

TITLE

**IMPLEMENTATION OF ELECTRONIC HEALTH RECORD UNDER
AYUSHMAN BHARAT DIGITAL MISSION: A REVIEW OF FACILITATORS
AND BARRIERS**

**A Capstone project submitted to
Johns Hopkins Bloomberg School of Public Health & IIHMR University
in partial fulfillment of the requirements for
the award of the degree of
Master of Public Health**

by

Dr Aishwarya Dhumale
MPH - Cohort X (2022-24)

Under the guidance of
Dr Neetu Purohit

October 2023

Introduction

The goal of establishing universal health coverage (UHC) is being supported by the development of digital technology as an enabler to assure accessible, affordable, and high-quality health care. India aims to achieve Universal Health Coverage by 2030. India has a both public and private healthcare providers, with multiple stakeholders involved at various levels of care. At present the system is operational in multiple silos which are not interoperable which raises concerns about the effective utilization of healthcare services. The Ministry of Health and Family Welfare (MoHFW) has made it a priority to increase the uptake of digital health for effective delivery of services and citizen empowerment.

India's National Health Policy (NHP) 2017 emphasizes on the adoption of digital technologies for improving the efficiency and outcomes of healthcare system. The National Digital Health Blueprint (NDHB) 2019 was outlined by Ministry of Health and Family Welfare of India after surveying the global best practices in enactment of digital technologies for healthcare. With the population of 148 crore, we have 1200000 healthcare facilities and over 5000000 healthcare professionals. These facilities have various digital systems in place thus generating fragmented data bases of health records. With the background of NHP 2017, NITI Aayog outlined National Health Stack (NHS) in 2018 for making health records available through cloud-based services. The blueprint is an implementation guide for creating a Digital health Ecosystem and moving from "silos to systems". (1–3)

Evolution of health records in India

The advent of the EHR in the 1960s led to a shift in the way patient medical records are captured and stored. India witnessed a shift from paper-based to electronic records.(4)The World Health Organization defines Electronic Health Record as follows;

“Electronic health records (EHRs) are real-time, patient-centered records that provide immediate and secure information to authorized users. EHRs typically contain a patient’s medical history, diagnoses and treatment, medications, allergies, immunizations, as well as radiology images and laboratory results”.(5)

Information and Communication Technology (ICT) has made tremendous progress over the past two decades when it comes to healthcare. While the implementation of EHR at a national level is challenging given the population, and already existing fragmented health systems at institutional level, it is imperative to have integrated longitudinal patient records for better health outcomes. (6) Some of the synonymous terms used to define electronic records are Automated health records (AHR), Computed based Patient Records (CPR), Electronic Medical Records (EMR) and Electronic Health Record (EHR). The main distinction between the EMR and EHR is, while EMR is digitized patient history and not delineated to be shared outside of an institution, EHR is comprehensive and a collective of medical records that can be shared outside of the healthcare institutions but the terms are still used synonymously.(4) Currently there are EHR software in Indian healthcare market. Each offering an array of services. It works on a subscription model with fees ranging from Rs.999 to over Rs.4000 a month. (7) Presence of these systems without interoperability poses a challenge for national implementation of EHR.

Fig.1. shows the evolution of EHRs in India with systemic and policy changes from 1960s to the present.

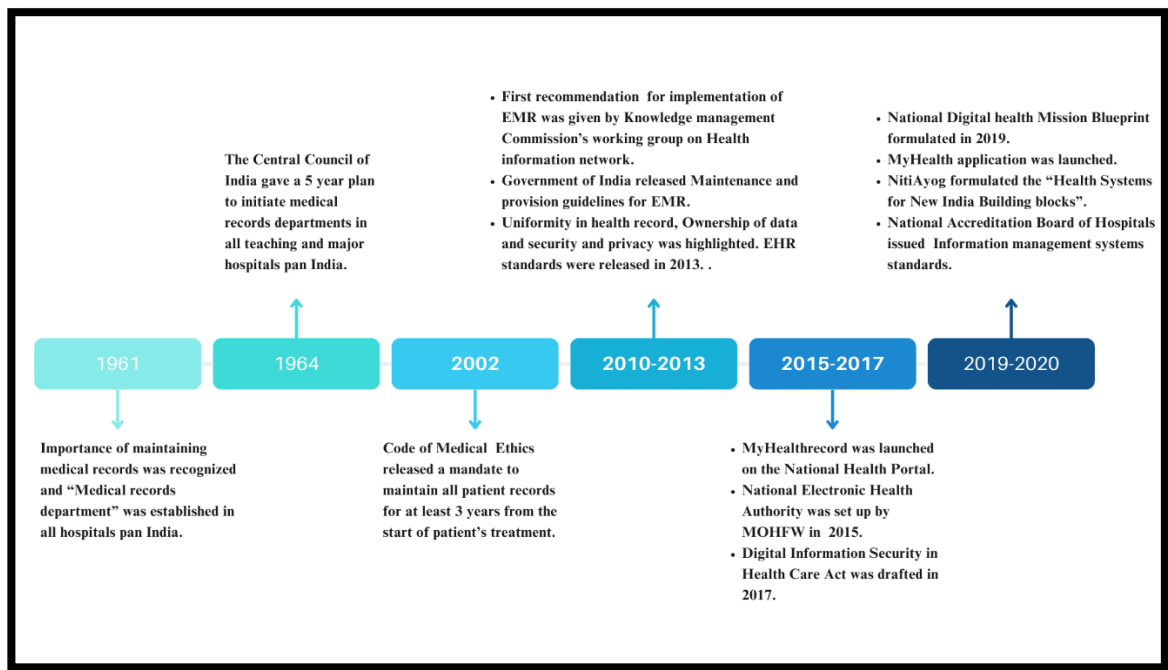


Fig. 1. Evolution of electronic records in India. (8)

Ayushman Bharat Digital Mission

The nationwide launch of Ayushman Bharat Digital Mission (ABDM) in 2022 is a stride towards realizing the goal of UHC India. The National Health Authority (NHA) is delegated with the responsibility for implementation of ABDM. The existing public digital infrastructure of Aadhar, Unified Payment Interface, Internet availability and increased use of smartphones, sets a strong foundation for ABDM. The goal of ABDM is to narrow the gap between the numerous stakeholders who make up the healthcare ecosystem by creating interoperability between different digital health systems. By allowing each digital solution to be integrated with ABDM, it aims to provide stakeholders with an ecosystem that is open and interoperable as opposed to a single digital health solution which is also known as the federated architecture in Information Technology or digital systems. (2,3,9)

It is therefore not necessary to store all digital health records on one system or in one place. Digital health records created will remain in the same digital system that the particular

healthcare provider (hospital, doctor, etc.) is now using. As a result, if a physician or a particular healthcare facility chooses a digital health solution designed by an IT developer that has storage at a particular place, that storage will continue to exist. In a same manner, patients will continue to use digital health solutions and preserve their information in the same manner, whether they are stored on a server or on their devices (mobiles, laptops, etc.). The digital health records will therefore be kept in many locations at the discretion of the hospitals, physicians, and patients. (9)

Key Principles of ABDM

Sr.no.	Key principle	Purpose
1.	Inclusivity	ADBM aims to create an inclusive network of various healthcare stakeholder. Every individual has a 14-digit ABHA account number for seamless access to health records.
2.	No cost registration	No fees are associated with ABDM registration.
3.	Opting out of the ABDM ecosystem.	Individuals are free to opt out and deactivate their ABHA account. They can delete the account and associated medical record will be deleted as well.

4.	Single source of truth	ABDM includes various stakeholder through registries. There is individual registration with ABHA ID, Healthcare facility Registry, Healthcare professional registry. These registrations will be verified and act as single source of truth with no copies.
5.	Privacy by design	Privacy and security of data is ensured in the ABDM through encryption and federated architecture.
6.	Voluntary participation	The healthcare facilities or institutions participation is voluntary. Once registered to be a part of the National Digital Health Ecosystem, all the healthcare professionals should get registered under the HPR.

Flow of data under ABDM

Healthcare data of an individual can be created at a facility level for example at a public or private clinic, a laboratory, an imaging center. It can also be created at state or national level

through various operational public health programs. With the ABDM the data flows from Health Information Provider (HIP) such as healthcare facilities, laboratories, imaging centers through the building blocks that are Health ID, HFR, HPR to the Health Information Users (HIU) such as healthcare professionals, pharmacies, diagnostics centers and digital lockers. The Health Information Exchange and Consent Manager (HIE-CM) allows consent-based access of medical records. The ABHA owner has to authorize consent before any data is exchanged at various levels of care. (9)

Key stakeholders of Ayushman Bharat Digital Mission.

Fig.2. Enlist the key stakeholders of ABDM.



The review is directed towards understanding the process of implementation of Electronic Health Records at a National level under the ABDM and to identify the roadblocks and the existing factors that can be leveraged for a successful implementation.

Objectives

- 1. To identify the facilitators and barriers for EHR implementation at primary, secondary and tertiary levels of healthcare in India**

Methodology

The review is based on secondary data analysis. Preliminary exploratory scope of literature was done in Google Scholar and PubMed using the keywords “*Ayushman Bharat Digital Mission*”, “*Electronic Health Records*”, “*Public Health Records*”, “*Medical Records*”. Boolean Operators AND, OR were used and the keywords were nested to narrow down the search results. PubMed yielded 7 results and 47 results were found in Google Scholar after the searching the keywords in the databases. Duplicates were eliminated and 13 articles were retrieved after manual selection. ABDM related articles in the context of medical records, which were published between 2019 to 2023 were included in the review.

Grey literature including ABDM handbooks, policy documents, reports and guidelines were also searched. A total of 11 government documents were referenced to extract information. Electronic Health Record implementation related current figures and insights were extracted from the ABDM dashboard. Total of 4 document from World Health Organization and Health Information Management Systems Society were referenced to collect information about the standard frameworks and manuals for implementation of the EHR.

The facilitators and barriers were identified and categorized based on the 15 factors identified in the article by Orna Fennelly and et al. title “*Successfully implementing a national electronic health record: a rapid umbrella review*” published in The Journal of Medical

Informatics in September, 2020. The 15 factors are further grouped under the 3 broad categories. (10)

Organizational	Individual	Technological
• Governance, leadership and support • End-user involvement • Training • Support • Resourcing • Workflows	• Skills and characteristics • Perceived benefits and incentives • Perceived change	• Usability • Interoperability • Adaptability • Infrastructure • Regulation, Standards and policies • Testing

Results

Benefits of maintaining Electronic Health Records at a population level

EHRs enable us to maintain longitudinal patient record, and ease of access which are crucial to improve patient outcomes. 5.2 million injuries and adverse reaction due to medical errors are reported in India. The errors are either diagnostic, treatment or preventative errors. Poor communication amongst the healthcare providers, lack of adequate information, misinterpretation of medical data, dosage errors and lack of allergy history are identified as causes of these errors.(11) EHRs improve the quality and accuracy of data recorded. It also increases healthcare provider's access to patient information.

It is estimated that diagnostic tests accounts for 12.3 percent of the out-of-pocket expenditure on health. (12) Lack of diagnostic test data over time increases the expenditure due to repetitive tests and imaging that the individual has to go through. EHRs reduces these healthcare cost and increases the healthcare provider's access to past and presents medical data, enables sharing of this data among the healthcare providers, it facilitates evidence based medical decision making and decreases the time for making accurate diagnosis for continuing care of patient. In addition to this longitudinal medical records aid policy makers and researchers. (4,6)

ABHA Building blocks

The data gathered from the building blocks of ABDM is the only centrally stored for creating an interoperable ecosystem. Health records remain close to point of contact.

1. Health ID

Ayushman Bharat Health Account number is a unique 14-digit identifier for accessing the health records digitally. It can be done via self-registration through smartphone or computer. ABHA application can also be downloaded to self-register. By visiting the participating healthcare provider ABHA can be created on request through assisted enrollment.(9) The ABHA registration requires Aadhaar number, with mobile number linked for OTP for login. As of September 29th 2023, over 138 crore Aadhaar have been generated. While there is no indicative number as to how many Aadhar are linked to mobile numbers as multiple Aadhaar's can be linked to single mobile number. It still leaves roughly 6 percent of the population not registered for Aadhar and unable to avail ABDM services.(13) Over 47 crore ABHA are created currently. 31 crore Health records

are linked. Out of the total ABHA created 48.5 percent are female, 51.42 percent are male and 0.01 percent are others.

ABHA partners help accelerate the registration and linking of health records. The partners can be government or private entities. Currently 56 private and 42 government partners are creating ABHA. The partners are categorized as HMIS, Insurance, Health tech, PHR application, Health locker, Government Programs, LMIS. (14)

2. Health Facility Registry

Healthcare facilities registry (HFR) is an archive of health facilities (Modern and Traditional medicine) which are registered under the ABDM. Public and private hospital, including laboratories, imaging centers and pharmacies can register for being a part of National Health Ecosystem. HFR enables facilities to have a national presence, retrieve and share health records across other registered facilities. HFR serves as single source of truth. All HFR registrations are verified and are needed to have ABDM compatible software. Guidelines for health facilities which can be registered are extensive and HMIS should adhere to the EHR standards for India, 2016. ABDM suggest digitization of OPD registration, consultation, prescription, pharmacy records, laboratory records, radiology reports and discharge summaries. (9) Currently 2,20,787 facilities are verified with 54,673 facilities having ABDM enabled software. 18,209 facilities are linking health records.(14) While the number of verified facilities is substantial there is limited data available if ABDM is operational at facility level.

3. Healthcare Professional Registry

Once a facility is registered under ABDM, all the healthcare professionals from the facilities are registered under ABDM under the Healthcare Professional Registry (HPR).

As various state and central medical councils do not have a centralized archive it is difficult to map all the healthcare professionals. Registering in HPR enables the professional to access patient records, provide teleconsultation, and to have an online presence. Each health professional will be provided a unique ABDM HPR ID after verification. (9) 2,33,434 health professionals are verified under ABDM. State of Uttar Pradesh has the highest number of verified health professionals registered under the ABDM HPR. 83.52 percent registered professionals are from government sector as opposed to 16.48 percent who are from private sector. (14) Private sector being the major provider of over 60 percent inpatient care and 70 percent outpatient care, majority of healthcare professionals work in private sector. More than 31 percent of professionals with training in medicine are currently out of labor force. (15) Given the current insights on the registration it is crucial to identify the factors hindering private sector professional from being a part of the National health ecosystem. While the insights are indicative there are limited sources to verify the number of registered professionals accessing and sharing medical record through the ABDM architecture.

Facilitators and barriers to Electronic Health Implementation under ABDM

Implementation of Electronic Health Record at a National level is a comprehensive and gradual process which requires step by step digitization of various process involved in healthcare. EHR Standards for India, 2016 gives a detailed account of suggestion on interoperability, clinical informatics stands, data privacy security and ownership, and coding of systems. It enlists 35 standards for efficient and compliant EHR system. (16)

1. Organization

1.1 Governance, leadership and support

The implementation of ABDM is delegated to the NHA. However, NHA's role is limited to the creation of an interoperable platform for accessing medical records, formulating standards and policies and creation of building blocks. NHA has no authority over the various medical councils and boards thus hindering the penetration of ABDM within the existing healthcare workforce. State governments and district administration are given the responsibility for capacity building, IEC and coordination with medical councils for verification of healthcare professionals and healthcare facilities. They are also responsible for optimizing the digital infrastructure and upgradation of hardware in the healthcare facilities within the state with no specific guidelines delineated. With multiple EHR vendors in the market the standardization of EHR workflows poses a big challenge. (9) At an organizational level the digitization of processes and onboarding of trained human resources to manage the workflows poses an economic burden on facilities.

1.2 End-user involvement

End-user involvement was emphasized as crucial at each level of the EHR implementation process because it ensures that the EHR matches their needs and workflows and fosters a sense of ownership and acceptance among staff. It was advised that end users from each stakeholder group be involved in decision-making. (10)

The registration of facilities under the ABDM is the decision made by the management of the private healthcare facility or the state government in cases of government facilities. For a complete integration within the National Health Ecosystem the health professional should register in the ABDM's HPR. Majority of healthcare services are offered by the private sector and the health professionals often consult at two or more hospitals, however the professional is given one Health Professional ID which is operational at facility registered under HFR. Thus, when s/he consults at the different hospital s/he will be

unable to access medical records of patient in other hospitals which are not in the HFR. The HPR does not register the professionals as per their specialty which discourages specialist from registering. (9) There is an inherent resistance to change and newer digital technologies from end users due increased work load which can be addressed by training, gradual digitization of work flow, capacity building and strengthening the digital infrastructure. (17)

1.3 Training

In collaboration with the relevant state and federal authorities, NHA is developing and implementing information, education, and communication (IEC) programs. Integrations with current digital applications run by different organizations are being leveraged to speed up adoption. (9) Arogya Manthan is organized every year to share insights and conduct learning session as well as connect with stakeholders. (18) There is a need to increase awareness of newer technologies through outreach activities and phased implementation of EHR to decrease the resistance. (17)

1.4 Support

The first 3 to 4 weeks of EHR implementation at a healthcare facility are crucial for its long-term sustainability. While there are no guidelines outlined in ABDM for the initiation of EHR implementation at a facility it is crucial to maintain communication channels for any guidance or support needed with the software.(10) Availability of hardware, uninterrupted power supply and IT support from trained personnel are crucial are additional sources which are crucial.(19)

1.5 Resourcing

For effective implementation of EHR the availability of resources needs to be ensured. Financial barriers especially at primary levels of care hinder implementation. As a result, it is essential to perform a cost analysis that accounts for personnel, maintenance, infrastructure, and ongoing optimization. Vendor dependence can be curbed through trained workforce. End-users should be given adequate time to get habituated to the new workflows.(10,17)

1.6 Workflows

While ABDM enables the health facilities to keep using the existing HMIS, it also demands digitization of certain workflows. End-user satisfaction and engagement is affected if the process in place do not align with the newer suggested digital infrastructure.(10) While diagnostics, lab reports, and pharmacy prescription are digitized in most facilities, the OPD and consultation are still on paper. Most hospitals follow a Hybrid (Paper Digital) mode of storage. ABDM suggested the ‘Scan and Share’ a QR code-based system which enables sharing of digital token and enables digitization of OPD and consultation records. (9)

2. Individual

2.1 Skills and characteristics

An individual’s personality traits and IT abilities can influence how successfully an EHR is implemented. Prior to effective EHR training, an assessment of computer literacy of an individual should be done. End-user assessment allows us to identify individuals who need baseline computer training. According to research, problem-solving and adaptability to change are the qualities that have a beneficial influence on the deployment of electronic health records. (10) Training and workshops are currently conducted for various stakeholder through Live events, master trainer session. Insights and workshops are held through Arogya Manthan. National and State master trainers for ABDM are appointed. (18)

Ayushman Bharat Health Account application is used for accessing health records by user, scanning QR code for OPD registration, managing consent for sharing health records across stakeholders and accessing various healthcare services through a single

application. It inherently requires understanding of mobile applications for accessing the services. National Family Health Survey 5 reports suggests that 33 percent of women and 51 percent of men have accessed internet.

3. Technological

3.1 Usability

3.2 Interoperability

3.3 Adaptability

3.4 Infrastructure

3.5 Regulation, Standards and policies

Digital Health Information in Healthcare Security Act (2018) is “An Act to provide for establishment of National and State eHealth Authorities and Health Information Exchanges; to standardize and regulate the processes related to collection, storing, transmission and use of digital health data; and to ensure reliability, data privacy, confidentiality and security of digital health data and such other matters related and incidental thereto”(Ministry of Health & Family Welfare, and Government of India 2018).

Reference

1. National Digital Health Mission Strategy Overview. 2020.
2. Aayog N. National Health Stack Strategy and approach. 2018.
3. NDHM Blueprint.
4. Wadhwa M. Electronic Health Records in India. 2020.
5. Country has national Electronic Health Record (EHR) [Internet]. [cited 2023 Oct 10]. Available from: <https://www.who.int/data/gho/indicator-metadata-registry/imr-details/4791>
6. World Health Organization. Regional Office for the Western Pacific. Electronic health records : a manual for developing countries. World Health Organization Western Pacific Region; 2006. 76 p.
7. 10 best EMR software in India - HealthPlix [Internet]. [cited 2023 Oct 11]. Available from: <https://healthplix.com/healthcare-insight/10-best-emr-software-in-india/>
8. Jena S, Tiwari P, Nundy S. 26 years of experience in medical records from 1996 to 2022. *Curr Med Res Pract.* 2023;13(3):131.
9. ABDM_Handbook_19_10_2022_24c5078481.
10. Fennelly O, Cunningham C, Grogan L, Cronin H, O'Shea C, Roche M, et al. Successfully implementing a national electronic health record: a rapid umbrella review. Vol. 144, *International Journal of Medical Informatics.* Elsevier Ireland Ltd; 2020.

11. Aashita. BASIC CONCEPT OF PATIENT SAFETY IN HEALTHCARE DELIVERY. 2018; Available from: <https://doi.org/10.24941/ijcr.30612.08.2018>
12. Ambade M, Sarwal R, Mor N, Kim R, Subramanian S V. Components of Out-of-Pocket Expenditure and Their Relative Contribution to Economic Burden of Diseases in India. JAMA Netw Open [Internet]. 2022 May 13 [cited 2023 Oct 11];5(5):E2210040. Available from: <https://pubmed.ncbi.nlm.nih.gov/35560051/>
13. Unique Identification Authority of India - Unique Identification Authority of India | Government of India [Internet]. [cited 2023 Oct 11]. Available from: <https://uidai.gov.in/en/about-uidai/unique-identification-authority-of-india.html>
14. ABDM-Insights [Internet]. [cited 2023 Oct 10]. Available from: <https://dashboard.abdm.gov.in/abdm/>
15. Karan A, Negandhi H, Hussain S, Zapata T, Mairembam D, De Graeve H, et al. Size, composition and distribution of health workforce in India: why, and where to invest? Hum Resour Health [Internet]. 2021 Dec 1 [cited 2023 Oct 11];19(1):1–14. Available from: <https://human-resources-health.biomedcentral.com/articles/10.1186/s12960-021-00575-2>
16. ELECTRONIC HEALTH RECORD (EHR) STANDARDS FOR INDIA 2016 Standards Set Recommendations v2.0.
17. Roy A, Mitra A, Soman B. OMSTH, 2023; 1(2): e23014 Public health in India Public health in India: Leveraging technology for a brighter future. 2023.
18. NHA | Official website Ayushman Bharat Digital Mission [Internet]. [cited 2023 Oct 8]. Available from: <https://abdm.gov.in/ebook>
19. HARDWARE GUIDELINES FOR STATES AND HEALTHCARE INSTITUTIONS AYUSHMAN BHARAT DIGITAL MISSION.

