

Review Article

Optimising Healthcare Delivery: The Role of Centralised Electronic Health Records in Enhancing Patient Care and Efficiency

Siddhi Santosh Kotre

Research Scholar, Thakur Institute of Management Studies, Career Development & Research (TIMSCDR) Mumbai, India

I N F O

E-mail Id:

siddhikotre2002@gmail.com

Orcid Id:

<https://orcid.org/0009-0005-2376-4489>

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A B S T R A C T

In the rapidly evolving healthcare landscape, the need for innovative solutions to enhance patient care and streamline operational efficiency has never been more critical. Centralised Electronic Health Records (EHR) have emerged as a ground-breaking tool in this transformation, revolutionising the way patient data is stored, accessed, and shared. By consolidating disparate health records into a unified, easily accessible system, EHRs eliminate the inefficiencies and risks associated with paper-based records and fragmented data. This seamless integration fosters real-time communication among healthcare providers, ensuring that patients receive timely, well-coordinated care. Furthermore, centralised EHR systems have the potential to significantly reduce administrative costs, minimise medical errors, and improve decision-making processes.

Keywords: Centralised Electronic Health Records, Healthcare Efficiency, Data Interoperability, Healthcare System Optimisation, Data Security, Healthcare Technology

Introduction

The healthcare system in India faces numerous challenges, including rising patient volumes, inefficient administrative processes, and fragmented patient data, which often lead to delayed treatments, medical errors, and increased healthcare costs. With a population of over 1.4 billion, India's healthcare sector is under immense pressure to provide quality care across both urban and rural areas, making effective healthcare delivery a complex task. The integration of Centralised Electronic Health Records (EHR) offers a promising solution to these challenges, providing a unified platform for storing, accessing, and sharing patient information among healthcare providers (figure 1). This integration can streamline administrative processes, enhance coordination among medical professionals, reduce duplication of tests, and ensure that timely and accurate patient data is available, all of which can significantly improve patient outcomes.¹⁻²

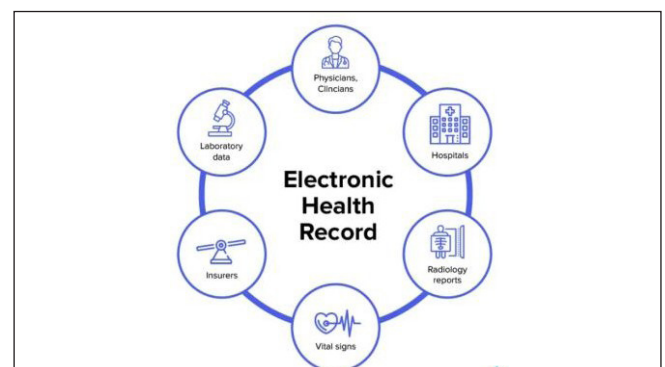


Figure 1.shows the EHR Integration

In India, the adoption of EHR systems has been slow but steady growing. According to a report by the National Health Authority (NHA), over 80% of healthcare providers in urban areas are transitioning to digital records, though rural areas still face challenges in terms of infrastructure and digital literacy (figure 2). The Indian government has

been actively promoting the use of EHRs through initiatives like the National Digital Health Mission (NDHM), launched in 2020, which aims to create an integrated digital health ecosystem in the country. Despite these efforts, widespread EHR adoption faces hurdles like data privacy concerns, lack of standardised formats, and resistance from providers due to high implementation costs.³⁻⁶

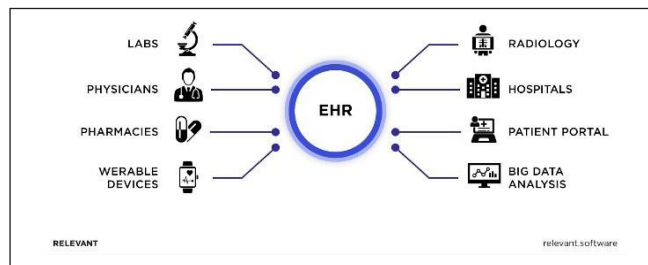


Figure 2.shows the EHR Components

Data from the Ministry of Health and Family Welfare suggests that digitising health records could reduce healthcare costs by up to 40% and cut medical errors by 50%. This research explores how centralised EHR systems can enhance healthcare delivery in India, focusing on patient care, efficiency, cost-effectiveness, and implementation challenges.^{7,8}

Literature Review

EHR systems have improved global healthcare by enhancing efficiency, patient care, and cost management. While countries like the U.S., UK, and Australia have successfully adopted EHRs, India's implementation is still evolving. This section explores global trends and compares India's progress, focusing on the challenges and benefits of centralised EHR systems.¹

Global Adoption and Benefits of EHR Systems

EHR systems have been widely adopted in developed countries, notably after the U.S. passed the HITECH Act in 2009. By 2020, over 85% of office-based physicians and 96% of hospitals in the

U.S. had implemented EHRs. The implementation of EHR systems resulted in numerous benefits, such as:

- **Improved patient care coordination:** Access to real-time patient data reduces medical errors and enhances decision-making, leading to better outcomes.²
- **Operational efficiency:** EHR systems help reduce administrative overhead, enhance clinical workflows, and minimise the duplication of medical tests.³
- **Cost reduction:** A study by the Journal of the American Medical Association found that EHRs could reduce healthcare costs by as much as \$77 billion annually in the U.S. alone.⁴

Similarly, the United Kingdom's National Health Service (NHS) integrated EHR systems early in the 2000s, using the National Programme for IT to digitise health records. The NHS reported significant improvements in operational efficiency, with reductions in paperwork and administrative costs.^{5,6} Global market for EHR Country-wise records mentioned in Figure 3.

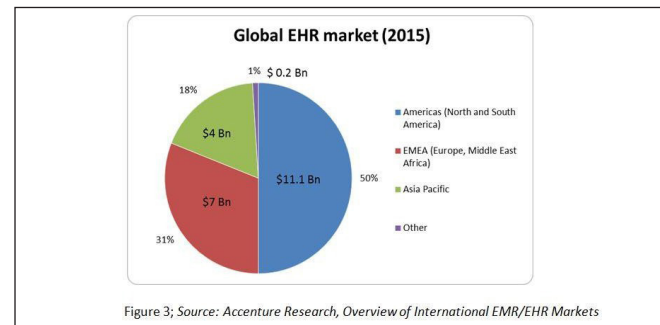


Figure 3.Source Accenture,research,Overview of International EMR/EHR Markets

- **EHR in Australia:** A Comparative Model Australia serves as another example of successful EHR implementation. The Australian Digital Health Agency (ADHA) has been at the forefront of establishing a national digital health strategy. By 2020, Australia had implemented the My Health Record system, which consolidates patient health information across the country. Key findings from Australia's EHR adoption include:
- **Increased patient satisfaction:** A report by the ADHA revealed that 85% of Australian patients felt that My Health Record improved the quality of their healthcare.
- **Reduction in healthcare costs:** The system saved over \$600 million annually by reducing unnecessary medical procedures and tests.

Australia's success with its national health information exchange system highlights the potential benefits of integration and standardisation, offering a promising model for countries like India to maximise the impact of EHR systems.

EHR in India: Current Adoption and Challenges

India, with its diverse healthcare landscape, faces unique challenges in implementing centralised EHR systems. According to a 2020 report by the National Health Authority (NHA), only 7-10% of healthcare providers in India have fully adopted EHR systems, with the rate being significantly higher in urban areas compared to rural regions. The adoption rate in rural areas remains low due to issues such as poor internet connectivity, lack of digital literacy, and limited access to technology.

- **Government Initiatives:** The Indian government launched the National Digital Health Mission (NDHM) in 2020 to promote digital health records and create a

unified healthcare platform. The mission aims to offer digital health IDs for citizens to improve accessibility and data sharing. However, its implementation faces challenges such as infrastructure gaps, data privacy concerns, and resistance from healthcare providers.

- **Challenges in Rural India:** A study by the Indian Council of Medical Research (ICMR) found that rural healthcare centres lack resources to implement EHRs. A 2018 NSSO survey revealed that only 16% of rural healthcare centres had computers, and less than 5% had internet access, hindering EHR adoption.
- **Privacy and Security Concerns:** Data privacy remains a major barrier to EHR adoption in India. A 2020 KPMG survey found that 58% of Indian patients were concerned about the security of their health data, citing fears of breaches and misuse.



Figure 4. show us various EHR Accessing Comparative Analysis: India vs. Prominent Countries

The adoption of EHRs in India contrasts sharply with that of developed countries like the U.S., the UK, and Australia. While India has made strides in digitising healthcare data, the overall progress is slower due to several barriers:

- **Infrastructure limitations:** India faces challenges like unreliable internet and a lack of skilled personnel, especially in rural areas.
- **Cultural resistance:** Many healthcare providers still prefer paper-based records due to high initial costs and doubts about EHR effectiveness.
- **Data privacy:** While countries like the U.S. and EU have strong data protection laws (e.g., HIPAA, GDPR), India's data privacy regulations are still evolving, with the Personal Data Protection Bill not fully implemented.

Architectural Models and Types of EHR

The quantitative approach will assess the broader impact of EHR systems, while the qualitative approach will explore the challenges, barriers, and benefits of implementation from the perspective of key stakeholders.

Types of Electronic Health Record systems

Deciding between cloud-based and on premise EHR software solutions is one of the most important choices you need to make.

- **On-premise:** EHR solution is installed and run directly on the local computers in your medical organisation. However, this can cause difficulties if problems arise or a new version needs to be updated.
- **Cloud-based:** means that users access the EHR system over the Internet without a need to pay upfront for EHR software licences in favour of a monthly fee. What's more, healthcare providers always have access to patient information, even in critical moments. Centralised EHR systems offer numerous advantages, including providing accurate, up-to-date, and comprehensive patient information for better diagnosis and care coordination. They enable quick access to patient records, improving healthcare providers' productivity and work-life balance. These systems facilitate secure sharing of e-health information among clinicians and patients, help avoid medical errors, and reduce costs by minimising paperwork. Additionally, EHRs support e-prescribing, allowing prescription details to be entered into the system with a single click, streamlining healthcare workflows and enhancing overall efficiency.

Benefits of centralised her systems

The adoption of centralised Electronic Health Records (EHR) systems brings transformative advantages to healthcare delivery, enhancing various aspects of patient care and operational efficiency:

- **Enhanced Patient Care:** Centralised EHR systems provide real-time access to patient information, improving diagnostic accuracy, care coordination, and outcomes.
- **Improved Efficiency:** EHRs digitise records, reducing paperwork and streamlining workflows, allowing healthcare staff to focus on patient care.
- **Secure Data Sharing:** EHRs enable confidential sharing of medical records among providers and patients, supporting integrated care delivery.
- **Reduction in Medical Errors:** Legible and comprehensive records minimise misinterpretation, medication errors, and redundant tests, enhancing patient safety.
- **Cost Reduction:** By reducing duplicate procedures and optimising resource use, EHR systems lower healthcare costs.
- **E-Prescription Capability:** Electronic prescribing reduces errors and enhances convenience for both providers and patients.
- **Improved Patient Engagement:** Patients gain access to their records, fostering active participation in their healthcare and better adherence to treatments.
- **Support for Telemedicine:** Centralised records enhance virtual consultations by providing complete patient histories, ensuring comprehensive care.

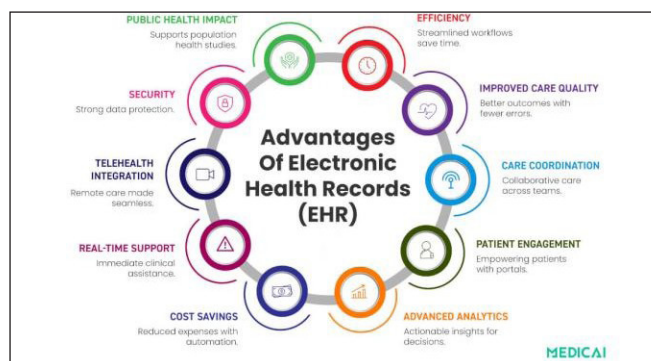


Figure 5.shows the Benefits of Centralised EHR Systems

Challenges in Implementing HER Systems in India

The implementation of centralised Electronic Health Record (EHR) systems in India is hindered by various structural, financial, and regulatory challenges, especially in a diverse healthcare landscape comprising urban and rural settings. Below are the critical barriers and insights drawn from existing data:

Infrastructure Gaps

India's healthcare infrastructure, particularly in rural areas, suffers from significant digital shortcomings. A 2018 survey by the National Sample Survey Organisation (NSSO) revealed that only 16% of rural healthcare centres have computers, and less than 5% possess internet access. These gaps in basic technological infrastructure, combined with unreliable electricity, impede the integration of EHR systems into the rural healthcare framework.

High Implementation Costs

The initial financial investment required for hardware, software, and workforce training discourages many small and mid-sized healthcare facilities from adopting EHR systems. The disparity in financial resources between urban and rural healthcare providers exacerbates this issue, as smaller facilities often prioritise essential healthcare services over technology upgrades.

Data Privacy and Security Concerns

India's data protection framework falls short of global standards like HIPAA and GDPR, raising concerns about the safety of health records. A 2020 KPMG survey found that 58% of Indian patients worry about data breaches, creating a trust deficit that hinders EHR adoption.

Interoperability Issues

The lack of standardised data formats and protocols in India's healthcare system creates barriers to interoperability between healthcare providers, limiting EHR systems' ability to enable coordinated care.

Shortage of Skilled Personnel

The implementation of EHR systems requires trained IT staff, which is scarce, particularly in rural healthcare centres. This shortage delays adoption and impacts the quality of system implementation.

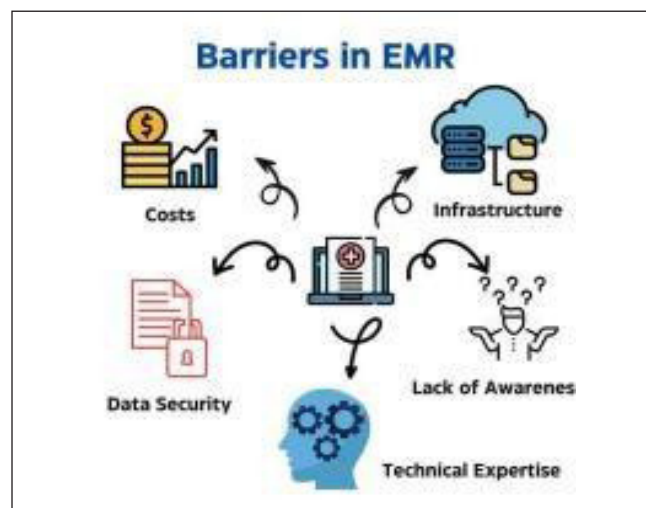


Figure 6.shows the Challenges in EHR Systems Policy and Regulatory Framework

The adoption of Electronic Health Record (EHR) systems in India is heavily influenced by the country's policy and regulatory landscape. While government initiatives like the National Digital Health Mission (NDHM) and Digital India provide a foundation for digital transformation, several gaps and challenges in the regulatory framework hinder widespread implementation. This section explores existing policies, regulatory requirements, and recommendations for improvement to support EHR adoption effectively.

Government Initiatives

- **National Digital Health Mission (NDHM):** Launched in 2020, NDHM aims to create a unified digital health ecosystem through digital health IDs, a comprehensive patient health record system, and interoperability across healthcare providers. Objectives include improving healthcare access, enhancing service delivery, and promoting data-driven healthcare decisions.
- **Digital India Program:** Digital India seeks to strengthen IT infrastructure and expand digital services across sectors, including healthcare. Its focus on improving internet connectivity and promoting digitisation in rural areas aligns with the goals of EHR implementation.
- **Telemedicine Guidelines:** The government has introduced guidelines for telemedicine, encouraging remote consultations and leveraging EHR systems for comprehensive patient history access during virtual consultations.

Regulatory Requirements for EHR Adoption in India

- **EHR Standards (2016):** The Ministry of Health and Family Welfare (MoHFW) introduced EHR Standards for India, aiming to establish uniformity in data storage and interoperability. These standards cover patient data capture, coding systems (ICD-10, SNOMED CT), and data exchange protocols.
- **Personal Data Protection Bill (PDPB):** The PDPB, still awaiting full implementation, proposes regulations for handling personal data, including sensitive health information. It mandates user consent, data minimisation, and security measures, addressing some privacy concerns related to EHRs.
- **Information Technology Act (2000):** This act provides a legal framework for electronic transactions and cybersecurity, relevant to securing EHR data.

Challenges in the Policy and Regulatory Framework

- **Lack of Enforcement Mechanisms:** EHR standards are not mandatory, leading to inconsistent implementation across healthcare providers.
- **Insufficient Data Protection:** While the PDPB outlines essential privacy principles, its delayed rollout leaves EHR systems vulnerable to data breaches.
- **Interoperability Issues:** The lack of standard compliance among healthcare providers results in fragmented data sharing and limited system integration.
- **Limited Incentives:** Unlike countries like the U.S., where incentives like the HITECH Act promote EHR adoption, India lacks financial or regulatory motivation for private healthcare providers.

Recommendation for Successful EHR Implementation

To ensure the effective adoption and integration of Electronic Health Record (EHR) systems in India's healthcare landscape, the following streamlined recommendations focus on key areas:

Strengthen Infrastructure and Provide Financial Support

- **Improve Connectivity:** Invest in reliable internet access and power supply, particularly in rural and semi-urban healthcare centres.
- **Subsidies and Grants:** Provide financial incentives, such as subsidies and tax benefits, to support small and mid-sized healthcare providers in acquiring the necessary hardware and software.

Enforce Data Privacy and Standardisation

- **Implement Data Protection Laws:** Expedite the Personal Data Protection Bill (PDPB) to ensure patient data security and build trust among stakeholders.

- **Adopt Standard Protocols:** Mandate compliance with EHR Standards (2016) to ensure uniformity and interoperability of healthcare data across systems.

Enhance Workforce Training and Stakeholder Awareness

- **Skill Development Programs:** Train healthcare professionals and IT staff on EHR usage, management, and troubleshooting.
- **Patient and Provider Engagement:** Conduct awareness campaigns to educate stakeholders on the benefits of EHRs, fostering acceptance and collaboration.

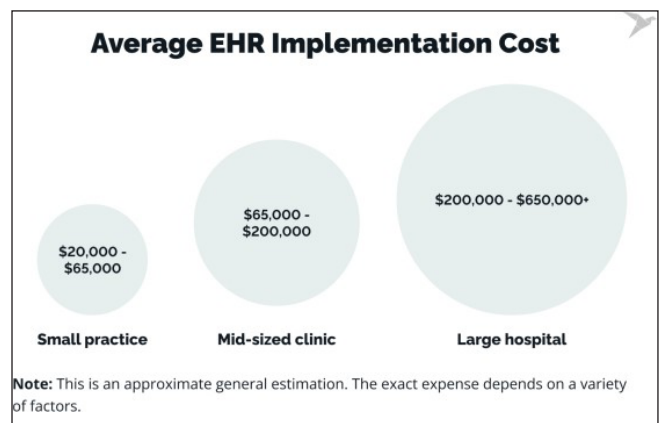


Figure 7. shows us the Cost Breakdown

Future Prospects and Trends

As India advances towards a connected healthcare system, future efforts will focus on improving interoperability between EHR systems, standardising data formats, and enhancing communication across providers for better care coordination. Integration with telemedicine, diagnostic systems, and pharmacy networks will further boost EHR efficiency.

EHRs will play a critical role in telemedicine, especially in rural areas, by providing healthcare providers with comprehensive patient histories during virtual consultations. This will enhance the accuracy and effectiveness of remote healthcare services, driving the adoption of centralised digital health records.

AI and machine learning will play an increasingly important role in the future of EHRs. By analysing large volumes of healthcare data, AI-powered tools will offer predictive insights, helping clinicians make more accurate diagnoses, identify trends in patient outcomes, and reduce medical errors. These tools can also assist in optimising healthcare operations and resource allocation. With data analytics, EHRs will evolve into powerful decision-support systems.

As concerns about data privacy and security remain a significant challenge, the integration of blockchain technology into EHR systems is emerging as a promising solution. Block

chain can provide secure, decentralised storage of patient data, ensuring that access and modifications to medical records are transparent, auditable, and tamper-proof. This would address patient concerns about data breaches and misuse, further building trust in digital health systems.

Conclusion

The integration of Centralised Electronic Health Record (EHR) systems in India has the potential to revolutionise healthcare by enhancing patient care, increasing efficiency, and reducing costs. Despite progress through initiatives like the National Digital Health Mission (NDHM), widespread adoption faces hurdles such as infrastructure gaps, high implementation costs, data privacy concerns, and cultural resistance. The lack of reliable internet and power in rural areas, as highlighted by the 2018 NSSO survey, coupled with limited funding for smaller healthcare providers, underscores the need for strategic investments in infrastructure and

financial incentives. Furthermore, the absence of robust data protection laws and interoperability standards hinders trust and seamless data sharing, necessitating policy enhancements and alignment with global frameworks like GDPR and HIPAA. Addressing these challenges through targeted policy reforms, workforce training, and technological integration is essential for scaling up EHR adoption. Emerging technologies like AI, block chain, and telemedicine can enhance EHR capabilities, offering improved security and predictive analytics. Awareness campaigns and training programmes for healthcare providers and patients will foster greater acceptance and utilisation of digital records. With a concerted effort from the government, private stakeholders, and healthcare professionals, India can overcome existing barriers and establish a robust, efficient, and inclusive healthcare ecosystem that benefits all stakeholders.

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