software utilization is concerned. Considering this point we will be elaborating the Indian case scenario:

The Government of India in February 2009 set up the Unique Identification Database Authority of India (UIDAI) with the aim of providing a Unique Identification number to all Indian citizens.

These positive developments impelled us to start a discussion on the use of UID as a healthcare identifier.

Some suggestions were given for the software vendors for the change in their software.

- UIDAI may decide policies for encryption, security and sharing with external applications and showing the UID on screens of the application etc. and specification to be able to process a UID as an UHID and set a standard.
- Each software vendor should add a field in patient record in which the UID may be stored compliant to standards set by government.
- Software Vendors should declare that their product is compliant to the standard and register themselves with UIDAI and or some other government authority and obtain compliance certification.
- This will help during transfer of patients data when patient moves from

1. One doctor to another doctor
2. One hospital to another hospital
3. One city to another city
4. One state to another state
5. Database of one software to another software

These are some of the recommendations. Now if we look into the deeper perspective of this, we want to have software which is scalable, expandable & e records should be such that it can be migrated over the database with a click or button. Our research aims for that. We will be converting a universal query into EDI so that it is scalable & the values in the distributed databases will be transferred from one database to another. This implies that with extensive research & database modeling the level of EMR can be aggravated.

VII. FEATURES VS. USABILITY

It is essential to use a Unique Healthcare Identifier (UHID) for each patient/citizen of India and the proposed UID can be used for this purpose. This assumes great significance as:

1. The individual patients in India are free to access healthcare provider of his/her choice.
2. The providers may refer the patient to another healthcare provider.
3. The patients may change the city, district or state for various reasons as well as change the provider.
4. In each healthcare establishment, all necessary facilities are not available and hence several diagnostic and therapeutic services are taken from other agencies.
5. More than one healthcare provider records healthcare information of each patient.
6. The information is maintained in unconnected and unrelated databases, electronic or otherwise, under disparate identification numbers.

7. Benefits of using electronic medical records for public health cannot be overemphasized.
8. If each electronic database maintains the information of each patient with their UID, it will help integration of medical information of each patient collected by various healthcare providers.
9. Integrated medical information of all patients will be helpful for both the experts deciding public health policies and the public health informaticians.

VIII. BENIFITS

- The patient saves traveling time and money for availing expert opinion.
- The doctors maintain the records in an organized form.
- Statistics generation is online /immediate for future planning.
- Disease prevalence /epidemics will be detected immediately.
- Doctors get Continuing Medical Education through the network.
- Mass Education can be distributed through the network.
- Dais and ANMs get online training as well as advise during difficulties.
- Fringe benefits of computerization like stocks maintenance, accounting etc. shall be availed. Immunization records, maintenance of Child Health, AIDS and other public Health Programs can be followed up.

IX. CONCLUSION

A meeting of minds has taken place. After all, a computer is required for sending the records and a doctor who keeps his records on a computer just needs to send the same record for a consultation as and when required for a specialist's opinion.

Realizing that the inputs required for both are similar and the efforts required for use can be complementary, both have now come together to bring out a comprehensive solution which solves the need of the health care industry. If all records of patient can be kept on the computer, the same quality of health care will be available in all the corners of our country saving on travel and time off work.

The challenge for ongoing national health record projects around the world is to take into account all the different types of EHRs and the needs and requirements of different health care professionals and consumers in the development of EHRs.

A further challenge is the use of international terminologies in order to achieve semantic interoperability.

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