

A SCOPING REVIEW OF ELECTRONIC HEALTH RECORD AROUND THE WORLD, HIGHLIGHTING ITS STATUS IN INDIA

Saloni Gupta*
M. Pharmacy, Department of
Pharmacology, Seth G. L. Bihani S. D.
College of Technical Education, Sri
Ganganagar (Raj.),
salonigupta290890@gmail.com

Abstract

The objective of this study is to create an overview of the existing literature on Electronic Health Record (EHR) and their role in Community Pharmacy/Primary Healthcare Centers (PHCs). Its progress Globally or worldwide with mainly reference to India along with its implementation in India at various places. We also reviewed various already existing EHRs presently working globally. Information was obtained from various bibliographic sources, including PubMed and others, on the role of EHRs and its progress and development worldwide and in India. Different guidelines for development of EHR were also reviewed from the PubMed search engine. The information was then summarized and evaluated from the perspective of contribution. Electronic Medical/Healthcare record is a repository of information regarding the health of a subject of care in computer-processable form. In the past, medical data were only stored on paper, making it difficult for health care providers to share patient information. Between 2001 and 2011, the number of doctors using an EHR system grew about 57%. EHR makes it easier for the patient and all the doctors to coordinate patient's care, and often reducing the chance of medical errors.

Keywords – EHR- Electronic health record, PubMed, PHC- primary healthcare center, patient, computer.

1. Introduction

In the past, medical data were only stored on paper, making it difficult for health care providers to share patient information. Now-a-days number of doctors are using EHR software system.

1.1 History of Health care system Globally

Electronic Medical/Healthcare record is a repository of information regarding the health of a subject of care in computer-processable form that is able to be stored and transmitted securely, and is accessible by multiple authorized users. This system has evolved into a science by itself [1].

1.1.1 Changes in Terms Over the Years - Before the Year 2000: The history of healthcare quality prior to 1960 is a fragmented collection of unrelated events rather than a streamlined organized effort [2]. In 1968, a federation named IFHRO (International federation of health record organization) was established to improve in the uses of health records and to support national association and health record professionals to implement the health record system [3]. The first appearance of PHR in an academic journal was in Germany in 1969 – ‘personal record linkage’ in Methods of Information in Medicine Supplement among the categories of ‘computers, humans, medical history taking, medical record linkage, medical records, and research [2].

1.1.2 Changes in terms Over the Years - After the Year 2000:

The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009, which is part of the American Recovery and Reinvestment Act (ARRA) (aka “stimulus package”), was signed into law with an explicit purpose of incentivizing providers (eg, hospitals and physicians) to adopt EHR systems [3]. In 2014, a study was conducted to review the published data on the utilization of open source EHR systems in different countries all over the world. Many such projects on developing Electronic Health Record (EHR) systems have been carried out in many countries.

Today with the vast development of technology in the world responding to the varied and complex needs for interchanging clinical information among healthcare providers to improve the quality of healthcare services seems more practical than any time before. Efficacy of healthcare services and medical interventions are highly dependent on a trustworthy and integrated history of individual medical and health status. Electronic health record (EHR) is one such response that covers the need of all engaged parties; including patients, doctors, clinical staff, insurance companies, health care providers and policy makers. It provides a platform on which individual health information is stored and accessed only by authorized people. EHR is defined as digitally stored healthcare information about an individual's life with the purpose of supporting continuity of care, education and research [4],[5].

In addition to personal data and data from the provider EMR and monitoring devices (Eg. weight, blood glucose), a Personal Health Record (PHR) could store other data on, for instance, social status, family history, or living and work environment. It could also include information on healthy lifestyles (diet, exercise, smoking, weight loss, and working habits) [6],[7]. In one study, patients could access education and automated advice programs and add their own information to hospital systems [8].

1.1.3 EHR in various countries

- EHR in USA:

In the United States of America, approximately 23.9% of physicians used EHR in the ambulatory setting [5]. Only a few major organizations in the private sector worked on the implementation of EHRs in USA [9].

- EHR in Canada

An organization named Canada Health Infoway founded by the federal government of Canadian 2000 aims to accelerate the development of EHR in Canada.

It tries to connect organizations, which are working on EHR projects and encourage them to produce and share “knowledge objects,” [5].

- EHR in Australia

HealthConnect is a joint Australian, State and Territory Government’s initiative for revolving paper-based health records to EHRs for the benefit of consumers and also healthcare providers. Through which, health information would be more quickly available and transferred among healthcare professionals under more secure condition. The main aims of this program were the accessibility of life-saving information in emergencies [5].

Table 1 give review of healthcare IT Programs World wide (Globally) [10].

Table 1: Review of Healthcare IT Programs World-wide

Country	National Healthcare IT Program
Austria	ELGA
Denmark	MedCom
England	Spine
Hongkong	her Infrastructure
Netherlands	AORTA
Singapore	EMRX
Sweden	National Patient Summary (NPO)

Relevant Healthcare Informatics Standards (as adopted Internationally) are given in Table 2 [10].

Table 2: Relevant Healthcare Informatics Standards (as adopted internationally)

Organization	Standards
National Recommendations for health information infrastructure in India	<ul style="list-style-type: none"> ➤ Information technology infrastructure for health (ITIH) framework ➤ Recommendations on Guidelines, Standards & Practices for Telemedicine in India ➤ Indian health information network development (iHIND) recommendations from the National Knowledge
International Organization for Standardization (ISO)	Requirements for Electronic health record Architecture (ISO/TS 18308)
European Committee for Standardization(CEN)	CEN / TC 251 EN 13606
Code of Federal Regulations (CFR)	Health Information Technology Standards, Implementation Specifications and Certification Criteria and Certification Programs for health Information

	Technology (Title 45, Part 170)
American Society for Testing & Materials (ASTM)	Continuity of Care Record (CCR)
Health Level 7 (HL7)	HL7 v2.x , HL7 v3 CDA-2 FHIR (Fast Health Interoperable resources) – the Newest version; easy upgrade from v2.x to FHIR EHR- system Functional Model
HL7 & ASTM Collaboration	Continuity of Care Document (CCD)
National Electrical Manufacturer’s Association (NEMA)	Digital Imaging and Communications in Medicine (DICOM PS 3.0 2004 onwards)
Office of National Coordinator for Health Information Technology (ONCHIT) – USA	EHR Meaningful use

1.2 Indian Scenario (Past, Present & Future)

1.2.1 History of Health care system: “Poor records mean poor defense, no records mean no defense” [1]. It is disheartening to note that in spite of knowing the importance of proper record keeping, it is still in a nascent stage in India [1].

In the current, largely paper-based medical records world, invaluable data is more often than not unavailable at the right time in the hands of the clinical care providers to permit better care. This is largely due to the inefficiencies inherent in the paper-based system. In an electronic world, it is very much possible, provided certain important steps are taken beforehand, to ensure the availability of the right information at the right time [10].

1.3 Present Health care system

Health Care sector in India has witnessed significant growth during the last few years, both in quality and capacity. The relatively lower cost of health care, as compared to developed countries, coupled with international quality, has positioned India as a major destination for health care services. As the health sector is poised for major growth in next decade, the sheer size of healthcare sector in the country will necessitate extensive use of information and

communication technology (ICT) infrastructure, services and databases [10].

Medical/health records form an essential part of a patient’s present and future health care. It is important for the doctors and medical establishments to properly maintain the records of patients for two important reasons. The first one is that it will help them in the scientific evaluation of their patient profile, helping in analyzing the treatment results, and to plan treatment protocols [1].

India has a vast network of Primary Health Centers (PHC) to provide primary health care. Health workers generate lots of data at various places and send it to the PHC, where it is compiled in the form of monthly reports and transferred to the secondary level. A lot of data that the health workers collect is redundant or never utilized adequately. Efficient management of data is difficult in a manual system, and often involves duplication of efforts and wastage of time. A computerized management information system is one among the many ways that Information Technology (IT) can help improve the health system by using various softwares related to Personal health record; IT can aid the workers in providing services, data collection, storage, analysis and dissemination of information [11]. An ambulatory electronic medical record (EMR) is may be being implemented in a medically-underserved regions of India to improve patient safety and assess provider and patient attitudes about health information technology by: 1) providing access to patient records across hospital services, home health, hospice, physician practices, and non hospital provider settings and 2) integrating electronic tools for prescription orders and management of medications [12].

As the 21st century began the era of widely available information, record formats have changed as well as the level of interest in individuals regarding their health records, resulting in increased interest in the PHR [2]. With the increasing use of medical insurance for treatment, the insurance companies also require proper record keeping to prove the patient's demand for medical expenses [1].

Republic of Croatia has started the process by introducing information systems (Primary Healthcare Information System (PHCIS)) to support healthcare domain to provide efficient healthcare related data management that provides domain of primary care that connects General Practitioners with the Croatian Institute for Health Insurance and Public Health Institute [13].

1.4 Methods of record keeping [1]

1. The traditional method of keeping records that is followed in most of the hospitals across India is the manual method involving papers and books. The present era has seen the computerization of medical records that are neat and tidy, and can be easily stored and retrieved.
2. Another major concern is maintaining confidentiality of the patient records as the patient can hold the doctor and the hospital negligent for breaking confidentiality of his medical records.

1.5 Guidelines used for EHR systems

1.5.1 Medical Council of India Guidelines on Medical Records [1]: The issue of medical record keeping has been addressed in the Medical Council of India Regulations 2002 guidelines answering many questions regarding medical records. The important issues that have been addressed are as follows:

1. Maintain indoor records in a standard performa for 3 years from commencement of treatment.
2. Request for medical records by patients or authorized attendant should be acknowledged and documents issued within 72 hours.
3. Maintain a register of certificates with the full details of medical certificates issued with at least one identification mark of the patient and his signature.

4. Efforts should be made to computerize medical records for quick retrieval.

1.6 Clinical Standards [1]

Clinical standards are health information standards to capture a patient's health information in a more coherent manner. This health information can include all or part thereof as relevant of the following:

- The illness a patient is suffering from.
- The physician's observation of the patient's illness.
- The diagnostic tests that need to be carried out to ascertain the patient's illness and to give the patient better treatment.
- The results of the diagnostic tests.
- The kind of treatment to be given to the patient.
- The way the treatment should be given to the patient.

1.7 EHR Minimum Data Set (MDS) [10]

The following MDS is recommended for an EMR to be used in India.

EHR MDS is given in Table 3.[10], Table 4.[10]

Table 3: EHR MDS (Minimum Data Set)

Data Item	Data Type	Format/Values	Status	Additional Observations
UHID	any	As per Institution	Mandatory	Wherever Adhaar Number is unavailable and the healthcare provider wishes to use their own ID system
Patient name	Alphanumeric	To be split into First Name, Middle Name and Last (Family) Name	Mandatory	only the person identification part of the meta data
Patient Date of Birth	Date	dd.mm.yyyy	Optional	
Patient Age	Numeric	999,99,999 no preceding zero [years, months, days]	Mandatory	Age is to be automatically calculated if date of birth is entered/available;
Patient Gender	Alphanumeric	To be shortened to one byte as M, F, U or T for Male, Female, Unknown and Transgender.	Mandatory	
Patient Occupation	Alphanumeric		Mandatory	
Patient Address Type	Alphanumeric	Current/Permanent/Previous	Mandatory	
Patient District	Alphanumeric		Optional	
Patient State	Alphanumeric		Optional	
Patient Country	Alphanumeric		Optional	
Patient Phone Type	Alphanumeric	Landline/Mobile/PP-Landline/Neighbour Landline/Relation Landline /Neighbour Mobile/Relation Mobile	Optional	
Patient Phone no.	Alphanumeric	(099)9999999999	Optional	
Patient Email ID	Alphanumeric	Must contain '@' and '.'	Optional	

		at appropriate positions		
Insurance Status	Alphanumeric	Insured/ Uninsured	Optional	
Present History	Alphanumeric		Optional	
Past History	Alphanumeric		Optional	
Personal History	Alphanumeric		Optional	
Family History	Alphanumeric		Optional	
Socio-economic Status	Alphanumeric		Optional	
Allergy Status	Alphanumeric	Active/Inactive	Optional	Allergies will be a list of values (drug generics, etc.) that would, in future, allow allergy alerts to be activated
Clinical Exam Vitals Systolic BP	Numeric	999 – no preceding 0	Optional	Unit of measurement is mmHg
Clinical Exam Vitals Diastolic BP	Numeric	999 – no preceding 0	Optional	Unit of measurement is mmHg
Clinical Exam Pulse Rate	Numeric	999 – no preceding 0	Optional	Unit of measurement is per minute
Clinical Exam Temperature (°C)	Floating	99.99	Optional	Unit of measurement is degrees Centigrade; if degrees Fahrenheit is to be used, then this may be converted at run time for display
Clinical Exam Height (cms)	Floating	999.99	Optional	Unit of measurement is centimetres; if any other unit of measurement is to be used, then this may be converted at time of display.
Clinical Exam Weight (kgs)	Floating	999.99	Optional	Unit of measurement is kilograms; if any other unit of measurement, like pounds, is to be used, then this may be converted at run time for display
Blood Group	Alphanumeric	A+/A-/B+/B-/AB+/AB-/O+/O-	Optional	
Investigation Results	Alphanumeric		Optional	
Diagnosis Type	Alphanumeric	Provisional/ Final/ Admission/ Interim/ Working/ Discharge	Mandatory	
Diagnosis	Alphanumeric		Mandatory	
Treatment Plan Medication	Alphanumeric		Optional	
Current Clinical Status	Alphanumeric	[Free text]	Mandatory	Captures the current clinical status; synonymous with clinical outcome or condition at discharge; it is preferable that terms such as “Fair”, “Relieved”, “Better”, “Same”, “Worse”, “Fatal”, etc. be used instead of long narratives

Table 4: Medication details for allopathic system in EHR MDS (Minimum data set)

Data Item	Data Type	Format/Values	Status	Additional Observations
Medication name	Alphanumeric	As per the drug database	Mandatory	Should preferably be generic
Drug Code	Alphanumeric	As per the drug database	Mandatory	
Strength	Alphanumeric	As per the	Mandatory	

		drug database		
Dose	Alphanumeric		Mandatory	To be entered by the care provider
Route	Alphanumeric		Mandatory	To be entered by the care provider
Frequency	Alphanumeric		Mandatory	To be entered by the care provider

1.8 Future of Health care system

“If suppose in the future, any officer comes and asks for records. To get the information from the register, it would take time. But by computer, we can do it immediately”.

Personal health records (PHRs), which are driven in part by this paradigm, have the potential to be a critical technological catalyst for healthcare consumers in the 21st century, which may in turn result in improved health [2]. Electronic medical recording is in the process of evolution and is being increasingly used. For example, an important issue is the electronic signature of the patient, doctors, and witnesses on informed consent forms [1].

The future challenge is to replicate this system in routine PHCs of state governments so as to enable a full evaluation of its implementation in a routine health system of the government as opposed to a health system run by an institution [11]. As personal management of health information by individuals is a unique feature of PHR, its wider use must involve collection, storage, analysis, feedback, and self-motivation through everyday use, rather than the health professional being the intermediate manager of information [2].

1.9 Comparative advantage of Electronic health records over paper medical records: [10]

- EHRs can make a patient's health information available when and where it is needed.
- EHRs can bring a patient's total health information together to support better health care decisions, and more coordinated care.
- EHRs can support better follow-up information for patients – for example, after a clinical visit or hospital stay, instructions and information for the patient can be effortlessly provided and reminders for other follow-up care can be sent easily or even automatically to the patient.
- EHRs can improve patient and provider convenience – patients can have their prescriptions ordered and ready even before they leave.

2. Methods [14]

2.1 Identification of studies

Computerized literature searches (PubMed) of articles in English or having abstracts in English were conducted using keywords related to an EHR system, EMR system, past present and future of EHR,

development of EHR system worldwide, benefits and drawbacks of electronic health records in India, etc. Comprehensive reviews of early literature were obtained, as well as an extensive collection of primary literature.

2.2 Analysis

Each of the sources was reviewed for relevance to the EHR system and its status in India as well as around the world. Available literature provided global information, but information regarding status of EHR in India was not sufficient, but it seems to be progressing in the future.

3. Results and Discussion

Various EHR systems are being used worldwide in Primary Healthcare Centers to facilitate patient as well as Health care providers.

3.1 EHR Systems used in India

1. In order to overcome the problems faced by the health workers in handling data and making efficient use of data collected, a computerized data management system run by AIIMS, New Delhi was introduced in the Comprehensive Rural Health Services Project Ballabgarh in February 1988 [11].

3.2 EHR Systems used Worldwide [5]

2. Hospital OS is an open source EMR system developed by Open Source Technology Co., Ltd. located in Phuket, Thailand.
3. iTrust is an open source EHR system, which was founded as a project in a software engineering course at North Carolina State University.
4. OpenEHR is founded by the OpenEHR Foundation, which is a not-for-profit company. It is initiated as a mutual project by University College London, UK and Ocean Informatics Pty Ltd, Australia.
5. OSCAR is an open source EHR system developed by the department of Family Medicine at McMaster University, Canada.
6. WorldVistA is an open source EHR system that evolved from VistA project to make it widely available outside of its original setting within the United States.

3.3 Astounding applications/Advantages

3.3.1 Electronic Health Records:

- It will become an integral part in making the Lifetime Electronic Health Record a solution for aging societies, which have the large burden of chronic illnesses [2].
- PHRs, with its increased focus on the medical and IT industries, are rapidly being developed and will soon be at the stage of selection by clinical consumers. They will allow individuals to increase the quality of their lives by managing their own health information. Thus, it is increasingly important for researchers in the healthcare industry to consider development, implementation, and expansion of PHRs [2].
- It supports program planning and decision making as well as improved the quality of and access to health care.
- Computerization ensures that vital event registration is more accurate and timely. It improves record keeping, integrity and validity of data through better supervision and a possibility of a random check.
- The major advantage of computerization has been in saving of time, of health workers in record keeping and report generation. Computerization has enabled the implementation of a good system for service delivery, planning, monitoring and supervision [11].
- In future, it can also provide a platform for convergence of different services related to social sectors [11].

3.3.2 Mobile Applications useful for Patient Compliance:

- *Mobile app for DOTs therapy*
The application is designed to support Patient's strategy to defeat multi-drug resistant tuberculosis (MDR-TB), strengthening directly observed therapy (DOT) through mobile technology, Presently, it is launched in Myanmar [15].
- *Mobile app for collection of blood group*
The five-member team of IIT-Madras students have developed a mobile app and a website to match people who need blood with those willing to give it, instantly. In this, once a request is placed, Bloodline runs algorithms to match potential donors based on location and blood group and notifies only them [16].
- *Mobile apps for anxiety*
To develop an engaging and challenging web-based application that modifies attentional control in users suffering from social disorders such as chronic anxiety, reducing their symptoms [17].
Figure 1, Figure 2 and Figure 3 show Progress of EHR worldwide or Globally i.e. Where we were, Where we are now and Where we are headed respectively [18],[19],[20].

Where We Were

There was a lot of paper



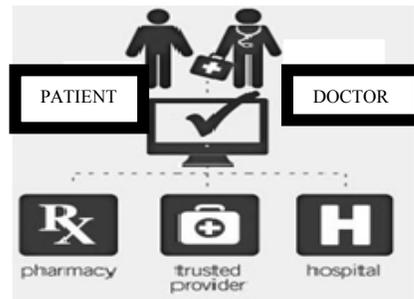
Figure 1: Where we were in the initial progress of the Electronic Health record

Where We Are Now

Many doctors are using Electronic Health Records

Doctors, labs, pharmacies and Hospitals can store patient's health data electronically. This will help:

- Make doctor visit faster
- Seamlessly coordinate patient's care among all doctors
- Allow patient to be in full control of all your medical data



2 out of 3 People would consider **switching** to a physician who offers access to medical records through a **secure** internet connection

What can you do with access to Patient's Health Record ?

Check to make sure your information is correct and complete	Keep track of important health information (e.g., vaccination records and test results)	Have your medical history available if you are changing doctors or visiting a specialist	Keep track of all your medicines and dosages

Having Electronic access to your better medical record can help patient better manage your health.

E- Health tools and mobile devices can help you better manage patient's personal health and wellness.

80% Americans who have access to their health information in electronic health records use it ³		65% Americans who don't have electronic access to their health information say it's important to have it ⁴
--	--	---

17 million
 Number of consumers using mobile devices to access health information in 2011⁵

27% Adults who use the internet have tracked the following:⁶

weight	diet	exercise routines	health indicators	symptoms

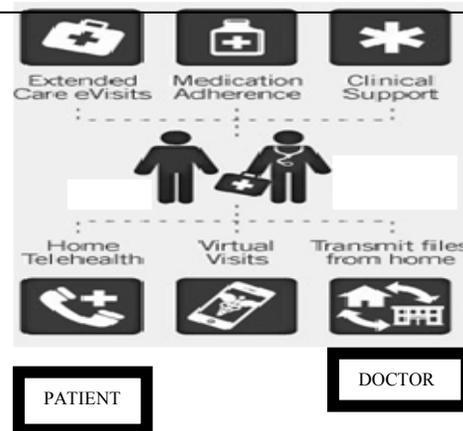
People who are **more engaged** in their health actually get **better health care**⁷

Figure 2. Where We Are Now in the progress of Electronic Health Record

Where We Are Headed

Emerging technologies offer new ways for patient and doctor to monitor and manage chronic illnesses. You will be able to:

- Use GPS technology or real time reminders and alerts to better prevent and treat health complications.
- Send vital health data from patient's home to Physician's offices
- Have virtual visits and receive health coaching from providers based on clinical data transmitted



11% users who downloaded an app to help them track or manage their health

Figure 3: Where we are headed in progress of Electronic Health Record.

4. What is New and Conclusion

Decline in medical errors is another important advantage of applying EHR that should seriously be taken into account [5]. The Minor problems in software continue to arise requiring any programming modifications which are regularly taken care to cater to the demands of the health system. Since the database stores personal information on a large population where they can be identified by names, data security is a vital concern [11].

The need for strengthening information systems in health care and the role that information technology can play in this has been emphasized by many authors. Lucas *et al* has also identified that one of the ways that IT can improve future health systems is to improve traditional health information systems [11]. Some authors predict that it will increase the cost and expense will be proved to be a burden on Healthcare system, but initial capital costs of computerization can be recovered within two years of implementation if the system is fully operational. A need for strengthening information systems and focus on building local capacity, increase utilization of data for planning and decision making has also been pointed out by Adindu *et al* [11]. EHR makes it easier for the patient and all the doctors to coordinate patient's care, and often reducing the chance of medical errors.

So, in future EHR is going to provide a brilliant chance of readily retrieving the required information for conducting a faster and a much more accurate decision for action.

References

- [1] Joseph Thomas. "Medical records and issues in negligence". *Indian J Urol.* (2009) 25 : 384-388. (Pubmed)
- [2] Jeongeun Kim, RN, Hongju Jung and David W. Bates. "History and Trends of Personal Health Record Research in Pubmed". *Healthc Inform Res* (2011) 17 : 3-17 (Pubmed).
- [3] Nir Menachemi and Taleah h Collum. "Benefits and drawbacks of electronic health record systems". *Risk Manag Healthc Policy* (2011) 4 : 47-55.
- [4] Rezae P, Ahmadi M and Sadughi F. "Comparative study on EHR content, structure, and terminology standards in selected organizations and design a model for Iran". *J Health Adm* (2007) 10 : 55-64.
- [5] Farahnaz Sadoughi and Maryam Ahamdi. "Utilization of open source electronic health record around the world: A systematic Review". *J Res Med Sci* (2014) 19 : 57-64. (Pubmed)
- [6] Tang PC, Ash JS and Bates DW. "Personal health records: definitions, benefits, and strategies for overcoming barriers to adoption". *J Am Med Inform Assoc* (2006) 13 : 121-125. (PubMed)
- [7] Archer N, U Fevrier-Thomas and S E Straus. "Personal Health Records: a scoping review". *J Am Med Inform Assoc* (2011) 18 : 515-522.(PubMed)
- [8] Cimino JJ, Patel VL and Kushniruk AW. "The patient clinical information system (PatCIS): technical solutions for and experience with giving patients access to their electronic medical records". *Int J Med Inform* (2002) 68 : 113-127. (PubMed)
- [9] Berner ES, Detmer DE and Simborg D. "Will the wave finally break? A brief view of the adoption of electronic medical records in the United States". *J Am Med Inform Assoc* (2005) 12 : 3-7.(pubmed)
- [10] Recommendations of EMR Standards Committee, constituted by an order of Ministry of Health & Family Welfare, Government of India and coordinated by FICCI, April 2013.
- [11] Krishnan Anand. "Evaluation of computerized health management information system for primary health care in rural India". *BMC Health services Research* (2010) 10 : 310. (pubmed)
- [12] DeLuca M. "Ambulatory Electronic Medical Record and Shared Access". Agency for Healthcare Research and Quality (2009).
- [13] Koncar M and Gvozdanović D. "Primary healthcare information system-the cornerstone for the next generation healthcare sector in Republic of Croatia". *Int J Med Inform* (2006) 75 : 306-314. (pubmed)
- [14] Cangoz S, Chang YY and Chempakaseril SJ. "The kidney as a new target for antidiabetic drugs: SGLT2 inhibitors". *Journal of Clinical Pharmacy & Therapeutics* (2013) 38 : 350-359.
- [15] "Launch of mobile application strengthens Myanmar's efforts against MDR-TB". Available from <https://www.cap-tb.org/news/mobile-app-launch> [accessed on 29 June 15].
- [16] "A mobile App to find Blood donor at the right time". Available from <http://timesofindia.indiatimes.com/tech/tech-news/A-mobile-app-to-find-blood-donor-at-the-right-time/articleshow/21947283.cms> [accessed on 29 June 15].
- [17] "Thoughts on treatment apps". Available from <http://www.internationalinnovation.com/thoughts-on-treatment-apps/> [accessed on 1 july 2015].
- [18] "Survey of Health care consumers in the US: key findings, strategic implications". Deloitte center for health solutions, Washington DC, 2011.
- [19] Bartolini E and McNeill N. "Getting to value: eleven chronic disease technologies to watch" (2012). Available from <http://www.nehi.net/publications/30-getting-to-value-eleven-chronic-disease-technologies-to-watch/view> [accessed on 1 july 2015].
- [20] "Making IT meaningful: How consumers value and trust Health IT". National partnership for women and families, 2012.
- [21] Watson P J. "International Federation of Health Records Organisation (IFHRO)- past, present and future". *J AHIMA* (1992) 63 : 72-74.(pubmed).
- [22] Lucas H. "Information and communications technology for future health systems in developing countries". *Soc Sci Med* (2008) 66 : 2122-2132.
- [23] Adindu A and Babatunde S. "Health manager's perception of the primary health care management information systems: a case of Bama Local Government in northern Nigeria". *Niger J Med* (2006) 15 : 266-70.
- [24] Tuli K, Kapoor SK and Nath LM. "Primary Health Care software - a Data Based Management System". *Ind J Com Medicine* (1990) 15 : 153-4.