Electronic Health Records (EHR)

Future of Electronic Health Record: Prediction and Implication for Health Care

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ABSTRACT: *The adoption of Electronic Health Records (EHR) has been a growing trend in health care over the past few decades. EHR systems are designed to store and manage patient health information in digital format, making it easier for healthcare providers to access and share patient data. The purpose of this research paper is to explore the benefits and challenges of implementing EHR systems in healthcare settings. Specifically, we will examine the impact of EHR systems on patient care, medical errors, and healthcare costs. We will also discuss the technical requirements for implementing EHR systems, including data security, interoperability, and user adoption. Finally, we will explore the potential for EHR systems to support population health management, disease surveillance, and clinical research. Our study will involve a review of the existing literature on EHR systems and interviews with healthcare providers who have experience using EHR systems in their practice. The results of this study will provide insights into the opportunities and challenges of implementing EHR systems in healthcare and offer recommendations for healthcare providers and policymakers to maximize the benefits of EHR systems while minimizing the risks.*

Keywords: Electronic Health Records (EHR), Access and share patient data, User Adoption

INTRODUCTION

Electronic Health Records (EHR) have become increasingly popular in healthcare systems worldwide, including in India. An EHR is a digital repository that stores and manages patient health information, providing healthcare providers with a comprehensive view of a patient's medical history, diagnosis, treatment plans, and outcomes. In India, the adoption of EHR systems is gaining momentum due to their potential benefits in improving patient care, reducing medical errors and streamlining healthcare processes.

The healthcare landscape in India is vast and diverse, with a population of over 1.3 billion people. Traditionally, healthcare records in India have been paper-based, leading to numerous challenges such as limited accessibility, data duplication, and the risk of physical damage or loss. EHR systems aim to address these issues by digitizing healthcare information, facilitating efficient data sharing and retrieval, and enhancing care coordination across various healthcare settings. The implementation of EHR systems in India is driven by several factors. Firstly, there is a growing recognition of the need for digitized health records to improve the quality and efficiency of healthcare services. Additionally, government initiatives, such as the National Digital Health Mission (NDHM), have been launched to promote the adoption of EHR systems and establish a unified health record ecosystem across the country. These efforts.

DEFINITION OF AN ELECTRONIC HEALTH RECORD

Electronic Health Records (EHRs), sometimes referred to as Electronic Medical Records (EMRs), are commonly used terms that are often used interchangeably (Torrey, 2011). These records are electronic versions of a patient's health information, which were traditionally documented, utilized, and stored in paper charts. Unlike Personal Health Records (PHRs), which are under the control of patients and can be modified by them, EHRs are created, managed, and maintained by healthcare organizations (Roman, 2009). Only healthcare professionals involved in a patient's care have authorized access to and use of EHRs (Roman, 2009). It is important to note that EHRs are safeguarded by the federal law known as the Health Insurance Portability and Accountability Act (HIPAA), while PHRs do not fall under the purview of HIPAA's protections (Roman, 2011).

"An Electronic Health Record (EHR) is a digitalized version of a patient's comprehensive health information and medical history. It is a longitudinal record that includes a wide range of data, such as patient demographics, medical diagnoses, medications, allergies, laboratory results, radiology images, immunization records, and treatment plans. EHRs are designed to facilitate the secure and efficient sharing of patient information among healthcare providers, enabling continuity of care across

different healthcare settings and improving patient outcomes. They serve as a centralized repository for healthcare information, allowing authorized healthcare professionals to access, update, and analyze patient data in real time. EHRs aim to enhance clinical decision-making, promote care coordination, reduce medical errors, and support population health management initiatives."
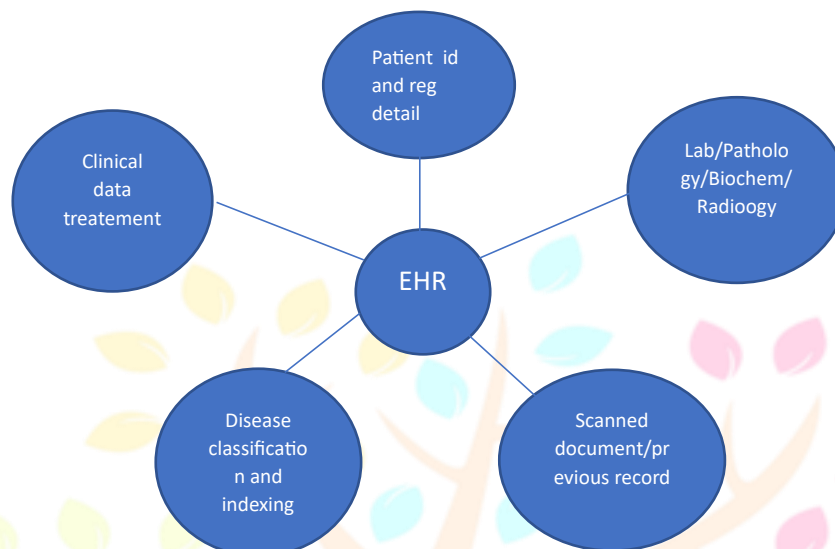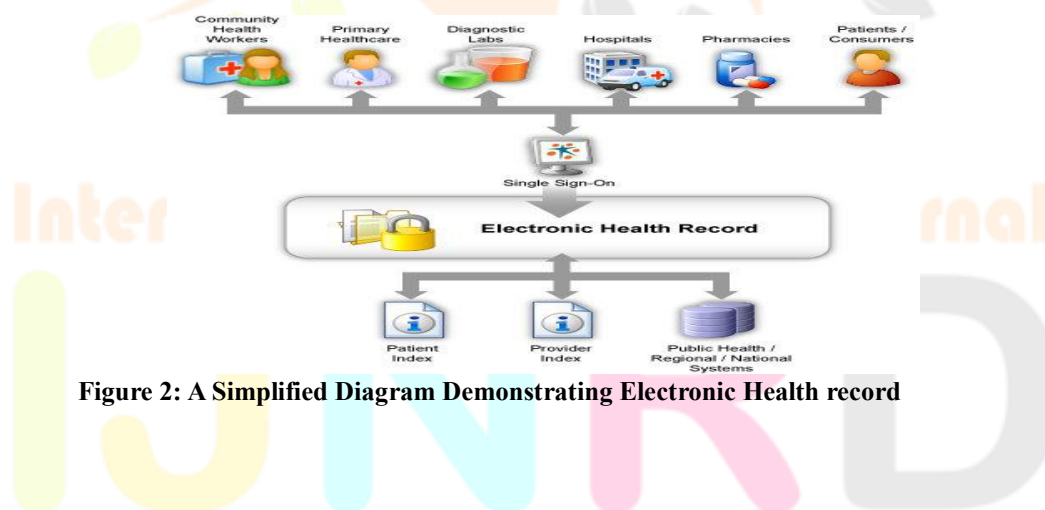

Figure 1: A simple Electronic Health System

Figure 2: A Simplified Diagram Demonstrating Electronic Health record

HISTORY OF ELECTRONIC HEALTH RECORDS

The concept of medical records has been an integral part of healthcare since its inception. Initially, medical records were primarily used to document diseases and their possible causes (National Institutes of Health, 2006). In the early 20th century, these records were maintained on three-by-five cards (Hufford, 1999). The healthcare landscape underwent significant changes in the 1960s and 1970s when the introduction of Medicare and the involvement of third-party payers, coupled with increasing healthcare litigation and the need for quality improvement, led to the emergence of medical records as a vital component of healthcare (Hufford, 1999). It was during this period that the first electronic health record made its appearance (History of the Electronic Medical Record, n.d.).

The adoption of electronic health records faced initial reluctance among physicians and healthcare providers. In 2009, it was estimated that less than 8% of hospitals had implemented electronic health record systems (Ford, Menachemi, Huerta, Yu, 2010). Several factors contributed to the slow adoption, including high implementation costs, the absence of national standards, and the significant time and financial investments required to comply with government regulations and patient privacy requirements (Morissette, 2011).

Recognizing the need for a modernized healthcare system, President Bush emphasized the importance of electronic medical records in a speech at the National Institutes of Health in 2005, referring to the existing paperwork system as outdated (ehrCentralHome,

2012). In response to the growing demand for electronic health records, the American Recovery and Investment Act of 2009 was passed by Congress. This act provided incentives for healthcare providers to adopt electronic health records and transition from paper-based systems. Facilities successfully implementing electronic health record systems became eligible for bonus incentive payments, while non-adoption could result in penalties (Information Week, 2009). Under this legislation, hospitals and physicians were offered incentive payments from Medicare and Medicaid to encourage the use and sharing of electronic health records, with the federal government allocating $27 billion for incentive payments (cms.gov, 2010). The requirements for meaningful use of electronic health records were outlined in three stages, with specific criteria related to quality data reporting, computerized physician order entry, electronic pharmacy orders, and the ability to exchange electronic health records with other healthcare providers (Jarousse, 2010).

BENEFITS OF ELECTRONIC HEALTH RECORDS

The benefits of EHR are manifold. Some of them are given in Table

No.	Benefits of Electronic Health Records
1.	Easy accessibility of patient records from anywhere, anytime
2.	Efficient storage in less space for indefinite periods
3.	Reduction in lost records due to electronic format
4.	Improved quality of patient records and cost-effectiveness
5.	Tracking of patient's clinical progress and enhancing compliance
6.	Summary reports of lifetime clinical encounters
7.	Enhanced accuracy and speed of diagnosis, avoiding unnecessary tests
8.	Easy transfer of EHRs within and across healthcare facilities
9.	Simultaneous access and updates by multiple users
10.	Low-cost backup of patient records
11.	Facilitates improved healthcare decisions and evidence-based care
12.	Supports research purposes

INITIATIVE BY THE GOVERNMENT OF INDIA

EHR Standards

The Ministry of Health & Family Welfare (MoH&FW) introduced the initial standards for Electronic Health Record (EHR) systems in India in September 2013. These standards were formulated based on recommendations from the EMR Standards Committee, which was established under the MoH&FW (Ozair et al., 2015). The objective was to establish a consistent framework for the creation and maintenance of EHRs by healthcare providers. The standards underwent revision and were officially notified in December 2016 (Mantri, 2016). For a convenient reference to the MoH&FW EHR Standards Version 2016, please refer to Annexure 1. Additionally, Annexure 2 provides a list of supporting and complementary standards. This information is sourced from the CSD Working Paper Series titled "Towards a New Indian Model of Information and Communications Technology-Led Growth and Development."

Goals of EHR Standards

The goals of EHR Standards are enlisted in Table2(Mantri 2016; Vikaspedia 2019)

Table : Goals of EHR Standards

No.	Objectives of MoH&FW EHR Standards
1.	Promote interoperability and specify content and vocabulary standards
2.	Support ongoing evolution and maintenance of adopted standards
3.	Encourage technical innovation within the framework of standards
4.	Foster participation and adoption by vendors and stakeholders
5.	Minimize implementation costs as much as possible
6.	Consider best practices, policies, experiences, and frameworks
7.	Prioritize modular standards to minimize interdependence

FUTURE SCOPE OF ELECTRONIC HEALTH RECORD

The development and adoption of Electronic Health Records (EHRs) in India are being shaped by several emerging trends. These trends include the use of large shared databases, increased reliance on cloud computing, the widespread implementation of telehealth, enhanced clinical decision support systems, and the integration of remote wireless monitoring into EHRs. Here are some key EHR trends that will shape the future of healthcare in India:

1. Improved Patient Access: EHR advancements have primarily focused on privacy and security concerns. However, future developments will prioritize making healthcare smarter, safer, and more accessible to patients. EHR vendors will design more intuitive user interfaces to enhance patient access and engagement.

2. Simplified Documentation: While EHR systems have reduced manual processes in healthcare facilities, there is still room for improvement. Future EHR developments will aim to minimize the burden on clinicians by automating data entry and simplifying documentation, giving equal importance to patient and clinician input.

3. Unified EHR Standards: The Ministry of Health and Family Welfare (MoHFW) is continually working on EHR standards. However, a unified standard for medical data that facilitates information sharing and processing is yet to be established. In the coming years, collaboration between hospital CIOs, developers, and vendors will lead to the development of such a system across all healthcare facilities in the country.

4. Cloud-Based Solutions: Cloud-based EHR solutions offer significant advantages in terms of security, storage, and information flow speed. While initial costs have deterred some medical organizations, they are realizing that cloud-hosted EHR software is a long-term investment with lower costs.

5. Centralized Patient Database: The promotion of EHR interoperability is a key goal for the MoHFW. Achieving true interoperability requires a centralized database of patient records, containing comprehensive medical information. This database will facilitate improved access to patient history, aiding physicians in providing more accurate diagnoses. It will also support government and research organizations in identifying disease and illness trends.

6. Patient History for Precise Treatments: EHRs currently enhance access to patient data and medical records. As healthcare facilities adopt EHR systems with unified standards and seamless interoperability, decision support systems leveraging advanced AI and deep learning algorithms will be integrated. This will enable doctors to make informed decisions and deliver more precise treatments.

Leading the way in EHR solutions is Halemind, a state-of-the-art platform developed using cutting-edge data and cybersecurity technologies. Halemind aligns with the workflow of healthcare providers in India and ensures compliance with the DISHA Act. With features like simplified storage and documentation, seamless data transfer, and robust security measures, Halemind is at the forefront of EHR solutions in India, going beyond hospital management.

These emerging trends and innovative solutions like Halemind will contribute significantly to improving the quality of health services and shaping the future of EHRs in India.

CONCLUSION

In conclusion, the adoption of Electronic Health Records (EHR) in healthcare settings offers numerous benefits such as improved patient care, reduced medical errors, and streamlined processes. EHR systems provide easy access to patient records, efficient storage, and comprehensive summaries of clinical encounters. They enhance diagnosis accuracy, enable data transfer between healthcare facilities, and support multiple users simultaneously.

Implementing EHR systems comes with challenges that need to be addressed. Technical requirements like data security, interoperability, and user adoption are crucial considerations. Interoperability and standardized content and vocabulary promote seamless data exchange, while ongoing maintenance and support for standards keep pace with technological advancements. Encouraging innovation within standards drives continuous improvement, and collaboration among stakeholders is essential for successful implementation. Keeping implementation costs low ensures accessibility for healthcare organizations.

The government of India has taken initiatives to promote EHR adoption. The Ministry of Health & Family Welfare (MoH&FW) has established EHR standards, emphasizing interoperability, ongoing evolution, technical innovation, participation, and adoption. The standards aim to minimize implementation costs and consider best practices and frameworks. The modular approach prioritizes independence among components, facilitating implementation and updates.

In summary, EHR systems offer significant potential to enhance healthcare services. By addressing challenges, adhering to standards, and involving all stakeholders, healthcare providers, and policymakers can maximize the benefits of EHR systems while minimizing risks. This will contribute to the advancement of healthcare in India, improving patient care, reducing errors, and streamlining processes.

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-      Simplified   Diagram   Demonstrating   Electronic   Health   Record   System   Taken   from   Orion (http://www.orionhealth.com/uk/solutions/electronic-health-record)

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https://blog.halemind.com/future-of-electronic-health-records-in-india-6484ca5b6315

Annexures

Annexure 1: Standards at a Glance

S.No.	Type	Standard Name	Intended Purpose
1	Identification & Demographics	ISO/TS 22220:2011 Health Informatics — Identification of Subjects of Health Care	Basic identity details of patient
2		MDDS — Demographic (Person Identification and Land Region Codification) version 1.1	Complete demographic for interoperability with E-Governance systems
3	Patient Identifiers	UIDAI Aadhaar	Preferable identifier where available
4		Local Identifier	Identifier given within institution / clinic /lab
5		Government Issued Photo Identity Card Number	Identifier used in conjunction with local in absence of Aadhaar
6	Architecture Requirements	ISO 18308:2011 Health Informatics — Requirements for an Electronic Health Record Architecture	System architectural Requirements
7	Functional Requirements	ISO/HL7 10781:2015 Health Informatics - HL7 Electronic Health Records-System Functional Model Release 2 (EHR FM)	System functional requirements
8	Reference Model and Composition	ISO 13940 Health informatics - System of Concepts to Support Continuity of Care	Concepts for care, actors, activities, processes, etc.
9		ISO 13606 Health informatics - Electronic Health Record Communication (Part 1 through 3)	Information model architecture and communication
10		openEHR Foundation Models Release 1.0.2	Structural definition and composition
11	Terminology	SNOMED Clinical Terms (SNOMED CT)	Primary terminology
12	Coding System	Logical Observation Identifiers Names and Codes (LOINC)	Test, measurement, observations
13		WHO Family of International Classifications (WHOFIC) including ICD, ICF, ICHI, ICD-O	Classification and reporting
14	Imaging	Digital Imaging and Communications in Medicine (DICOM) PS3.0-2015	Image, waveform, audio/video
15	Scanned or Captured Records	JPEG lossy (or lossless) with size and resolution not less than 1024px x 768px at 300dpi	Image capture format
16		ISO/IEC 14496 - Coding of Audio-Visual Objects	Audio/Video capture format
17		ISO 19005-2 Document Management — Electronic Document File Format for Long-Term Preservation - Part 2: Use of ISO 32000-1 (PDF/A-2)	Scanned documents format
18	Data Exchange	ANSI/HL7 V2.8.2-2015 HL7 Standard Version 2.8.2 - An Application Protocol for Electronic Data Exchange in Healthcare Environments	Event/Message exchange
19		ASTM/HL7 CCD Release 1 (basis standard ISO/HL7 27932:2009)	Summary Records exchange
20		ISO 13606-5:2010 Health informatics — Electronic Health Record Communication - Part 5: Interface Specification	EHR archetypes exchange [Also, refer to openEHR Service Model specification]
21		DICOM PS3.0-2015 (using DIMSE services & Part-10 media/files)	Imaging/Waveform Exchange
22	Other Relevant Standards	Bureau of Indian Standards and its MHD-17 Committee	Standards Development Organizations (SDOs)
23		ISO TC 215 set of standards	
24		IEEE/NEMA/CE standards for physical systems and interfaces	
25	Discharge/ Treatment Summary	Medical Council of India (MCI) under regulation 3.1 of Ethics	Composition as prescribed
26	E-Prescription	Pharmacy Practice Regulations, 2015 Notification No. 14-148/ 2012- PCI as specified by Pharmacy Council of India	Composition as prescribed
27	Personal Healthcare and medical Device Interface	IEEE 11073 health informatics standards and related ISO standards for medical devices	Device interfacing
28	Data Privacy and Security	ISO/TS 14441:2013 Health Informatics — Security & Privacy Requirements of EHR Systems for Use in Conformity Assessment	Basis security and privacy requirements
29	Information Security Management	ISO/DIS 27799 Health informatics — Information Security Management in Health using ISO/IEC 27002	Overall information security management
30	Privilege Management	ISO 22600:2014 Health informatics — Privilege Management and Access Control (Part 1 through 3)	Access control

	and Access Control		
31	Audit Trail and Logs	ISO 27789:2013 Health informatics - Audit trails for Electronic Health Records	Audit trail
32	Data Integrity	Secure Hash Algorithm (SHA) used must be SHA-256 or higher	Data Hashing
33	Data Encryption	Minimum 256-bits key length	Encryption key
34		HTTPS, SSL v3.0, and TLS v1.2	Encrypted connection
35	Digital Certificate	ISO 17090 Health informatics - Public Key Infrastructure (Part 1 through 5)	Digital certificates use and management

Annexure 2: List of Supporting / Complimenting Standards

S.No.	Standard	Description
1	ISO 12967:2009	Health Informatics - Service Architecture (Parts 1 - 3)
2	ISO 13972:2015	Health Informatics - Detailed Clinical Models, Characteristics and Processes
3	ISO 20301:2014	Health Informatics - Health Cards - General Characteristics
4	ISO 21090:2011	Health Informatics - Harmonized Data Types for Information Interchange
5	ISO 8601:2004	Data elements and Interchange Formats - Information Interchange -Representation of Dates and Times
6	ISO 13119:2012	Health Informatics - Clinical Knowledge Resources - Metadata
7	ISO 22857:2013	Health Informatics — Guidelines on Data Protection to Facilitate Trans-Border Flows of Personal Health Data
8	ISO 21549-1:2013	Health Informatics — Patient Healthcard Data — Part 1: General Structure
9	ISO TS 14265:2011	Classification of Purposes for Processing Personal Health Information
10	ISO TS 27527:2010	Health Informatics — Provider Identification