International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Revolutionizing Health Records: The AI Way

Dr. Sharon Nelson[1], Dr. R. Saranya[2]

[1]Assistant Professor cum Epidemiologist, Government Dindigul Medical College, Dindigul

[2]Senior Resident, Madha Medical College and Research Institute, Chennai

Abstract: ***The integration of Electronic Health Records (EHR) and Artificial Intelligence (AI) represents a pivotal advancement in modern healthcare delivery. Originating in the mid - 20th century, EHRs have evolved from simple digital platforms to comprehensive repositories of patient health data. In parallel, AI technologies have emerged as transformative tools for analyzing vast datasets and improving clinical decision - making processes. AI integration into EHR systems offers numerous benefits, including efficient diagnosis and treatment planning, predictive analysis for risk stratification, enhanced data management, streamlined workflows, reduced physician burnout, and improved clinical trial matching. However, challenges such as data quality, privacy concerns, interoperability issues, cost considerations, transparency, and user acceptance must be addressed for successful implementation. Despite these challenges, the integration of AI into EHR systems holds immense potential to revolutionize healthcare delivery, improve patient outcomes, and reduce healthcare disparities. Responsible implementation, ongoing research, and collaboration between stakeholders are essential to maximize the benefits of AI - powered EHR systems while mitigating risks.***

Keywords: Electronic Health Records, Artificial Intelligence, Predictive Analysis, Treatment plans, Data Management

1. Introduction

In today's digital age, there has been a tremendous transformation in the healthcare industry driven by technological breakthroughs. Among the most notable technological innovations is the use of Electronic Health Records (EHR), which has changed the way patient information is documented, stored and accessed. The development of Electronic Health Records began in the middle of the 20th century progressing from simple digital platforms to the complex ones that exist today. They represent a departure from the traditional paper based medical records that offers a comprehensive, digitized repository of a patient's health history which can be accessed securely by authorised healthcare providers.

As the healthcare landscape continues to evolve, there has been a growing interest to integrate Artificial Intelligence (AI) into EHR Systems. With its capacity to analyse vast amounts of data, spot trends, and produce insights, artificial intelligence (AI) has the potential to greatly improve EHR system capabilities by streamlining processes, automating repetitive operations, and eventually improving patient outcomes. This article explores the major turning points, benefits and challenges that have influenced their development over the decades.

The Origins of EHR:
A person's health record must, at minimum, date from conception or birth in order to have clinical significance. As one grows older, each record of a clinical visit indicates a health - related event in one's life. Each of these records may be trivial or significant, depending on the individual's current difficulties. Thus, it is critical that these records be available, longitudinally organised as a time series, and clinically relevant in order to provide a summary of a person's numerous healthcare episodes throughout their life. (1)

Electronic health records are medical records of the patient stored in the digital format made accessible to the health personnel. It is a comprehensive report of the individual's health. Though they might be a novel concept, it has its inception since 1960's in the USA. (2) This was a major breakthrough in moving from paper to digital albeit in a small scale. It had its share of disadvantages namely the burgeoning cost of the product as well as the limited scale of operability at that time. It was considered as a complement instead of as a replacement to paper records. (3) But notwithstanding, EHR has grown leaps and bounds to this day.

Adoption of EHR in India:
Presently in India, adoption of EHR system is slow, because EHR is not mandated. (4) The Indian government has acknowledged the role of digital health technologies, including EHR, in advancing healthcare delivery nationwide. The EHR standards for India was developed in 2013 by the Ministry of Health and Family Welfare. It was duly revised in 2016 and adopted by the Government of India. (1) They provide detailed recommendations on the interoperability and standards, clinical informatics standards, data ownership, privacy and security aspects, and the various coding systems. In 2019, the National Digital Health Blueprint (NDHB) was launched to create a nationwide digital health record system. (5) This led to the launch of National Digital Health Mission on 2020 with the goal of utilising IT and related technologies to support the current health systems in a "citizen - centric" manner, while also offering a continuum of care with the citizen serving as the owner of the data in a holistic healthcare programme. (6) One of the main pillars of this mission is the creation of Ayushman Bharat Health Account (ABHA) number which is a unique 14 number identifier for the process of standardising the identification of an individual across healthcare providers. Initiatives such as the National Digital Health Mission (NDHM) are designed to accelerate the adoption of EHR and to promote interoperability among healthcare providers across the country.

Integration of AI In EHR:
EHR is a treasure trove of invaluable healthcare information and data that when harnessed efficiently has the power to revamp healthcare delivery. Another game changer in the healthcare sector, is the introduction of artificial intelligence

in analysing data. The integration of Artificial Intelligence (AI) into Electronic Health Records (EHR) systems has emerged as a transformative force in healthcare, offering unprecedented opportunities to enhance patient care, streamline clinical workflows, and improve healthcare outcomes. AI technologies, which includes machine learning algorithms and natural language processing techniques, have the potential to revolutionize the way healthcare providers interact with EHR data, leading to more efficient diagnosis, treatment, and decision - making processes.

2. Benefits

1) Efficient Diagnosis and Treatment Planning:

AI - driven diagnostic support systems leverage machine learning algorithms to analyze vast amounts of patient data stored in EHR systems, including medical history, laboratory results, and imaging studies. By identifying patterns and correlations within this data, AI algorithms can assist healthcare providers in making more accurate and timely diagnoses.

A study by Rajpurkar et al. (2018) demonstrated the effectiveness of deep learning algorithms in interpreting chest radiographs for the detection of various diseases, including pneumonia and tuberculosis. The integration of such AI - driven diagnostic tools into EHR systems can help radiologists and clinicians expedite the interpretation process, leading to faster diagnosis and treatment initiation. (7)

Additionally, AI - based predictive modelling techniques can analyse EHR data to forecast patient outcomes and recommend personalized treatment plans. For instance, a study by Li et al. (2021) utilized machine learning algorithms to predict the risk of diabetic retinopathy progression based on patient demographic and clinical data extracted from EHR records. By leveraging these predictive models, healthcare providers can proactively manage patient conditions and tailor interventions to individual patient needs. (8)

2) Predictive Analysis for Risk Stratification:

Using EHR data, AI algorithms can stratify patients based on a range of risk variables, including lifestyle characteristics, chronic diseases, medication adherence, and socioeconomic determinants of health. Additionally, they are able to forecast the likelihood of unfavourable outcomes including mortality, complications, or readmissions to hospitals. By identifying high - risk patients who need intensive care management, it can assist healthcare organisations in allocating resources more effectively, boosting resource utilisation and healthcare delivery

A study done by Singh et al. (2015) demonstrated the effectiveness of predictive analytics for risk stratification for short term progression of renal dysfunction. (9)

A multi - centre study conducted by Sharmin S et al. (2021) provided valuable insights into predicting all - cause unplanned readmissions within 30 days of discharge using electronic health records. By identifying risk factors associated with readmission and developing predictive models, the study offered implications for healthcare providers and policymakers in improving post - discharge care, enhancing care coordination, and reducing healthcare costs. (10)

3) Enhancing Data Management:

A key challenge in healthcare is the vast amount of data generated and stored in EHR systems. AI algorithms are adept at organizing, analyzing, and extracting meaningful insights from this data, thereby streamlining data management processes. For instance, AI - powered natural language processing (NLP) algorithms can automatically extract information from unstructured clinical notes, enabling healthcare providers to quickly access relevant patient data without manual input. A study by Lipton et al. (2015) demonstrated the effectiveness of NLP in extracting clinical information from EHR narratives, showcasing its potential to streamline data retrieval processes. (11)

4) Automated Documentation and streamline workflow:

Documentation is a fundamental aspect of healthcare delivery, but it can be time - consuming for clinicians. AI - powered EHR systems offer a solution by automating data entry and extraction. A study by Meystre et al. (2010) demonstrated the effectiveness of natural language processing (NLP) algorithms in extracting clinical information from unstructured text. By automatically populating EHRs with relevant data, AI reduces the burden on clinicians and minimizes the risk of errors. (12)

5) Reduce physician burnout:

According to a time motion study done by Sinsky et al. (2016), it was found that 49.2% of the physician's time was spent on EHR while only 27% was spent on the patient. It was also reported that 2 hours was being spent on documentation after hours. (13) This not only takes up valuable patient time, but it also contributes to excessive work - life balance, discontent, high attrition rates, and burnout. AI tools with functionality like speech to text conversion helps in transcribing the physician notes and comments and creates a summary formatted for the EHR. This considerably reduces the time spent in documentation and increases the time spent with the patient. (14)

6) Clinical trial matching:

Clinical trials are considered to be time consuming and cost intensive. Patient recruitment and retention are the main hindrances to the success of any clinical trial. AI powered EHR could sift through the huge amount of data to identify potential participants that meet the inclusion criteria for the clinical trial and drastically cut time usually used for the recruitment process. This is a huge advantage especially for trials that test the efficacy of life saving drugs or treatment. Few studies demonstrated that AI helped in matching for cancer trials with high accuracy and was efficient as well. (15) (16)

3. Challenges

As the healthcare industry moves toward integrating AI technology, it is essential to acknowledge that this shift comes with challenges.

1) Data Quality and Bias:
A fundamental challenge in leveraging AI within EHR systems is the quality and bias present in healthcare data. EHR data often suffer from incompleteness, inconsistency, and inaccuracies, which can adversely affect the performance of AI algorithms. Moreover, biases inherent in the data, such as disparities in healthcare delivery or underrepresentation of certain patient demographics, can lead to catastrophic consequences. A study by Rajkomar et al. (2018) highlighted the importance of addressing data quality issues and mitigating biases to ensure the reliability and fairness of AI - driven insights derived from EHR data. (17) The data that is used to train AI algorithm must be diverse and representative and regularly audited for bias to mitigate this particular challenge.

2) Privacy and Security Concerns:
Electronically stored medical data has the risk of cyberattacks and unauthorized access as they are hard to detect and even harder to mitigate identity theft. When AI is used for analysing vast amounts of medical data, concerns arise about patient autonomy and control of health information. Clear patient consent, data anonymization, robust encryption protocols and protective firewalls are mandatory to mitigate potential risks.

3) Limited Interoperability:
Interoperability in healthcare refers to the effortless exchange of health information and to use the data cohesively. This is advantageous for health care providers as they can remotely access the records and correspond electronically with others. For the patients this would be a seamless experience when they seek care from various health care providers. Medical record systems are not designed to communicate with each other at present. They often operate in silos which hinders data exchange, leading to duplication of effort, increased costs, and potential medical errors. (18)

4) Cost and Infrastructure:
The initial cost of implementing robust AI systems can be substantial, encompassing expenses related to software development, hardware upgrades, data storage, and IT infrastructure. Healthcare organizations must ensure sufficient computing power, network bandwidth, and data storage capacity to handle the computational demands of AI algorithms and accommodate the growing influx of patient data generated by EHR systems. They also need to invest on maintenance costs and capacity building of the healthcare professionals on AI technologies which incurs additional cost. In India where rural areas constitute about 70%, the lack of infrastructure is more pronounced where even the basic facilities are scarce compared to the urban areas. This discrepancy in access to healthcare between rural and urban areas may make India's already severe health disparities worse and restrict AI's ability to improve patient outcomes. (19) Incentivisation and encouraging public private partnership for strengthening the infrastructure are some of the starting steps that would promote in integrating AI in healthcare. The National Health Authority of India launched the Digital Health Incentive Scheme in 2023 to boost the adoption of digital health services and records. of up to Rs.4 crores based on the number of digital health records created and linked to ABHA. (20)

5) Lack of Transparency and Explainability:
Many AI algorithms function as "black boxes, " and how a specific conclusion is reached is unclear. This lack of transparency can raise concerns about accountability in AI - driven decisions. (21) Transparency is very much needed in the healthcare settings as we need to trace what went wrong and how to prevent it from occurring in the future which is not applicable in the case of AI. (22) An evolving area of research is explainable AI which aims to create more understandable models while maintaining a high level of performance. (23)

6) Clinical Adoption and User Acceptance:
Successful integration of AI in EHR hinges on clinician acceptance and engagement with the technology. Resistance to change, lack of training, and skepticism about AI's capabilities may impede its adoption in clinical practice. (24) Awareness about AI, its use and capacity building of the physician can help to increase its user acceptance.

In conclusion, the integration of Artificial Intelligence (AI) into Electronic Health Records (EHR) represents a transformative step forward in healthcare delivery and patient care. While the adoption of AI in EHR systems presents significant opportunities for healthcare innovation, it also poses challenges related to data privacy, model interpretability, and clinician acceptance. Addressing these challenges and ensuring responsible implementation of AI technologies are essential to maximize their potential benefits and minimize potential risks. With continued research, development, and collaboration between healthcare providers, policymakers, and technology developers, AI - powered EHR systems have the potential to transform the way healthcare is delivered, ultimately leading to better health outcomes for individuals and populations alike.

References

[1] Electronic Health Records Standards of India, 2016 [Internet]. [cited 2024 Feb 23]. Available from: https: //main. mohfw. gov. in/sites/default/files/17739294021483341357. pdf
[2] Wadhwa M. (2020) Electronic Health Records in India.
[3] Evans RS. Electronic Health Records: Then, Now, and in the Future. Yearb Med Inform [Internet].2016 [cited 2024 Feb 23]; (Suppl 1): S48. Available from: https: //www.ncbi. nlm. nih. gov/pmc/articles/PMC5171496/
[4] Aggarwal MS and H. EHR Adoption in India: Potential and the Challenges. Indian J Sci Technol [Internet].2016 May 6 [cited 2024 Mar 6]; 9 (34): 1–7. Available from: https: //indjst. org/
[5] National Digital Health Blueprint (2019) National Health Authority, ministry of Health and Family Welfare, Government of India [Internet]. [cited 2024 Mar 5]. Available from: https: //abdm. gov. in: 8081/uploads/ndhb_1_56ec695bc8. pdf
[6] National Digital Health Mission (NDHM) (2020) Strategy Overview, National Health Authority, ministry of Health and Family Welfare, Government of India, New Delhi. [Internet]. [cited 2024 Mar 5]. Available from: https: //www.niti. gov. in/sites/default/files/2023 - 02/ndhm_strategy_overview. pdf

[7] Rajpurkar P, Irvin J, Zhu K, Yang B, Mehta H, Duan T, et al. CheXNet: Radiologist - Level Pneumonia Detection on Chest X - Rays with Deep Learning [Internet]. arXiv; 2017 [cited 2024 Mar 6]. Available from: http: //arxiv. org/abs/1711.05225

[8] Li W, Song Y, Chen K, Ying J, Zheng Z, Qiao S, et al. Predictive model and risk analysis for diabetic retinopathy using machine learning: a retrospective cohort study in China. BMJ Open [Internet].2021 Nov 26 [cited 2024 Mar 6]; 11 (11): e050989. Available from: https: //www.ncbi. nlm. nih. gov/pmc/articles/PMC8628336/

[9] Singh A, Nadkarni G, Gottesman O, Ellis SB, Bottinger EP, Guttag JV. Incorporating temporal EHR data in predictive models for risk stratification of renal function deterioration. J Biomed Inform [Internet].2015 Feb 1 [cited 2024 Mar 6]; 53: 220–8. Available from: https: //www.sciencedirect. com/science/article/pii/S1532046414002354

[10] Sharmin S, Meij JJ, Zajac JD, Moodie AR, Maier AB. Predicting all-cause unplanned readmission within 30 days of discharge using electronic medical record data: A multi-centre study. Int J Clin Pract [Internet].2021 Aug [cited 2024 Mar 6]; 75 (8): e14306. Available from: https: //www.ncbi. nlm. nih. gov/pmc/articles/PMC8365643/

[11] Lipton ZC, Kale DC, Elkan C, Wetzel R [Internet]. [cited 2024 Mar 6]. Learning to Diagnose with LSTM Recurrent Neural Networks. Available from: https: //ar5iv. labs. arxiv. org/html/1511.03677

[12] Meystre SM, Savova GK, Kipper - Schuler KC, Hurdle JF. Extracting Information from Textual Documents in the Electronic Health Record: A Review of Recent Research. Yearb Med Inform [Internet].2008 Aug [cited 2024 Mar 7]; 17 (01): 128–44. Available from: http: //www.thieme - connect. de/DOI/DOI?10.1055/s - 0038 - 1638592

[13] Sinsky C, Colligan L, Li L, Prgomet M, Reynolds S, Goeders L, et al. Allocation of Physician Time in Ambulatory Practice: A Time and Motion Study in 4 Specialties. Ann Intern Med [Internet].2016 Dec 6 [cited 2024 Mar 11]; 165 (11): 753–60. Available from: https: //www.acpjournals. org/doi/full/10.7326/M16 - 0961

[14] Coombs B. CNBC.2023 [cited 2024 Mar 11]. How hospitals are using A. I. to fight doctor burnout. Available from: https: //www.cnbc. com/2023/08/07/hospitals - use - ai - like - microsoft - nuances - dax - app - to - fight - burnout. html

[15] Beck JT, Rammage M, Jackson GP, Preininger AM, Dankwa - Mullan I, Roebuck MC, et al. Artificial Intelligence Tool for Optimizing Eligibility Screening for Clinical Trials in a Large Community Cancer Center. JCO Clin Cancer Inform [Internet].2020 Dec [cited 2024 Mar 12]; (4): 50–9. Available from: https: //ascopubs. org/doi/10.1200/CCI.19.00079

[16] Haddad T, Helgeson JM, Pomerleau KE, Preininger AM, Roebuck MC, Dankwa - Mullan I, et al. Accuracy of an Artificial Intelligence System for Cancer Clinical Trial Eligibility Screening: Retrospective Pilot Study. JMIR Med Inform [Internet].2021 Mar 26 [cited 2024 Mar 12]; 9 (3): e27767. Available from: https: //www.ncbi. nlm. nih. gov/pmc/articles/PMC8088869/

[17] Rajkomar A, Oren E, Chen K, Dai AM, Hajaj N, Hardt M, et al. Scalable and accurate deep learning with electronic health records. NPJ Digit Med [Internet].2018 May 8 [cited 2024 Mar 7]; 1: 18. Available from: https: //www.ncbi. nlm. nih. gov/pmc/articles/PMC6550175/

[18] Spencer - Jolliffe N. Lack of trust in AI - led electronic health systems remains [Internet]. Medical Device Network.2023 [cited 2024 Mar 13]. Available from: https: //www.medicaldevice - network. com/features/lack - of - trust - in - ai - led - electronic - health - systems - remains/

[19] Kavyashree (2023) AI in Healthcare: Implementation Challenges [cited 2024 Mar 13]. Available from: https: //www.theggi. org/post/ai - in - healthcare - implementation - challenges

[20] National Health Authority (NHA) extends its incentive scheme under Ayushman Bharat Digital Mission (ABDM) to encourage digital health adoption by hospitals, labs, pharmacies and health tech companies [Internet]. [cited 2024 Mar 14]. Available from: https: //pib. gov. in/pib. gov. in/Pressreleaseshare. aspx?PRID=1945911

[21] Linardatos P, Papastefanopoulos V, Kotsiantis S. Explainable AI: A Review of Machine Learning Interpretability Methods. Entropy [Internet].2021 Jan [cited 2024 Mar 13]; 23 (1): 18. Available from: https: //www.mdpi. com/1099 - 4300/23/1/18

[22] Kiseleva A, Kotzinos D, De Hert P. Transparency of AI in Healthcare as a Multilayered System of Accountabilities: Between Legal Requirements and Technical Limitations. Front Artif Intell [Internet].2022 May 30 [cited 2024 Mar 13]; 5. Available from: https: //www.frontiersin. org/articles/10.3389/frai.2022.879603

[23] Kumar A. National Strategy for Artificial Intelligence.

[24] Singh RP, Hom GL, Abramoff MD, Campbell JP, Chiang MF. Current Challenges and Barriers to Real - World Artificial Intelligence Adoption for the Healthcare System, Provider, and the Patient. Transl Vis Sci Technol [Internet].2020 Aug 11 [cited 2024 Mar 13]; 9 (2): 45. Available from: https: //www.ncbi. nlm. nih. gov/pmc/articles/PMC7443115/