

**EXPLORING THE STATUS, CHALLENGES, AND STRATEGIES FOR
EFFECTIVE IMPLEMENTATION OF ELECTRONIC HEALTH RECORDS
(EHRS) IN PRIVATE SECTOR: A COMPARATIVE ANALYSIS**

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfilment for the award of the degree of

Master of Business Administration (MBA)

in

Hospital and Health Management

By

Tanu Gupta

Under the Supervision and Guidance of

Dr. Anoop Khanna

2024



Dated: 14th June 2024

TO WHOM IT MAY CONCERN

This is to certify that Tanu Gupta has successfully completed Internship from “18th March2024” to “14th June 2024”. Tanu’s designation during the internship was Intern (Clinical Transformation). During the internship she was found punctual, hardworking, and inquisitive.

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled **“Exploring the status, challenges, and strategies for effective implementation of electronic health records (EHRs) in private sector: a comparative analysis”** is the bona-fide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

A handwritten signature in black ink, reading 'Tanu Gupta' with a stylized underline.

Name of Student – Ms. Tanu Gupta

Date – 14-06-2024

CERTIFICATE

This is to certify that dissertation titled **Exploring the Status, Challenges and Strategies for Effective Implementation of Electronic Health Records (EHRs) in Private Sector: A Comparative Analysis** is a record of the research work undertaken by Ms. Tanu Gupta in partial fulfilment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.

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ACKNOWLEDGEMENTS

Completing a dissertation is a significant opportunity for professional growth and learning. I feel fortunate to have had the opportunity to undertake my project at MyHealthcare Technologies. The knowledge and experience I gained from the professionals in the organization have been invaluable.

I would like to express my heartfelt gratitude to the academic fraternity at **IIHMR UNIVERSITY, JAIPUR** for establishing such a dedicated system that provides students like me with the opportunity to pursue their areas of interest and enhance their knowledge. The support and guidance provided by the faculty and staff at IIHMR UNIVERSITY, JAIPUR have been invaluable throughout my academic journey. Their commitment to providing quality education and fostering a learning environment has greatly contributed to my personal and professional growth. I would like to extend my sincere gratitude to my mentor **Dr. Anoop Khanna** for his invaluable guidance, expertise, and support throughout this research project.

I am particularly thankful to **Shyatto Raha, Divya Laroyia, and Dr. Poorva Nandedkar** for their in-depth discussions and guidance. Their timely support, inspiration, and unconditional assistance played a crucial role in shaping my study. I am immensely grateful to Dr. Poorva, despite her busy schedule, she made the effort to listen to me, provide feedback, and offer insightful suggestions throughout the project. Her contributions were vital in making this project a reality.

I would also like to extend my gratitude to **Dr. Vaibhav Sundriyal and Dr. Ashiya Mahran** for their active cooperation and mentoring. I would also like to express my appreciation to my colleagues and the entire staff at **MyHealthcare Technologies** for their attention to my work and their assistance. Their support significantly contributed to the success of my project. I am sincerely thankful to everyone involved.

LIST OF CONTENTS

S. No	Content	Page No
1.	Acknowledgements	2
2.	Certificates	4
3.	List of Contents	5
4.	List of Abbreviations	6
5.	List of Figures	8
6.	Abstract	9
7.	Chapter 1: Introduction	11
8.	Chapter 2: Review of Literature	19
9.	Chapter 3: Methodology	28
10.	Chapter 4: Results	31
11.	Chapter 5: Discussion	43
12.	Chapter 6: Conclusion	46
13.	Chapter 7: Recommendations	48
14.	References	50

LIST OF ABBREVIATIONS

S. No	Abbreviation	Full Form
1.	HER	Electronic Health Records
2.	EMR	Electronic Medical Records
3.	SNOMED CT	Systematized Nomenclature of Medicine – Clinical Terms
4.	HIPPA	Health Insurance Portability and Accountability Act
5.	ICD	International Classification of Diseases
6.	HITECH	Health Information Technology for Economic and Clinical Health Act
7.	SOAP	Subjective, Objective, Assessment and Plan
8.	NDHM	National Digital Health Blueprint
9.	PHR	Personal Health Records
10.	ACOS	American College of Surgeons
11.	NITI	National Institution for Transforming India
12.	MoHFW	Ministry of Health and Family Welfare
13.	MU	Meaningful Use
14.	HIS	Hospital Information System
15.	RIS	Radiology Information System
16.	LIS	Laboratory Information System
17.	CHI	Canada Health Infoway
18.	PACS	Picture Archiving and Communication System
19.	NAHIT	National Alliance for Health Information Technology
20.	HIMSS	Health Information Management Systems Society
21.	ONC	Office of the National Coordinator
22.	CMA	Canadian Medical Association
23.	AHA	American Hospital Association
24.	OPD	Out-Patient Department
25.	IPD	In-Patient Department
26.	IT	Information Technology
27.	DISHA	Digital Information Security in Healthcare Act
28.	MeitY	Ministry of Electronics and Information Technology

29.	UHC	Universal Health Coverage
30.	POMR	Problem – Oriented Medical Records
31.	AHIMA	American Health Information Management Association
32.	VisTA	Veterans Health Information System and Technology
33.	ARRA	American Recovery and Reinvestment Act
34.	LOINC	Logical Observation Identifiers Names and Codes
35.	OECD	Organisation for Economic Co-operation and Development
36.	DICOM	Digital Imaging and Communications in Medicine
37.	HL-7	Health Level – 7
38.	NeHA	National e-health Authority of India
39.	ICT	Information and Communication Technology

LIST OF FIGURES

S. No	Figure	Page No
1.	History of EHRs	15
2.	Adoption rates of basic and comprehensive EHRs in U.S. hospitals from 2009 to 2019 is examined.	33
3.	Adoption rates of basic and comprehensive EHRs in U.S. hospitals, based on various characteristics, from January 2020 to June 2020.	34

ABSTRACT

Title: Exploring The Status, Challenges, And Strategies for Effective Implementation of Electronic Health Records (EHRs) In Private Sector: A Comparative Analysis

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Advisor Name: Dr. Anoop Khanna

Keyword: The following keywords were used to search the literatures. "Electronic health record" "private sector" "EHR implementation" "challenges" "health information technology" "comparative analysis" "EHR adoption" "barriers" "electronic medical record" "implementation strategies"

Background: The healthcare sector is undergoing significant digital transformation, driven primarily by the adoption of Electronic Health Records (EHRs). EHRs serve as digital versions of traditional paper-based medical records, consolidating a patient's medical history in a secure and accessible format. They not only digitize records but also enhance the storage, dissemination, and utilization of healthcare data, offering a comprehensive approach to patient care and operational efficiency.

Objective: The study aims to examine the existing policies and regulatory frameworks governing the implementation of EHRs. It seeks to identify the key challenges hindering the effective adoption of EHRs within the healthcare system. Additionally, the study discusses potential strategies and future directions for addressing these challenges, promoting the effective adoption and utilization of EHRs.

Method: This study employs a secondary research approach, reviewing existing literature on Electronic Health Records (EHR) implementation. The study focuses on articles from the USA, Canada, and India, published in English between 2005 and 2023, covering EHR adoption and barriers. Exclusions include non-EHR specific studies, articles from other countries, non-English publications, and those outside the specified

date range. Literature databases such as PubMed, Scopus, and Google Scholar were searched with keywords like "Electronic Health Records," "EHR implementation," and "healthcare technology." Relevant information on EHR status, barriers, theoretical frameworks, and strategies was extracted from the selected studies.

Result: In the United States, EHR adoption surged post-HITECH Act, with basic EHR usage rising to 81.2% and comprehensive systems to 63.2% by 2019. Major hospitals and urban areas lead in adoption rates, while smaller, rural, and for-profit hospitals lag. In Canada, initiatives by Canada Health Infoway significantly boosted EHR integration, with 86% of family physicians adopting EMRs by 2019. Challenges included initial resistance and proficiency issues. In India, EHR adoption faces hurdles due to low healthcare spending and regulatory gaps. However, private hospitals have shown successful integration, highlighting the potential for nationwide EHR implementation with adequate support and investment.

Conclusion: EHR systems have the potential to transform healthcare delivery by enhancing the quality and efficiency of care. While the benefits are substantial, successful implementation requires addressing the associated challenges through strategic planning, adequate training, and continuous support. Overall, the adoption of EHRs represents a critical step towards modernizing healthcare and improving patient outcomes.

CHAPTER 1: INTRODUCTION

The realm of healthcare is currently experiencing a digital transformation, with the focal point of this evolution being the notion of electronic health records (EHRs). Fundamentally, EHRs serve as the electronic counterparts of conventional paper-based medical records, methodically consolidating an individual's medical background in a secure and convenient manner. Nevertheless, EHRs transcend beyond mere digitized files; they embody a fundamental change in the storage, dissemination, and application of healthcare data.

Electronic Health Records (EHRs) refer to electronically preserved healthcare data over an individual's lifespan aimed at facilitating seamless care provision, educational endeavours, and research activities. These records may encompass various components such as observations, laboratory assessments, medical imaging, interventions, therapeutic modalities, pharmaceuticals dispensed, patient demographic details, and legal authorizations.(1).

In a 2006 report by the National Institutes of Health, the Health Information Management Systems Society (HIMSS) offered a definition of Electronic Health Records (EHRs). An EHR is an electronic record that tracks a patient's health information over time. This information comes from various healthcare settings where the patient received care. It includes details like demographics, medical history, medications, allergies, lab results, and imaging reports. EHRs aim to make doctors' work more efficient by automating tasks and creating a complete picture of a patient's health. They can also be used for other purposes such as suggesting the best course of treatment based on evidence, managing healthcare quality, and reporting on patient outcomes.(2).

Electronic Health Records (EHRs) encompass a broad spectrum of patient data, comprising the following categories:

- **Demographics:** Foundational information such as name, age, residence, and contact details.
- **Medical History:** A comprehensive timeline detailing prior illnesses, surgeries, and medical procedures.
- **Medications and Allergies:** A comprehensive list of current medication intake and documented allergies.

- Immunization Status: Documentation of administered vaccinations along with corresponding dates.
- Laboratory Test Results: Digital records of various lab analyses including blood work and urine tests.
- Radiology Images: Digital representations of diagnostic imaging studies like X-rays, CT scans, and MRIs.
- Vital Signs: Measurements such as blood pressure, heart rate, and body temperature.
- Personal Statistics: Data pertaining to height, weight, and other biometric indicators.
- Billing Information: Details concerning medical expenses and insurance provisions.

EHRs and EMRs are frequently utilized interchangeably due to their shared functions of digitizing patient health data and enhancing the efficiency of medical record-keeping, causing confusion regarding their distinct purposes and scopes. Both terms originated within the context of the broader electronic documentation trend in the healthcare sector, with the goal of substituting traditional paper-based records with more effective, precise, and easily accessible digital formats. The overlap in their primary operations, including the management of patient data, support for clinical processes, and enhancement of data precision, further complicates the differentiation between the two. Moreover, as the healthcare field has progressed, the functionalities of EMRs have broadened, increasingly resembling the comprehensive capabilities of EHRs. This blending of functions, alongside the general lack of awareness of the subtle variances among healthcare professionals and the public, contributes to the frequent interchangeable usage of these terms.

The National Alliance for Health Information Technology (NAHIT) provides distinct definitions to differentiate between EHRs and EMRs. It defines EMR as “the electronic record of health-related information on an individual that is created, gathered, managed, and consulted by licensed clinicians and staff from a single organisation who are involved in the individual’s health and care”, whereas EHR is “the aggregate electronic record of health-related information on an individual that is created and gathered cumulatively across more than one health-care organisation and

is managed and consulted by licensed clinicians and staff involved in the individual's health and care"(3).

Distinguishing factors between Electronic Health Records (EHRs) and Electronic Medical Records (EMRs) include:

Feature	Electronic Medical Records (EMRs)	Electronic Health Records (EHRs)
Scope	Single Practice or Facility	Multiple Practices, Facilities, and Providers
Data Sharing	Limited to within the specific practice	Designed for sharing across different healthcare settings
Interoperability	Typically, not interoperable with other systems	Highly interoperable with other healthcare systems
Patient Information	Specific to the medical history at one provider	Comprehensive, covering all aspects of patient care across providers
Patient Involvement	Patients typically do not have access	Patients often have access via patient portals
Regulatory Compliance	Meets basic regulatory requirements for electronic records	Meets extensive regulatory standards (e.g., meaningful use criteria)
Functionality	Basic clinical functions like diagnosis and treatment	Advanced functions like e-prescribing, lab integration, and decision support
Data Types	Clinical data specific to one provider's encounters	Comprehensive data including clinical, demographic, and treatment information from multiple sources
Examples of Use	Used primarily in smaller practices	Used in hospitals, multi-provider practices, and integrated healthcare systems
Focus	Improving practice efficiency and record-keeping	Enhancing overall patient care coordination and outcomes

Implementation Complexity	Less complex, easier to implement	More complex, requires significant integration and training
Cost	Generally lower cost	Higher initial cost, potential for higher long-term savings

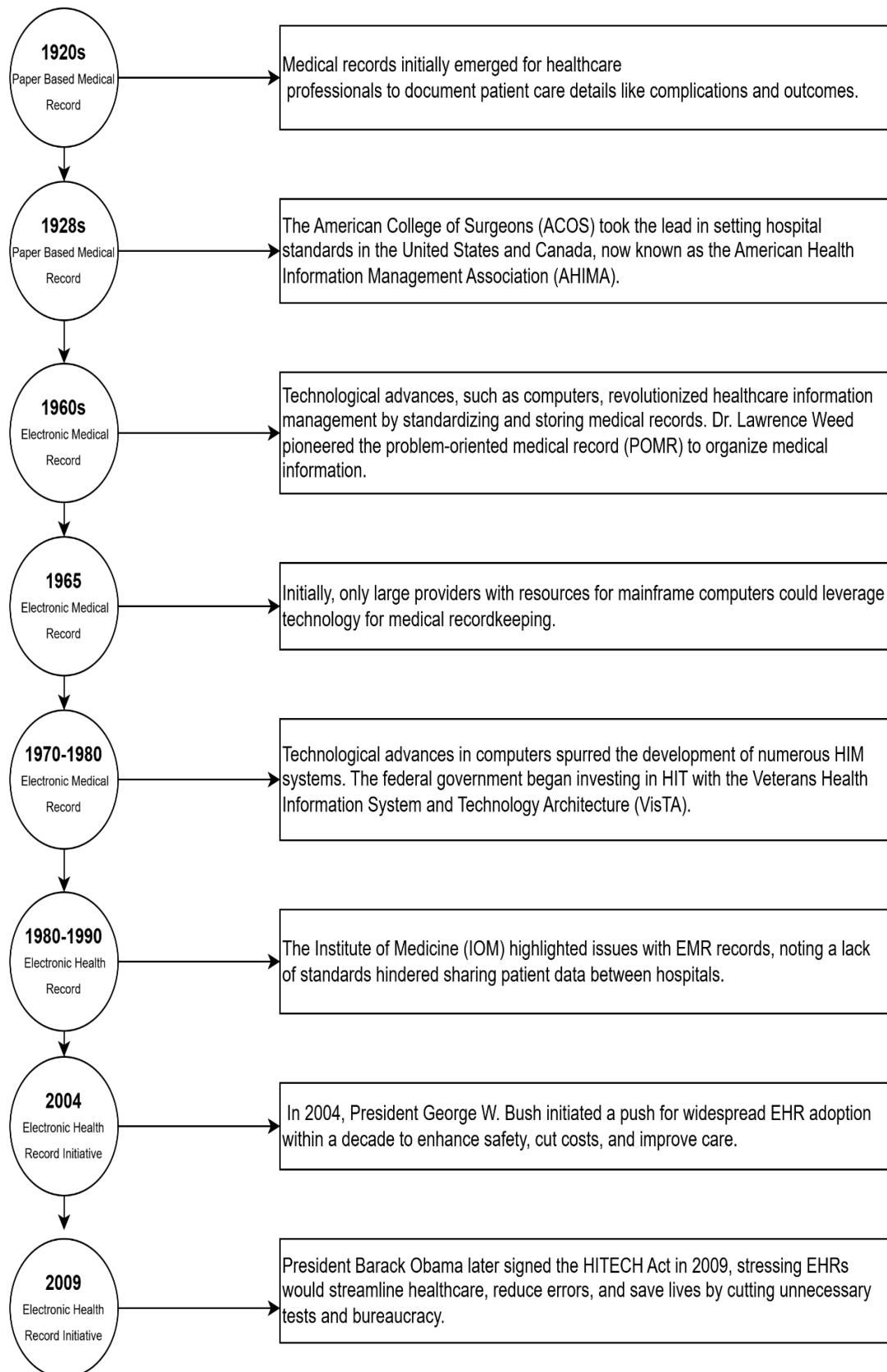
HISTORY OF ELECTRONIC HEALTH RECORDS

Since their inception, medical records have evolved significantly. Originally used for documenting ailments and treatments, by the early 20th century, these records were managed on index cards. The introduction of Medicare in the 1960s and 1970s, alongside other regulatory changes, elevated the importance of detailed medical records. However, the transition to Electronic Health Records (EHRs) during this period faced challenges including high costs, lack of standardization, and regulatory complexities, which slowed adoption.

In 2005, President Bush highlighted the limitations of paper-based systems and emphasized the potential benefits of EHRs. The turning point came with the passage of the American Recovery and Reinvestment Act of 2009, which included the Health Information Technology for Economic and Clinical Health (HITECH) Act. This legislation aimed to incentivize healthcare providers to adopt EHRs through financial incentives tied to achieving "meaningful use" criteria. These criteria included functionalities like electronic data submission, electronic prescribing, and interoperable systems.

The federal government allocated \$27 billion towards this initiative, with a goal of achieving widespread EHR adoption by 2014. This initiative aimed not only to modernize record-keeping but also to enhance healthcare quality, reduce medical errors, and improve patient outcomes. By encouraging healthcare providers to digitize patient records and implement advanced health information technology, the initiative sought to streamline healthcare delivery and improve efficiency across the healthcare system(4).

Fig.1: Evolution of electronic health records



ADVANTAGES OF USING ELECTRONIC HEALTH RECORDS

1. **Reduced Errors through Standardization:** EHRs eliminate handwritten notes by replacing them with typed entries, thus ensuring clarity and mitigating the risk of misinterpretations stemming from poor penmanship. EHR technology helps with proper documentation and has diagnosis databases built in to assist coders and billers to produce accurate healthcare claims(4). EHRs frequently employ predetermined choices for diagnoses, medications, and procedures, thereby reducing errors attributed to typographical mistakes or discrepancies in documentation, consequently resulting in more dependable medical records.
2. **Preventing Adverse Events with Alerts and Reminders:** EHRs can be configured to examine potential interactions between newly prescribed drugs and a patient's existing medications or allergies. These real-time alerts serve to prevent adverse reactions and severe complications that may arise from drug interactions. EHRs can incorporate clinical decision support tools that offer guidance to healthcare providers on relevant clinical protocols and potential complications associated with specific diagnoses or procedures. This feature aids in averting errors in requesting unnecessary or unsuitable tests or treatments. EHRs can automatically monitor the progress of laboratory tests and inform healthcare providers of any abnormal findings. This functionality ensures prompt follow-up and diminishes the likelihood of missed diagnoses or delayed treatment due to overlooked lab outcomes.
3. **Improved Communication for Better Care:** EHRs frequently provide secure messaging capabilities that facilitate enhanced communication between patients and healthcare providers. Patients can seek clarifications, provide feedback, or express concerns electronically, thereby contributing to well-informed consultations and heightened patient satisfaction. Researchers have also found an association between EHR use and physician satisfaction with their current practice, as well as their career satisfaction(5). EHRs furnish a centralized depository for a patient's complete medical history, encompassing allergies, medications, past diagnoses, and procedures. This holistic perspective enables healthcare providers

to render more informed treatment decisions grounded on the patient's individual medical background.

4. **Empowering Patients through Self-Management:** Numerous EHR systems feature patient portals, enabling secure access to medical records, appointment scheduling, and communication with healthcare providers. This capability empowers patients to assume a more proactive role in managing their well-being by facilitating the review of their medical data, monitoring progress, and engaging in shared decision-making. EHRs can be leveraged to pinpoint patients at risk of developing specific conditions based on their medical and familial history. This proactive approach allows for interventions like sending reminders for preventive screenings and vaccinations, ultimately culminating in earlier disease detection and improved health outcomes.
5. **Enhanced Operational Efficiencies for Enhanced Productivity:** The use of EHRs can reduce the redundant use of tests or the need to mail hard copies of test results to different(6). Automation of data entry tasks, such as the documentation of vital signs, medication administration, and progress notes, by EHRs diminishes the likelihood of errors linked to manual input, thereby freeing up essential time for healthcare professionals and support staff. Promotion of improved care coordination through EHRs enables smooth information exchange among authorized healthcare personnel, obviating the need for redundant data collection.
6. **Integration of Automated Processes to Alleviate Administrative Burden:** The automation of coding and billing processes by EHRs streamlines the workflow by eliminating laborious manual coding duties. This guarantees precise billing in accordance with the rendered services, potentially expediting claim reimbursements and enhancing the financial liquidity of healthcare establishment. By incorporating voice recognition software, EHRs enable healthcare providers to verbally dictate notes directly into the electronic system, thus eliminating the necessity for transcription services and resulting in substantial cost reductions.
7. **Utilization of Data-Driven Insights to Enhance Resource Allocation:** EHR data furnishes valuable insights into healthcare usage trends, enabling administrators to pinpoint areas necessitating enhancement, optimize resource distribution, and

curtail wastage. For instance, scrutinizing patterns of lab test orders can identify superfluous tests and streamline processes effectively. EHRs offer a holistic overview of a patient's medical history by making patient information more readily available, EHRs reduce costs related to chart pulls as well as supplies needed to maintain paper charts(6).

8. **Enhanced Data Security:** Encryption is commonly utilized in EHRs, wherein data is transformed into an incomprehensible format. This method guarantees that in the event of unauthorized access, individuals would be unable to interpret the data without the decryption key and incorporate access controls that restrict entry to patient data based on the user's role and permissions. This ensures that solely authorized healthcare staff can access the necessary information for providing care, thus reducing the risk of unauthorized entry or data breaches.
9. **Multi-Factor Authentication:** A significant number of EHR systems necessitate multi-factor authentication, which enhances security beyond mere usernames and passwords. This could entail one-time codes dispatched to a user's device or biometric scans, thereby increasing the complexity of unauthorized entry. EHRs commonly feature user activity monitoring functionalities that trace individuals who accessed patient data and their corresponding actions. This aids in recognizing suspicious behaviours and potential security violations.
10. **Audit Trails:** EHR systems uphold elaborate audit trails that document each attempt to access patient data. These records capture the user who accessed the data, the access time, and the specific details accessed, furthering accountability, and aiding in the detection of potential security incidents.
11. **Data Backups:** EHR systems frequently execute scheduled data backups to a secure off-site destination. This guarantees that in the event of hardware malfunctions, natural calamities, or unforeseen circumstances, patient data remains secure and retrievable

CHAPTER 2: REVIEW OF LITERATURE

AUTHOR	YEAR	METHODOLOGY	KEY FINDINGS
G.R. Stream	2009	The study was conducted across USA. A survey was conducted in which questionnaire was send to physicians of different specialization out of which 120 Responses were reported and constitutes the final sample size.	- Facilitators for EHRs adoption were reimbursement for using e-health records, adequate technical support, performance-based incentives. - Barriers reported were lack of standards, cost factors- Ongoing & upfront cost, technical limitations, lack of computer literacy, time needed for training.
Suzanne C. Biro, David T. Barber, Jyoti A. Kotecha	2012	The study was conducted across Canada, focusing on physicians and other specialists across provinces like Alberta, Ontario, and British Columbia. The study compared data from the 2007 and 2010 NPS to analyse EMR usage trends. Specific sample size numbers were not provided.	- Alberta exhibited the greatest proportion of physicians who solely utilized EMRs at 28%, with Ontario following at 20% and British Columbia at 19%. - The utilization of both EMRs and paper charts concurrently saw an increase from 26% to 34% within a span of three years.

			• By the year 2010, 39% of physicians employed electronic records for clinical annotations, 20% made use of electronic prompts for patient care, and 20% resorted to electronic alerts for drug interactions. • Adoption of EMRs was shown to enhance physicians' readiness for managing chronic diseases and improve adherence to clinical guidelines.
Amal Mohammad AL-ASWAD, Simon BROWNSSELL, Rebecca PALMER and Jonathan P. NICHOL	2013	The study location includes a global perspective, focusing extensively on EHRs adoption worldwide. The research paper did not specify the sample size used which involved analysing a wide range of studies and viewpoints to understand the adoption landscape comprehensively.	• The United States has achieved notable advancements in the incorporation of EHRs through the provision of a substantial sum of 19 billion dollars by the Congressional body for the integration of EHR and other health IT. • Several primary obstacles encountered by hospitals in the United States in the deployment of EHRs comprise financial

			constraints (73%), upkeep expenses (44%), cultural obstacles (36%), uncertainty regarding the return on investment (32%), and inadequacy in IT education (30%).
M. Price, A. Singer	2013	Study design for this study was quantitative. The study was conducted across Canada. Discussions and interviews were carried out with clinicians and other staff members of the healthcare facilities to study the challenges associated with EMR adoption. The sample size for the study was 57.	• Facilitators for EHRs adoption reported were proper change management approach, ensuring proper training, collaborative culture, unified business & clinical aspects and good quality of data. • Barriers reported were lack of computer literacy, lack of compatibility with other systems, lack of policies related to electronic health, training limitations and security concerns.
Feng Chang Nishi Gupta	2015	The study was conducted across Canada. The sample size and sampling techniques used in the study were not explicitly mentioned in the provided contexts.	• Research highlights the effectiveness of provincial incentives in driving EMR adoption, supported by statistical evidence of increased

			adoption rates in incentivized regions. • Statistical analyses within the literature reveal perceived benefits of EMR adoption, such as improved patient care and workflow efficiency, based on documented outcomes and trends. • Barriers to EMR adoption, including financial constraints or technical challenges, are often quantified in studies, providing numerical data on impediments faced by healthcare providers.
Meenakshi Sharma Himanshu Aggarwal	2016	The study aimed to assess the adoption rate of EHRs in India relative to global trends. Bibliographic research was conducted using data obtained from various hospital sources and consultations with EHR vendors. The study focused on understanding the current scenario of EHR adoption in Indian healthcare settings.	• Over a 7-month pilot study period, approximately 20 major hospitals successfully implemented EHRs systems in India. This indicates a growing but still emerging trend in the country. • Globally, adoption rates of EHRs are significantly higher in countries like China (96%), Brazil (92%),

			France (85%), and Russia (93%) as of the latest available data. This underscores India's lower adoption rate in comparison. • As of 2020, the global market for EHRs was valued at US\$25.98 billion, with CAGR reflecting robust expansion in the sector. • The study identified several barriers to EHR adoption in India, including interoperability standards issues, financial constraints, and inadequate governance and health policies.
Julia Adler-Milstein, Jay Holmgren, Peter Kralovec, Chantal Worzala, Talisha Searcy, and Vaishali Patel	2017	The study was conducted in the US, focusing on hospitals EHRs adoption. The research included a sample size of 3,643 non-federal acute care hospitals in the U.S. The sampling technique employed was a cross-sectional design using data from the American	• Studies have shown a growing trend in EHRs adoption among hospitals, with about 84.5% of U.S. hospitals adopting basic EHR systems. • Despite the overall increase in adoption, a digital divide exists, with only 18.7% of hospitals considered as

		Hospital Association Annual Survey.	"advanced users" EHR systems. • Research indicates that hospital size, teaching status, urban or rural location, and ownership type significantly impact the level of EHR adoption and advanced use. • Statistical analyses reveal that larger hospitals, teaching hospitals, urban location, and private non-profit ownership are positively associated with advanced EHR use.
Ankit S., S. Jadhav	2020	Cross sectional study design was adopted for the study. The study was conducted across India. A questionnaire was developed based on TAM and total of 145 response of physicians were recorded and analysed.	• Facilitators for EHRs adoption reported were positive attitude towards using EMR, customization of EMR to align with healthcare facility workflow, reliability of EMR and monetary incentives for using EMR. • Barriers reported were complex usability and lack of consistent data.

Manohara M. M. Pai Raghavendra Ganiga Radhika M. Pai Rajesh Kumar Sinha	2021	This investigation centered on the digitalization of medical records within public healthcare institutions, with a specific focus on developing countries such as India. It delved into the obstacles related to the integration of EHRs that offer immediate access at any location and time. The study specifically scrutinized the acceptance and execution of EHRs in various tiers of healthcare establishments in India, including PHC, CHC, District Hospitals (Secondary Health Centers), and National level Tertiary Healthcare Centers.	• Some secondary and tertiary healthcare facilities in India have started implementing IT systems like HIS and EMRs. However, these systems are not interoperable. • Healthcare facilities face difficulties in data collection, processing, and secure storage due to disparate IT systems and lack of standardization. • The study proposes a standardized EHRs framework using medical terminology and coding standards to improve data accessibility and integration across the healthcare system. • Implementing EHR across all levels of healthcare in India is expected to streamline workflows, enhance patient care continuity, and facilitate informed decision-making by healthcare providers.
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Nisha B Jain, Samiran Nundy	2021	The study location where the research was conducted is in India. The research paper included a sample size of 690 respondents, comprising various healthcare professionals and administrators. The study utilized convenient and snowball sampling techniques to gather data from the participants	• The paper highlights the challenges and promises associated with EHRs in India, focusing on issues like interoperability, data standardization, privacy concerns, and the potential benefits of EHR implementation.
John Jiang, Bai, Kevin Schulman	2023	The study was conducted in the US over a 10-year period, from 2009 to 2019, with the latest data collected from January to June of 2020. The research analysed a substantial sample size of 38,576 hospital-year observations, covering multiple years within the specified timeframe, with an average of 3507 hospitals included per year. To gather data, the study utilized information from the 2019 AHA IT survey. The sampling technique involved collecting data	• From 2009 to 2019, basic EHR adoption in US hospitals rose significantly to 81.2%, whereas comprehensive EHRs increased to 63.2%. • Hospitals experienced varying rates of EHR adoption, emphasizing the importance of fair access and policies to encourage competition in digital healthcare infrastructure implementation. • The EHR market was dominated by 6 major vendors, controlling 90% of the market share,

		from a diverse range of hospitals across the US to capture variations in EHR adoption rates, ensuring a comprehensive overview of trends and disparities in the healthcare system.	creating potential challenges for hospitals related to flexibility and costs. • Concerns were raised regarding the maintenance costs of EHR systems, highlighting ongoing issues of sustainability and affordability in healthcare institutions despite the increased adoption rates. • The research offers valuable insights into hospitals' readiness to use digital systems, especially in times of global health crises like the COVID-19 pandemic, suggesting the need for strategic interventions to enhance the resilience of the healthcare system.
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CHAPTER 3: METHODOLOGY

Study Design:

This study employs a secondary research approach, relying on a comprehensive review and synthesis of existing literature, including peer-reviewed articles, government reports, policy documents, and industry publications related to Electronic Health Records implementation.

Research questions:

1. What is the present state of adoption of electronic health records and what are the accompanying obstacles?
2. How can these challenges be addressed to facilitate the successful integration of EHRs?

Objectives:

1. To study the present rate of adoption of electronic health records in the United States, Canada, and India?
2. To study the key barriers to the effective adoption of EHRs in the healthcare system.
3. To discuss the potential strategies and future directions for addressing the identified challenges and promoting the effective adoption of EHRs.

Inclusion Criteria:

- Geographical Location – USA, Canada and India.
- Studies focusing on EHRs implementation and adoption and barriers to adoption of EHRs.
- Articles published in English language between 2005 and 2023.

- Research articles, review papers, and policy documents providing insights into the status, challenges, and future directions of Electronic Health Records.

Exclusion Criteria:

- Studies not specifically addressing EHRs implementation.
- Studies addressing EHRs implementation in countries other than the inclusion criteria.
- Articles published in languages other than English.
- Studies published before 2005 or after 2023.

Study Tools:

- Literature databases such as PubMed, Scopus, and Google Scholar were searched using relevant keywords including "Electronic Health Records" "EHR implementation", status of adoption of EHR in India, UK, USA, Cannada, "barriers to adoption of EHR", EMR, "healthcare technology", "health informatics", benefits of using EHR/EMR etc.
- Data extraction: Relevant information, including the status and barriers to EHR adoption, theoretical frameworks, and strategies, was extracted from selected studies.

Implications of research:

Electronic Health Records hold immense potential for revolutionizing healthcare. However, their successful implementation requires addressing critical challenges. This study, focusing on policies, challenges, and strategies for EHR adoption, is necessary for several reasons:

- **Limited Understanding of Policy Landscape:** Studying policy and regulatory frameworks will help identify gaps, redundancies, or inconsistencies that hinder adoption.

- **Persistent Adoption Challenges:** Despite ongoing efforts, challenges like interoperability, data security, and usability persist. Analysing these challenges will provide insights for developing targeted solutions.

Ethical considerations:

- Proper attribution and citation of sources is done for maintaining academic integrity and respecting the intellectual property rights of original authors.
- The credibility and trustworthiness of the literature reviewed is critically evaluated and sources that may contain biased or misleading information is avoided.

CHAPTER 4: RESULTS

ADOPTION OF EHRs IN DIFFERENT COUNTRIES

1. UNITED STATES (US)

The establishment of the Office of the National Coordinator (ONC) for Health Information Technology in 2004 signified the creation of the primary federal body responsible for overseeing the coordination of nationwide initiatives aimed at facilitating the adoption and progression of health information technology and the electronic transmission of health data(7).

The HITECH Act, a component of the American Recovery and Reinvestment Act of 2009, is a legislation aimed at promoting the meaningful utilization of EHRs and enhancing the confidentiality and security protocols of the Health Insurance Portability and Accountability Act (HIPAA). The 2009 Health Information Technology for Economic and Clinical Health (HITECH) Act was enacted with the explicit goal of expediting the adoption and encouraging the "meaningful use (MU)" of EHRs by healthcare providers in the United States(8).

This legislation allocated a significant amount of funding to offer financial incentives to eligible professionals who integrate EHRs into their practice and can demonstrate that their systems and usage patterns align with specific criteria aimed at positively impacting healthcare delivery and expenses. By the conclusion of 2014, the federal government had disbursed \$28.1 billion to eligible physicians and other practitioners under the Medicare and Medicaid EHR MU initiatives. Healthcare providers are required to confirm their eligibility for the MU Stage Two program by 2016 to be considered for participation in the incentive payment structure. Moreover, physicians who are eligible for the Medicare incentive initiative and fail to adopt a certified EHR by 2015 will face penalties equivalent to 1% of their Medicare payments, with this percentage escalating to 3% over the subsequent 3 years and eventually reaching 5% in subsequent years(9).

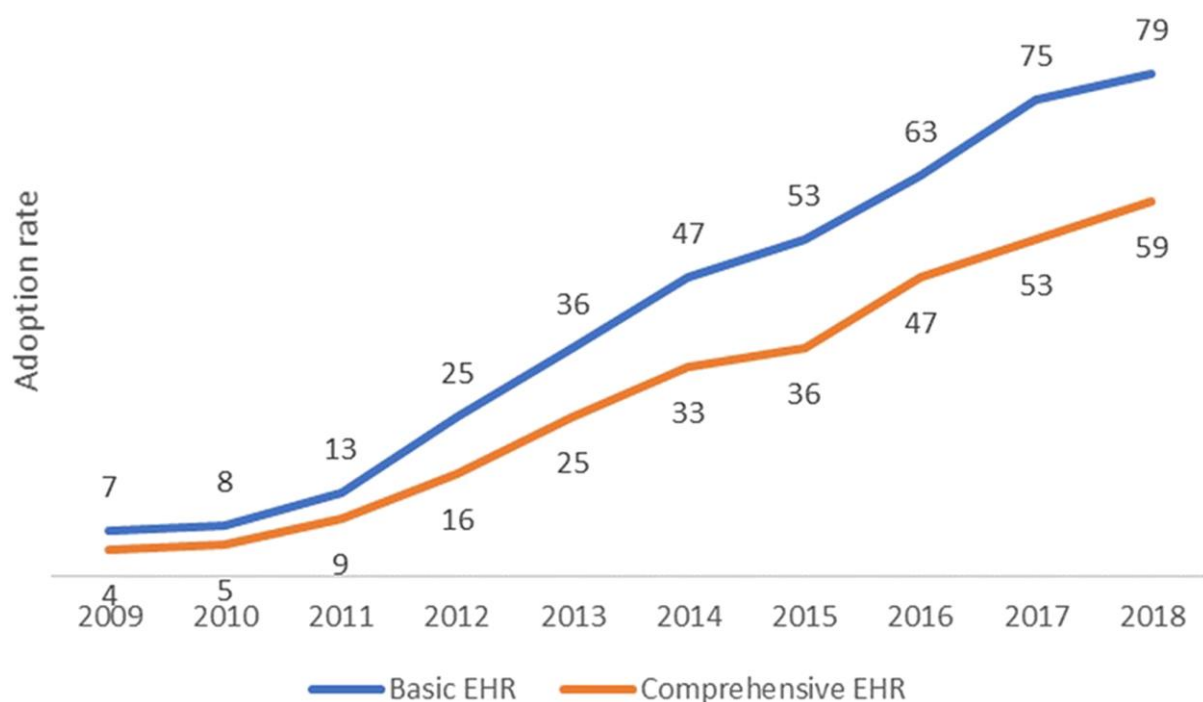
In the year 2015, a total of 80.5% of hospitals in the United States had implemented a basic Electronic Health Record (EHR) system, marking a 5.3 percentage point increase from the previous year's rate of 75.2%. The adoption of basic EHR saw a marginal uptick from 41.1% in 2014 to 41.4% in 2015, whereas the levels of comprehensive EHR adoption experienced a rise from 34.1% to 39.1%. Over 70% of hospitals indicated utilizing EHR data for the purposes of patient safety surveillance and facilitating ongoing enhancements in quality. Furthermore, the integration of patient engagement features exhibited even higher rates, with more than 80% of hospitals implementing three key functions: online data viewing, data downloading, and granting family/caregiver access to information(10).

By the year 2017, it was documented that around 96 percent of non-federal acute care hospitals and 86 percent of office-based physicians had deployed a "certified" EHR system. Additionally, 80 percent of hospitals and 54 percent of physician offices had incorporated an EHR with advanced features, such as the ability to monitor patient demographics, record medications, store clinician notes, and track medication prescriptions, lab tests, and imaging results. The introduction of the 21st Century Cures Act in 2016, aimed at promoting the widespread use of EHRs, dictates that all healthcare providers must provide patients with electronic copies of their medical records in a machine-readable form upon request(11)(12).

Utilizing data obtained from the American Hospital Association (AHA) between 2009 and 2019, it was established that the prevalence of basic EHR systems at a national level experienced a consistent growth from 6.6% to 81.2%, while the adoption rates for comprehensive EHR systems rose from 3.6% to 63.2% during the same period. Nonetheless, the variances in EHR adoption rates across different types of hospitals have not diminished. Large hospitals exhibit a 7% higher rate of comprehensive EHR adoption compared to medium-sized hospitals and are notably ahead of small hospitals by more than 34%. Simultaneously, rural hospitals lag behind urban areas in comprehensive EHR adoption by 12%. Furthermore, system-affiliated hospitals outperform independent ones, displaying gaps of 15% in basic EHR adoption and 22% in comprehensive EHR adoption rates. Similarly, teaching hospitals excel over non-teaching hospitals, leading by 14% in basic EHR adoption and 22% in comprehensive EHR adoption.

Likewise, teaching hospitals outshine non-teaching hospitals, leading by 14% in basic EHR adoption and 22% in comprehensive EHR adoption. These statistics reaffirm that the disparities among various hospital classifications have remained steady, with no significant reduction since 2014(13).

Fig.2:

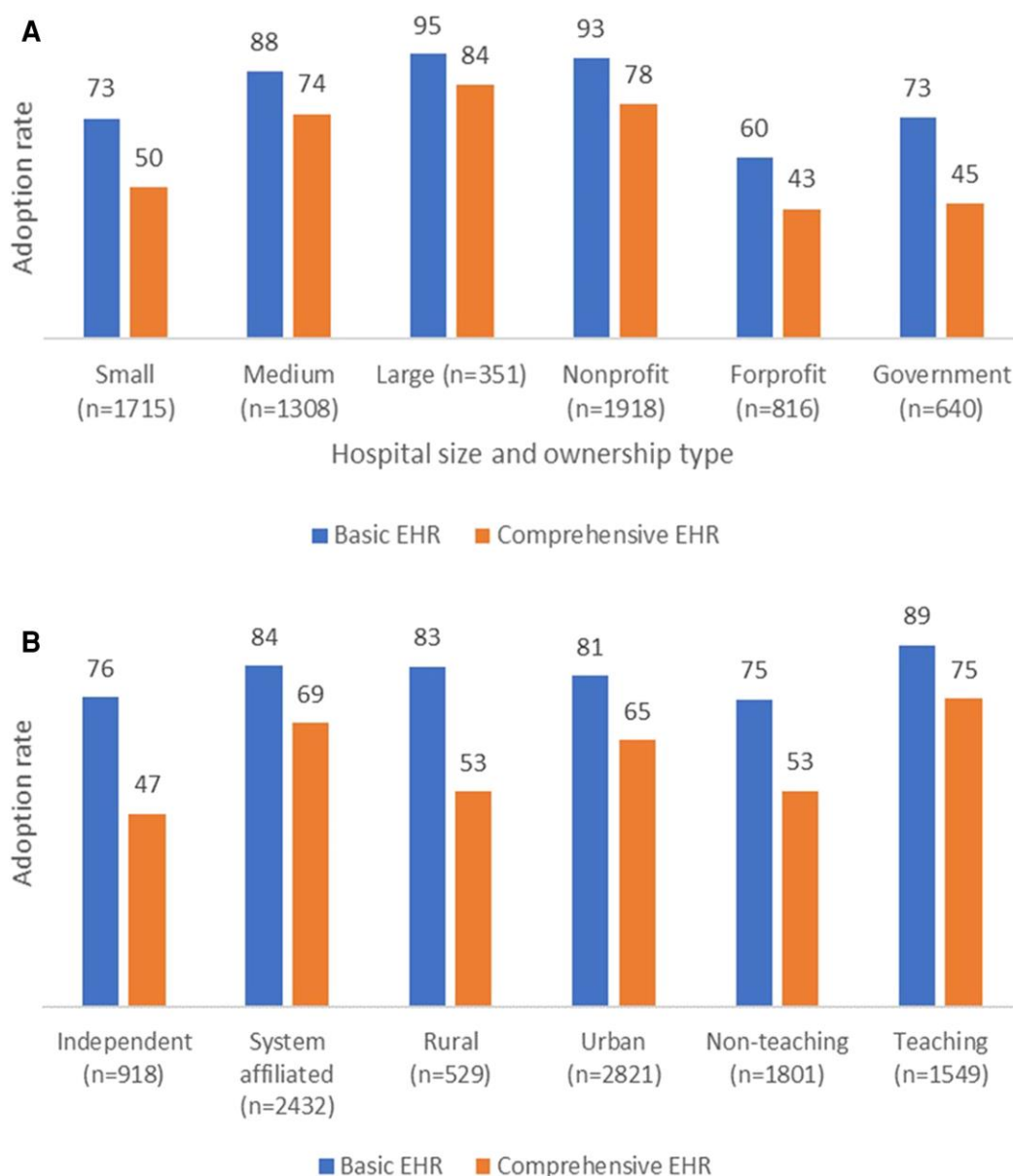


Source – Adoption rates of basic and comprehensive EHRs in U.S. hospitals from 2009 to 2019 is examined.

For-profit hospitals exhibit the lowest rates of Electronic Health Record (EHR) adoption, with rates of 60% for basic EHRs and 43% for comprehensive EHRs. In contrast, government hospitals have adoption rates of 73% for basic EHRs and 45% for comprehensive EHRs, while nonprofit hospitals lead with 93% for basic EHRs and 78% for comprehensive EHRs. Larger hospitals generally show higher EHR adoption rates than smaller ones. Specifically, in 2019, 95% of large hospitals (400 or more beds) adopted basic EHRs, with 84% implementing comprehensive EHRs. Medium-sized hospitals (100–399 beds) had adoption rates of 88% for basic EHRs and 74% for comprehensive EHRs. Smaller hospitals (99 or fewer beds) reported 73% adoption for basic EHRs and 50% for comprehensive EHRs. Rural hospitals demonstrated similar basic EHR adoption rates to urban hospitals (83% vs. 81%, with no significant difference), but they lagged behind in comprehensive EHR adoption (53% vs. 65%). Hospitals that are part of a system show higher basic EHR adoption (84% vs. 76%) and

comprehensive EHR adoption (69% vs. 47%) compared to independent hospitals, likely due to resource advantages or economies of scale. Teaching hospitals are more likely than non-teaching hospitals to adopt basic EHRs (89% vs. 75%) and comprehensive EHRs (75% vs. 53%). Comparing this data to 2014, it appears that the disparities among different types of hospitals in EHR adoption have not diminished.

Fig.3:



Source - A, B: Adoption rates of basic and comprehensive EHRs in U.S. hospitals, based on various characteristics, from January 2020 to June 2020.

While EHRs hold great promise for improving healthcare, their widespread adoption in the US faces several hurdles.

High Costs: Implementing EHRs involves significant upfront costs for purchasing the system, installation, training staff, and ongoing maintenance. These costs can be particularly burdensome for smaller practices and rural providers.

- **Interoperability Issues:** Different EHR systems often don't communicate seamlessly, making it difficult to share patient data between providers. This lack of interoperability can hinder coordinated care and frustrate clinicians(13).
- **Workflow Disruption:** Transitioning from paper to digital records can disrupt existing workflows, impacting clinician productivity and potentially leading to frustration.
- **Privacy and Security Concerns:** Storing sensitive patient data electronically raises concerns about privacy breaches and unauthorized access. Clinicians and patients alike need assurances that their data is secure.
- **Clinician Burnout:** Some EHR systems are cumbersome and time-consuming to use, leading to clinician burnout and decreased job satisfaction.

2. CANADA

Canada Health Infoway (CHI), established in 2000 and funded by the federal government of Canada, was created with the primary mission of modernizing the country's healthcare system through the widespread adoption of electronic health records (EHR). The organization focused on accelerating EHR implementation across all provinces and territories, working in close collaboration with regional health departments, healthcare providers, and other stakeholders to ensure a unified approach. A key milestone in Infoway's mission was the development of an EHR blueprint by 2007, designed to provide a comprehensive framework for EHR systems, outlining best practices, standards, and protocols to achieve interoperability and secure information exchange(14).

Infoway's initiatives included establishing national standards, funding pilot projects, and promoting stakeholder engagement and training. These efforts facilitated the creation of technologically advanced, efficient, and patient-centered EHR systems. The impact of Infoway's work has been profound, enhancing the efficiency and quality of healthcare delivery, empowering patients through better access to their health information, and supporting data-driven decision-making and policy formulation. Canada Health Infoway has significantly contributed to modernizing healthcare in Canada, positioning the country as a leader in health information technology.

EMR utilization levels in Canada are progressively growing annually. As per the data from the National Physician Survey (NPS) in 2010, 16% of Canadian doctors stated their exclusive reliance on EMRs, while an additional 34% mentioned using a combination of EMRs and paper records.(15). The overall adoption rates have escalated from about 20% of medical practitioners in 2006 to an estimated 62% of practitioners in 2013(15).

The primary reported functions of EMRs include:

- Accessing patient notes (39%),
- Utilizing electronic reminders for patient care (20%), and
- Employing electronic drug interaction checking software (20%)(16).

Personnel in both administrative and medical roles who have embraced EMRs acknowledge that the enduring benefits overshadow the initial challenges of implementation. An absence of effective leadership and guidance during the formative years impeded numerous physicians from integrating an EMR system into their practices. Among the numerous clinicians who have not yet transitioned to EMRs, a lack of proficiency in computer skills emerges as the principal obstacle to implementation. Additionally, the considerable amount of time required for staff members to familiarize themselves with a new system, transfer existing patient records into EMR databases, update records, and master scheduling, billing, prescription, and test retrieval procedures are contributing factors to the delay in adoption(17).

The 2017 Workforce Survey conducted by the Canadian Medical Association (CMA) revealed that 85 percent of family physicians indicated the utilization of Electronic Medical Records (EMRs) in 2017, showing a significant increase from the 41 percent reported in the 2010 National Physician Survey. Similarly, the adoption of EMRs among specialist doctors has also experienced a substantial surge, with 79 percent of specialists

acknowledging the use of EMRs in the 2017 CMA survey, a notable rise from the 36 percent recorded in the 2010 National Physician Survey.

EHRs have been implemented and developed to varying degrees throughout Canada. By January 2018, every province and territory had reported the presence of active monthly EHR users, encompassing individuals accessing clinical areas such as lab information systems, drug information systems, or diagnostic imaging repositories. The cumulative number of active users utilizing provincial and territorial EHRs in Canada reached almost 191,000 in 2018, representing a growth of over 300 percent within the previous five years(18).

In 2019, the utilization of EMRs among Canadian family physicians reached a notable milestone, with an impressive 86% of participating practitioners incorporating this technology into their practices. Although this figure falls slightly below the Commonwealth average of 93%, it reflects a remarkable upward trend over the past decade. Indeed, the adoption rate has more than doubled since 2009 when only 37% of Canadian family physicians utilized EMRs, and it further increased to 73% by 2015.

This substantial growth underscores the evolving landscape of healthcare in Canada, where digital solutions are becoming increasingly integral to medical practice. Key to this progress has been the development of pan-Canadian EMR content standards and minimum data sets, which have provided a standardized framework for information management across healthcare settings.

Additionally, ongoing assessments of EMR benefits have contributed to sustaining momentum, as stakeholders continue to recognize the significant advantages these systems offer in terms of efficiency, accuracy, and patient care. As Canada's healthcare system continues to embrace technological innovations, the widespread adoption of EMRs represents a pivotal step forward in enhancing the delivery and coordination of healthcare services nationwide.

Canada's journey with Electronic Health Records (EHRs) has seen progress, but challenges remain.

- **Financial Burden:** While funding initiatives exist, EHR implementation can be expensive for smaller clinics. Costs include software, hardware, training, and ongoing maintenance. Studies suggest funding variations have minimal impact on adoption rates, implying cost may be a deeper issue.

- **Interoperability Barriers:** Fragmentation in healthcare delivery across provinces creates challenges. Different funding models and a variety of approved EHR vendors contribute to a lack of standardized systems that can easily share data. Bilingual requirements in provinces like Quebec further limit software options.
- **Workflow Disruption and Clinician Resistance:** Shifting from paper to electronic records requires adapting workflows, which can disrupt daily routines and lead to resistance from clinicians accustomed to paper charts. Training and support are crucial to address these concerns(19).
- **System Usability and Functionality:** Clinicians may find EHR systems cumbersome or lacking functionalities they need. Poor usability can decrease efficiency and satisfaction. Studies point to user-task issues and system limitations as significant concerns(19).
- **Uncertain Value of Personal Health Records (PHRs):** While EHRs focus on provider-controlled records, PHRs give patients more control. However, there's confusion among stakeholders about the definition and purpose of PHRs in Canada, hindering their adoption.

3. INDIA

As a developing nation with the largest population globally, India faces a pressing need for quality healthcare services. To address this, the government is prioritizing the digitalization of healthcare to ensure everyone can access treatment affordably. Central to this effort is the adoption of EHRs, which store patients' medical information electronically.

India adheres to a semi-federal system of governance where health falls under the jurisdiction of individual states as outlined in the Indian Constitution. Consequently, the decision to enact policies devised by the central administration rests with the state governments. The Ministry of Health and Family Welfare (MoHFW) primarily devises and enforces healthcare policies, with the assistance of the government's policy institute, the National Institution for Transforming India (NITI) Aayog, aiding MoHFW in its undertakings.

By embracing EHR systems, India aims to achieve universal health coverage (UHC) and make healthcare more accessible and efficient. These digital records facilitate better coordination among healthcare providers, encourage patient involvement in their own care, and support medical research efforts. Additionally, they help reduce healthcare expenses over time. Moreover, the government is also emphasizing affordable drug discoveries and healthcare research, leveraging data generated within the country.

With the initiation of the 'Digital Health Mission' by the Government of India, significant progress has been made in the integration of the Healthcare and IT sectors(20). This initiative has sparked the creation of novel approaches and instruments for storing patient information in a digital format. One notable solution that has emerged is EHRs, designed to enhance patient care within healthcare facilities of all scopes and sizes by providing functionalities that conventional records lack.

A vital necessity within healthcare establishments involves the incorporation of interoperability and standardization approaches to enable smooth sharing and transfer of healthcare data across various tiers. Central to the attainment of interoperability is the application of standardized terminology, which improves efficient communication among healthcare professionals.(21).

The Government of India has initiated the formulation and publication of an Electronic Health Record standard in September 2013, followed by a revised version issued on 31 December 2016. The MoHFW recommends healthcare facilities to adhere to specific standards such as Systematized Nomenclature of Medicine – Clinical Terms (SNOMED CT), International Classification of Diseases (ICD 11), Logical Observation Identifiers Names and Codes (LOINC), and National Drug Code (NDC) for EHR implementation. The utilization of standardized terminologies and coding systems within Health Information Systems plays a crucial role in ensuring data clarity. Content Exchange Standards (CES) facilitate the sharing of clinical information, including summaries and prescriptions. Digital Imaging and Communications in Medicine (DICOM) and Health Level-7 (HL-7) are among the content exchange standards utilized for exchanging health data between different healthcare facilities during patient transitions(22).

To improve the execution of digital healthcare at a nationwide level, the standard committee of the Ministry of Electronics and Information Technology (Meity) has devised the National Digital Health Blueprint (NDHB). The preliminary version of the NDHB was formally introduced to the Ministry of Health and Family Welfare,

Government of India, on the 24th of April 2019. Following this, the NDHB preliminary version was released to the public for input.

The main elements of the blueprint include a federated framework, a set of architectural principles, and a system of architectural building blocks organized into five layers. Key components include the Unique Health ID (UHID), mechanisms for managing privacy and consent, and ensuring national portability. The blueprint also features the Electronic Health Record (EHR) system, relevant standards and regulations, health analytics, and the MyHealth App designed to boost patient engagement. Additionally, it provides various access points such as support call centers and the Digital Health India portal to improve data exchange between healthcare professionals and patients.(23).

The EHR model proposed adheres to the guidelines specified in the NDHM document, specifically meeting the EHR minimum dataset requirement(24). This EHR system is designed to enable healthcare facilities from primary to tertiary levels to collect and exchange patient information securely and without constraints.

Various other steps taken by the Government of India:

- The proposition of establishing the National e-health Authority of India (NeHA) took place in 2015 within the Ministry of Health & Family Welfare (MoHFW), with the objective of instituting the e-Health ecosystem in India.
- A draft has been presented by the Ministry of Health & Family Welfare (MoHFW) for the creation of an Act known as Digital Health Information in Healthcare Security (DISHA) to be introduced in parliament as a legal entity aimed at encouraging the adoption of e-Health standards.
- NITI Aayog has put forth the concept of a visionary digital framework named "National Health Stack" with the goal of developing digital health records for every Indian citizen by the year 2022.

India possesses a diversified healthcare system encompassing a plethora of hospitals operated by both the Central Government, State Government, and the private sector. Broadly speaking, the utilization of Information and Communication Technology (ICT) within the healthcare domain in the nation has been comparatively modest when juxtaposed with other global counterparts. Concurrently, there is a concerted effort by both the union and State Governments to capitalize on the advantages presented by ICT. The private sector medical facilities are similarly engaged in the implementation of ICT initiatives, such as electronic medical records.

Some of the corporate hospitals in India, such as Max Health, Apollo, Sankara Nethralaya, Fortis, among others, have established integrated ICT systems, encompassing various functions including registration, billing, laboratory, and clinical data management. The initiation of EHRs implementation in Max Healthcare hospitals dates to 2009, leading to the attainment of Stage 6 on the EMR Adoption Model, a benchmark utilized by HIMSS to evaluate EMR system adoption levels in hospitals. Notably, Max Healthcare Group received accolades for its hospitals—East Wing, Saket and West Wing, Saket, New Delhi in 2012(25)(26).

Similarly, the Apollo Group has integrated EHR systems in its hospitals and reached Stage 6 on the EMR Adoption Model for four hospitals situated in Chennai, Nandanam, Aynambakkam, and Jubilee Hills(27).

Sankara Nethralaya (SN) has deployed an EMR system within its medical facilities and affiliated clinics in Chennai. The organization enlisted the services of Tata Consultancy Services (TCS) for the execution of this system. Furthermore, SN and TCS collaborate to provide the EMR suite and hospital management system to various other healthcare institutions(28).

Nevertheless, the sharing of EMRs among private hospitals is infrequent. These records typically remain confined within the respective hospital and are accessed during subsequent patient visits. The precise tally of patients whose electronic medical records have been archived is currently undocumented.

Challenges in implementation of EHRs in India:

1. The level of public health expenditure in India remains low, with the government allocating merely 1.13 percent of its gross domestic product (GDP) to healthcare (NITI Aayog, 2019). Comparative analysis based on data from the Organisation for Economic Co-operation and Development (OECD)(29) reveals that India's healthcare expenditure falls below the averages observed in both developed and developing nations.
2. India lacks a comprehensive or sector-specific regulatory framework, particularly in the realm of healthcare data security. The nation is distinguished by the presence of Aadhaar, a distinctive identifier. Nevertheless, the absence of established regulatory structures and policies concerning the security of Aadhaar poses challenges in utilizing it for managing sensitive patient data. Recently, there

have been efforts by the government to leverage Aadhaar for ensuring COVID-19 vaccination; however, there are concerns regarding the optimal utilization of this identifier while upholding data security standards. The Aarogya Setu, an Indian mobile application introduced by the government in 2020 for COVID-19 contact tracing, syndromic mapping, and self-assessment, faced criticism due to data security issues and ultimately could not be enforced as a mandatory measure.

3. The governmental authorities have not delineated any specific technical criteria for a comprehensive framework of healthcare provision and service delivery. The EHR Standards of 2016 enumerates a catalogue of ISO standards that healthcare establishments could adhere to. Nevertheless, healthcare facilities retain the autonomy to opt for the standards they wish to adhere to. In jurisdictions like Australia and the United States, there exist essential standard prerequisites that organizations are obligated to adhere to ensure efficient record keeping and seamless data exchange(23).
4. The presence of challenges, such as the limited allocation of funds towards Information Technology (IT) in hospitals for the purpose of EHRs implementation, is a notable concern. When juxtaposed with several nations which allocate approximately 5 percent of their overall hospital budget to IT, it is evident that Indian private hospitals only designate 2.5 percent of their total budget to IT. This percentage is significantly lower in government hospitals. Primarily, the financial resources are directed towards elements that generate revenue, such as hospital beds and wards, rather than being allocated towards healthcare IT.

CHAPTER 5: DISCUSSION

UNITED STATES

- The adoption of EHRs in the US has surged due to legislative efforts like the HITECH Act of 2009, which incentivized healthcare providers to integrate EHRs for improving care quality and efficiency. By 2019, adoption rates for basic EHRs had risen from 6.6% to 81.2%, with comprehensive EHR systems increasing from 3.6% to 63.2%. Despite this progress, disparities persist among hospital types: major hospitals lead in adoption rates over medium and small hospitals, and urban settings outpace rural areas in comprehensive EHR adoption.
- Hospitals affiliated with systems and teaching hospitals also demonstrate higher adoption rates compared to independent and non-teaching hospitals, respectively. For-profit hospitals lag government and nonprofit counterparts in EHR adoption, indicating financial and operational challenges unique to their model.
- To bridge these gaps, future strategies should focus on targeted support for smaller and rural healthcare facilities, enhancing interoperability standards, and continued policy incentives to ensure equitable access and effective utilization of EHRs across all healthcare settings.

CANADA

- Canada Health Infoway (CHI), established in 2000 and funded by the federal government of Canada, has played a pivotal role in modernizing the country's healthcare system through the widespread adoption of Electronic Health Records (EHRs). By collaborating closely with provincial and territorial health departments, healthcare providers, and stakeholders, CHI has facilitated the accelerated implementation of EHRs across Canada. A significant milestone was the development of a comprehensive EHR blueprint in 2007, which standardized best practices and protocols for interoperability, ensuring secure information exchange.
- CHI's initiatives have included setting national standards, funding pilot projects, and promoting stakeholder engagement and training. These efforts have led to the

creation of advanced, efficient, and patient-centered EHR systems, significantly enhancing healthcare delivery and supporting data-driven decision-making.

- The adoption rates of Electronic Medical Records (EMRs) among Canadian physicians have shown remarkable growth. By 2019, 86% of family physicians had integrated EMRs into their practices, reflecting a doubling in adoption rates since 2009. This evolution has been supported by pan-Canadian EMR content standards and ongoing assessments of EMR benefits, which have streamlined information management and improved healthcare efficiency and patient care nationwide.
- Despite initial challenges such as proficiency in computer skills and time-consuming implementation processes, the enduring benefits of EMRs have outweighed these hurdles. Moving forward, Canada continues to embrace technological innovations in healthcare, positioning itself as a leader in health information technology with a commitment to further enhancing the coordination and delivery of healthcare services across the country.

INDIA

- In India, the adoption of Electronic Health Records (EHRs) is pivotal to transforming its healthcare landscape amidst challenges and opportunities. The government, through initiatives like the Digital Health Mission and the National Digital Health Blueprint, aims to enhance accessibility, efficiency, and affordability of healthcare services across the country. This strategic focus aligns with India's aspiration for universal health coverage (UHC) by leveraging digital solutions to streamline patient care, improve coordination among healthcare providers, and empower patients with better access to their health information.
- However, the implementation of EHRs in India faces several hurdles. A significant challenge lies in the disparity of public health expenditure, with only 1.13% of GDP allocated to healthcare, limiting financial resources available for IT infrastructure and EHR deployment in both public and private sectors. Moreover, the absence of a robust regulatory framework for healthcare data security poses concerns about privacy and data protection, particularly in a context where digital identity systems like Aadhaar are being considered for health data management.

- Despite these challenges, notable progress has been made in select private hospitals like Max Healthcare, Apollo Group, and Sankara Nethralaya, where advanced EHR systems have been integrated, achieving high levels of adoption and recognition on international EMR adoption models. Such successes underscore the potential for scaling EHR adoption nationwide, provided there is continued investment in IT infrastructure, regulatory clarity, and capacity building across healthcare facilities.
- As India navigates these complexities, the ongoing commitment to digital health initiatives and collaborative efforts between government bodies, healthcare providers, and technology partners will be crucial in realizing the full benefits of EHRs, improving healthcare delivery, and advancing public health outcomes for its vast population.

CHAPTER 6: CONCLUSION

The adoption of Electronic Health Records in the United States, Canada, and India reflects a global shift towards leveraging technology to enhance healthcare delivery and patient outcomes. Each country has made significant strides in integrating EHR systems into their healthcare landscapes, driven by unique legislative frameworks, organizational initiatives, and technological advancements.

In the United States, the implementation of the HITECH Act in 2009 stands as a cornerstone in accelerating EHR adoption across various healthcare settings. This legislation, bolstered by substantial financial incentives, has enabled most hospitals and physicians to embrace certified EHR systems. Despite these achievements, disparities persist, particularly affecting smaller, rural, and independent healthcare facilities. Bridging these gaps necessitates ongoing support from policymakers, advancements in interoperability standards, and sustained investment in healthcare IT infrastructure. These efforts are pivotal in ensuring equitable access to advanced healthcare technologies and maximizing the benefits of EHRs on a national scale.

Canada has similarly advanced its healthcare modernization agenda through Canada Health Infoway (CHI), fostering widespread EMR adoption among healthcare providers. The development of national standards and best practices has facilitated secure data exchange and interoperability across provincial and territorial healthcare systems. As Canada continues to evolve its digital health landscape, the integration of EMRs plays a crucial role in improving healthcare access, efficiency, and quality for all Canadians. Moving forward, standardized frameworks and continuous evaluation of benefits will be instrumental in sustaining these advancements.

In India, the adoption of EHRs represents a critical milestone in modernizing its healthcare system to cater to the diverse healthcare needs of its vast population. Spearheaded by initiatives like the Digital Health Mission and supported by NITI Aayog and the Ministry of Health and Family Welfare, India aims to achieve universal health coverage and enhance healthcare delivery efficiency through digital transformation. However, challenges such as inadequate public health expenditure, limited regulatory frameworks for data security, and disparities in IT infrastructure remain significant hurdles. Addressing these challenges requires comprehensive strategies including increased investment in healthcare IT infrastructure, strengthened regulatory frameworks,

and enhanced public-private partnerships. By overcoming these obstacles, India can fully harness the potential of EHRs to improve healthcare access, facilitate better patient care coordination, and drive advancements in medical research.

Looking ahead, all three countries must continue to prioritize interoperability, data security, and comprehensive regulatory frameworks to maximize the benefits of EHR adoption. Collaboration between government entities, healthcare providers, technology vendors, and other stakeholders will be essential in fostering a robust digital health ecosystem. Moreover, ongoing training and support for healthcare professionals are crucial to ensure effective utilization of EHR systems and to drive continuous improvement in healthcare quality and patient outcomes. By collectively addressing these challenges and seizing opportunities for innovation, the global healthcare community can advance towards a future where EHRs play a transformative role in delivering equitable, efficient, and patient-centered healthcare services.

CHAPTER 7: RECOMMENDATIONS FOR EHR ADOPTION BASED ON COUNTRY ANALYSIS

UNITED STATES:

- Bridge the adoption gap: Focus on targeted support for smaller, rural, and independent healthcare facilities through financial incentives and technical assistance.
- Enhance interoperability: Invest in standardizing EHR systems to ensure seamless data exchange across healthcare providers.
- Continued policy support: Maintain and refine policies like the HITECH Act to encourage continued EHR adoption and utilization.

CANADA:

- Sustain the momentum: Continue to invest in Canada Health Infoway (CHI) and its initiatives for ongoing development and implementation of EHR standards and best practices.
- Prioritize user experience: Focus on improving the usability and functionality of EHR systems to enhance user satisfaction and optimize workflow integration.
- Promote patient engagement: Encourage the development and adoption of Personal Health Records (PHRs) to empower patients with better access to their health information.

INDIA:

- Increase public health investment: Allocate greater resources towards healthcare IT infrastructure to facilitate nationwide EHR deployment.
- Strengthen data security regulations: Develop robust legal frameworks to ensure patient privacy and data protection in the digital health ecosystem.

- Foster public-private partnerships: Leverage collaboration between government, healthcare providers, and technology companies to accelerate EHR adoption and address implementation challenges.

GLOBAL CONSIDERATIONS:

- Standardized interoperability: Promote international collaboration to establish common standards for data exchange, enabling seamless information sharing across borders.
- Cybersecurity best practices: Develop and implement robust cybersecurity measures to safeguard sensitive patient data stored in EHR systems.
- Continuous evaluation and improvement: Regularly assess the effectiveness and impact of EHR systems, and refine policies and practices based on data-driven insights.

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