



A STUDY ON ,”USE OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE DELIVERY IN INDIA”

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Abstract

In India, the field of artificial intelligence (AI) has experienced exponential growth. The article discusses recent policy developments that support the faster adoption of AI in Indian healthcare. The variety of AI applications in Indian healthcare is then covered in this article. Applications of AI can be found in early screening and diagnosis as well as in treatment and rehabilitation. Innovations that can enhance rural healthcare are highly regarded in the Indian healthcare sector. In order to fill the gaps, a number of the start-ups highlighted in this article have attempted to implement AI in rural Indian healthcare. With the rise of smartphones, AI-enabled reality is now feasible. Nonetheless, there are a number of obstacles to increasing the use of AI in Indian healthcare delivery, as this article discusses. At the moment, the majority of applications is still regional in scope. Before AI is genuinely a reality for India, a number of difficulties pertaining to scaling up the data level must be resolved. Among the complex issues that need to be resolved are data availability, data pooling, data collection, data sharing, data protection, and data privacy. Aside from the high cost of investing in AI-based innovations, other problems include those related to human resources, cyber security, lack of infrastructure, and ignorance of the need to address ethical issues in AI-based innovations. Through NITI Aayog towards Responsible AIforAll, a number of legislative and policy frameworks and processes are being introduced to address these issues. The piece ends with the assertion that AI in healthcare can.

Keywords: *Healthcare; artificial intelligence (AI); India.*

Introduction

Artificial intelligence (AI) can make better decisions through improved public health surveillance and can also produce leaner, faster, more focused research and development when individual patient data is aggregated with other data across the health system. AI is positioned to be a helper for all medical professionals as it becomes a crucial component of healthcare, helping with virtual observation, diagnosis, rehabilitation, mental health support, and patient outreach in addition to automating patient data documentation and fast tracking image analysis. AI can prove to be an efficient tool for identification of early infections, developing treatment protocols, drugs and vaccine development. Whether medical, epidemiological or molecular applications AI in healthcare can help. Presence of AI in Indian healthcare several research studies over the last two years have increasingly brought out the fact that AI technologies have the potential to bridge the gap particularly in rural areas to better access quality healthcare. A multitude of stakeholders including Microsoft and Google, have also come together to work on variety of initiatives to build AI infrastructure across India. They have conducted pilots with hospital chains in India.

Indian policy space accelerating use of AI in healthcare delivery

The Indian government's policy think tank, "NITI Aayog," was given permission in 2018 to develop the country's strategy for artificial intelligence (AI) and other new technologies. Healthcare is one of the five industries that NITI Aayog concentrated on because it is thought to gain from AI the most in meeting societal requirements.



In this endeavor, NITI Aayog has embraced the motto "AI for all" (AIforAll). Along with ensuring proper data privacy and security, NITI Aayog also aims to strike a balance between the need for innovation and ethical considerations (11).

To quicken the rate at which AI-related advancements in healthcare are made, the following suggestions are being implemented.

1. Establishing The National Artificial Intelligence Marketplace, a multistakeholder marketplace. The stage of development necessitating numerous specialized procedures. To foster the creation of long-lasting AI solutions in the healthcare industry, it is imperative to tackle information asymmetry and advance efficient teamwork. The following could be achieved by setting up a "marketplace":
2. Provide access to the necessary AI component, such as business models or data, as well as services like data annotation and the ability to rate these assets
3. Function as a platform for transaction execution and verification. Make sure to gather data currently being gathered at the hospital level but not yet processed in order to create the large dataset needed to speed up AI research.
4. Unlocking new data sources and enabling the more effective utilization of human and computer resources. Today, just about 1% of data is thought to be analyzed since AI professionals are not widely available or well-informed. For example, a number of medical imaging centers are gathering important data, but these databases are not being examined since AI models require both qualified staff and computer equipment to be developed (11).
5. Diagnostic centres would be motivated to gather this data and make it available in the market with the necessary security measures in place if there was a genuine marketplace.
6. Offer a chance to talk about ethical issues with data sharing: setting up a formal market for data transactions would guarantee the establishment of data security procedures to stop the misuse of important data. At present, India is in the process of formulating a data protection legislation.
7. To guarantee that the big data created in India is used to empower local communities and provide them with services rather than to exploit them for commercial benefits, this and the support of local inventors and leaders in AI technology are essential measures .
8. Collaboration and partnerships- It is suggested to approach partnerships in the following tiered manner:
9. Informal encounters like conferences and social networking have little transfer; industrial employee training, internship programmes, and academic entrepreneurship have medium mobility.
10. High relationships: using interorganizational agreements and infrastructure sharing to further research and development. For example, a computer scientist and radiologist could collaborate in real time to improve understanding and find answers.

Promotion of AI in India

Additionally, the Union Health Ministry has stated in the open that it is excited to apply AI to Indian healthcare. According to the Union Minister, India is investigating the potential of AI in public health. NITI Aayog suggests building "Big Data" sets . This might then be used by newcomers to the field, such as Indian AI engineers. The Department of Biotechnology is also aiding in the implementation of strategies for the quick integration of AI in Indian healthcare.



A major hurdle to the adoption and promotion of AI is the lack of awareness with regards to the work being done across the country. The promotion of AI is can be overcome by creating an online portal such as an AI Database for registered people to access and obtain information (11).

Promoting startup

Ensuring their involvement in AI initiatives requires the provision of sufficient financial assistance and infrastructure .Expanding India's HR talent pool to better meet AI's demands in the healthcare industry Many universities have started multidisciplinary programmes to boost the creation of human resource skills trained with the appropriate skill set .

PG programme in Medical Science and Technology programme offered by IIT Kharagpur which provides an option for MBBS graduates to enter into engineering for those with an interest in AI;

- A. AIIMS and IIT Delhi are working on several collaborative projects of AI in healthcare from government/semi government front.
- B. Centre for AI has been established in JSS Medical College, Mysore, Karnataka;
- C. .Centre of Excellence in AI has been launched in India (www.opengovasia.com). The center of excellence has been developed by the national informatics center to use AI to improve the delivery of government e-services; .
- D. The Hope Foundations—International Institute of Information Technology launched its Centre for of Excellence in Artificial Intelligence at Hinjawadi;
- E. Narayana Health uses data analytics, and IA to provide affordable healthcare high quality healthcare;.
- F. Health Ministry signs MOU with AI based work solutions in combating TB; .
- G. .Amazon Alexa, launch in Pune on Aug 30, 2019, Chandra Kumar—for the first time Amazon team will conduct hands on workshop for developing Alexa assistants;.
- H. TISS and CII—National Conference on AI in Health;.
- I. Chitkara University has been leading with a lot of innovation programmes which it is offering to computer science students with specializations in different areas of AI like Big data; Artificial intelligence;.
- J. IIT Delhi is another institute actively working on AI solutions in healthcare.

Classification of AI use in Healthcare in India

There are four broad categories for AI in healthcare (15):

Descriptive: this is currently the most widely used. It involves quantifying events that have already occurred, and using this data to detect trends and other insights; ‘what wellness monitoring or clinical episode happened’;

Diagnostic: why a specific clinical episode or healthcare case had happened;

Predictive: this uses descriptive data to make predictions about the future, about what healthcare issues are likely to happen;

Prescriptive: not only detects trends but also suggests possible treatments in public health or more targeted clinical trials in research and development. It seeks to ‘prescribe to the relevant actions required to mitigate or eliminate healthcare problems and to exploit specific healthcare trends in improving patient or care outcomes’.



Categorization of AI Utilization in Indian Healthcare

AI in healthcare falls under four major groups (15):

Descriptive: at the moment, this is the most often utilised. It entails measuring past occurrences and utilizing the data to identify patterns and further insights, such as "what wellness monitoring or clinical episode happened";

Diagnostic: the reason behind a particular clinical event or medical situation;

Predictive: this makes forecasts about the future, including what healthcare problems are most likely to arise, using descriptive data;

Prescriptive: not only does it identify patterns, but it also makes recommendations for potential public health interventions or more focused clinical trials for scientific advancement. It aims to "recommend the pertinent activities necessary to reduce or eradicate healthcare issues and to Healthcare applications of AI in India Matra Technology, a firm that the Indian Institute of Technology Bombay supported, created the mobile AI product Naima, which lowers the chance of pregnancy (16) (<https://www.wadhwaniai.org/>). Anthropometric technology on smart phones for maternal, neonatal, and child health enables front-line healthcare providers to screen for low birth weight babies.

Based on mapping body heat embedded with AI methodology, Niramai Health Analytics (Bangalore) developed a low-cost, non-invasive method in 2016 to test for early breast cancer (18). The term "Niramai" stands for Non-Invasive Risk Assessment Using Artificial Intelligence and Machine Learning. Based on "Thermalytix" technology, it can identify cancers five years before mammography or clinical examinations (18, 19).

Janitri inventions, a pregnancy healthcare company, offer a variety of inventions, such as the paperless labor monitoring system Daksh (20). Keyar is a non-invasive cardiotocography (CTG) device that tracks a pregnant woman's uterine contractions and can measure the heart rate of the unborn child. In rural and distant locations, this gadget is lightweight, non-intrusive, and simple to operate .

When the gadget was evaluated at St Johns Medical Hospital in Bangalore against the gold standard CTG machine, its performance was equal to the gold standard (21).

Predictive AI has demonstrated that AI is superior to humans in predicting suicide attempts .In India, taking family history via chatbots will be very helpful because patients typically travel from remote locations to cities or towns just to sit and answer questions (24, 25). It can save a tonne of time to do this. In genetics, family history is very significant. Voice bots in India have the potential to overcome several literacy issues that chat bots encounter. The hardest part of developing chatbots is figuring out how to convert the majority of them into regional languages that the average person can understand. They also have limitations in places where there is low literacy.

AI for screening AI has been proven to be just as effective—and sometimes even more so—in diagnostic fields like pathology and radiology.

The Centre for Advanced Research in Imaging, Neuroscience and Genomics, or CARING, has advanced cutting edge scientific and clinical research while also concentrating on developing pertinent products in partnership with others. They have applied AI to imaging as well as integrative research in the fields of neuroscience and genomics.



The TumourRadiomics Atlas Project for Cancer unit and the Machine Learning and Artificial Intelligence Database at Tata Memorial Centre Imaging Biobank are partners in the AI-based Radiomics project that NITI Aayog is now working on. With NITI AAYOG, a number of other intriguing ideas are underway. As of right now, it's been applied to psychology, medical diagnostics, and the therapy of specific illnesses.

Remidio Fundus on Phone: a portable, reasonably priced retinal camera for diabetic retinopathy. Primary care facilities will now do DR screening thanks to this AI innovation. Using a camera smartphone, Medios AI's automatic screening of referable DR on the Remidio FOP operates offline. It functions with non-mydratic images and output, and it offers an ophthalmologist referral in addition to visualizing the lesions found.

AI advances are available for both TB screening with X-rays and Histopathological image processing. As the official AI partner of India's Central Tuberculosis Division Technologies, Wadhvani Institute for AI is also making amazing progress in these domains (31).

IOT/IOMT-based medical devices upload and analyse data in real time, and they are utilised for anything from self-quarantining to telemonitoring and teleICU consultation to AI sepsis prediction (32, 33). Wheelchairs—such as the sensor for autonomous wheelchair parking (34), thermometer, weighing scale, and ECG (35), are among the gadgets with AI capabilities.

This 2018-founded medtech company is situated in Kolkata and develops inexpensive, non-invasive AI-based solutions for the early detection of chronic illnesses. This gadget offers simple, reasonably priced diagnostic options with the goal of increasing Indians' access to preventive healthcare (36). The company's first product, called AJO, or anaemia jaundice and oxygen saturation, is a non-invasive IOT-enabled gadget that can be purchased for less than Rs 1 that tests for medical issues relating to anaemia, liver, and lungs without requiring blood testing. After the test is over, the user-friendly device can be operated without the need for medical knowledge or experience. The results can be sent through text message or email in less than 1.5 seconds. The gadget passed NRS Medical College Kolkata's clinical trials.

Models of Osteoporosis Prediction for Assessing Patients' Risk

The creation of a predictive model for the timely and precise identification of osteoporosis is the goal of the innovation titled "Osteoporosis." The age, weight, and gender of the patient are typically considered the clinical features. By placing the patient in the at-risk or not-at-risk category, it evaluates the likelihood that the patient would develop osteoporosis.

AI in therapeutic approaches launched in March 2017 by a startup situated in Kochi The shortage of blood in rural India is addressed by the BAGMO (blood bag monitoring) gadget. It has created a blood bag monitoring system called Bag More, which keeps track of the blood bank blood bags' temperature while they are being stored and transported. It resolves problems with communication and logistics (38, 39). Prantaeis is a biotech firm based in Bhubaneswar that was founded due to the founder's experience with pre-eclampsia, a pregnancy disorder. The company primarily develops diagnostic tools and gadgets for prenatal treatment. There are currently four solutions available: Embargo, which can identify antibiotics in food products; ProFoIU, which monitors kidney health; EyeRa, which can identify preeclampsia early; and Salubrious, which offers a solution for concealed hunger (40).



Developed in Kollam, Kerala, Waferchips Techno Solutions' wearable electrocardiography (ECG) device, termed "Biocalculus," uses Bluetooth to communicate data to an Android application in the event that a smartphone is not available. Up to one month's worth of recorded data will be stored by it. The tool creates a clinically useful report using AI for additional diagnosis and treatment.

AI for healing

The field of rehabilitation is one where AI is beneficial. Numerous AI-based solutions that facilitate mobility are on the horizon. These consist of exoskeletons, augmentations, rehabilitative prostheses, and Brain Computer Interfaces (BCIs) that use an EMG-based interface to receive mental inputs .

AI in the COVID era

AI was crucial during the COVID-19 pandemic. The following uses of AI have been tested:

- (I) early infection diagnosis and detection
- (II) Treatment monitoring;
- (III) Contact tracing;
- (IV) Futuristic case and mortality projections;
- (V) Drug and vaccine development;
- (VI) Reducing healthcare workers' workload; and
- (VII) Disease prevention.

Challenges to be addressed to scale up use of AI in healthcare delivery in India

The challenges and barriers to the implementation of AI in healthcare in India must be understood to facilitate the scaling up of use of AI in healthcare India .

Lack of trained personnel and expertise for AI Replacement of humans because of AI is another huge worry which affects the support for the adoption of AI in healthcare.

The lack of AI trained professionals can also be a key barrier to using AI in healthcare Awareness of AI and quicker deployment of AI innovations.

The possibilities and advantages of using AI in healthcare delivery are not well understood by a variety of stakeholders. In India, few people are aware of it, including patients, healthcare workers, and proprietors. The public and medical professionals, especially those in leadership roles, still don't fully comprehend artificial intelligence (AI) and its advantages.

Another major issue is the asymmetry of information among the stakeholders. The negative coverage of AI's potential effects on employment in Indian media has made it more difficult for start-ups to secure investment.

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Liability in law and assigning blame for neglect Indemnity for .This is also a crucial problem that has to be fixed because, at the moment, the doctor bears entire responsibility instead of the technology. Explain ability is crucial while making judgments.

Indian Cybersecurity

Worldwide, cyberattacks on all kinds of companies are increasing, making digitally stored personal information susceptible to hacking and unauthorised access . A hacking of a laboratory database in 2016 led to the release of more than 35,000 patient records from all over India. The lab had not taken any steps to safeguard the data in spite of an earlier attack. Higher requirements for data security and privacy are necessary for this. Multinational corporations accessing local data without providing advantages locally is a source of worry in India. To stop sensitive health information from being compromised, concerns about cybersecurity and confidentiality must also be addressed.

High startup costs for AI projects, The infrastructure needed for AI to develop is still insufficient in India. Particularly struggling with little resources and inadequate data backup methods are smaller firms in the health sector. Medical start-ups encounter difficulties obtaining data from sources outside of India. Interoperability is prohibited, for instance, by EU data protection legislation.

Inadequate infrastructure Page 6 of 10 Journal of Hospital Management and Health Policy, 2021 © Journal of Hospital Management and Health Policy. Despite this, the Indian government has boosted investment. Reserved rights apply. J Health Care Manag Policy 2021;5:28 | DOI: 10.21037/jhmhp-20-126 Compared to other growing economies, the healthcare business receives relatively little public funding .

India has little AI (6). Policymakers in India continue to overlook the infrastructure required for AI to flourish (6). This covers the accessibility of electricity and the internet. Managers employing IT technology may encounter challenges in hospitals without an IT infrastructure.

Obstacles to healthcare data availability for artificial intelligence usage in healthcare

India faces a number of issues, including an abundance of unstructured data sets and interoperability issues. Worries that there aren't any publicly available medical data sets, that there aren't enough big data analytics tools, and that algorithms could provide data that is biased towards certain cultures One of the biggest obstacles facing startups is the lack of access to public data sets As an illustration, compiling and downloading all of the data from monitors in intensive care units, identifying important medical trends, and initiating a medical intervention.

Data gathering and pooling

Data access is necessary for the application of AI . There is a wealth of health data available in India. However, India does not have a formal system in place for exchanging health-related data .

Lack of strong open sets of medical data is a major barrier to AI acceptance and application in Indian healthcare. Legal issues and other factors may make it difficult to access healthcare datasets. Since larger players frequently already have access to such data, this presents a unique difficulty for start-ups in particular. As a result, startups frequently rely on freely accessible datasets from the US, Europe, and other regions. The fact that AI in healthcare does not address the needs of the Indian population diminishes its efficacy.



Algorithms that are biased by the use of open data from different settings are created, and solutions tailored to a particular group of people are developed. In particular, when it comes to drug discovery and genomics, it would be important to retrain solutions on Indian data and account for these biases in the application of AI techniques. The National Cancer Registry and the state of Tamil Nadu are two sporadic instances of open source data in the Indian setting, but they are insufficient. For a variety of factors, India lacks the essential historical health data. The fact that health records are frequently handwritten in regional tongues could make digitization more difficult. Data security and confidentiality the implementation of big data in healthcare in India is greatly hampered by worries about information privacy. In India, there are worries that foreign corporations have previously used the hospital resources in India to construct hospital information systems based on intangible knowledge from the country's healthcare sector. These same hospitals, however, were eventually forced to purchase licenses for the subsequent iterations of the same or related items in order to obtain access to the products they had assisted in developing. One major data difficulty is obtaining consent for collection.

Absence of policy standards and regulatory compliance

Ineffective health data governance is a result of issues with interoperability and standardization of digital health data. While the lack of such regulation has given start-up businesses more freedom to gather data and implement self-regulatory measures such as anonymizing data before further use, the regulatory void creates uncertainty about possible developments. One of the main challenges facing start-ups in India is the requirement for evidence of satisfactory outcomes through expensive and time-consuming clinical trials.

Guidelines for data gathering are scarce in India, particularly with reference to healthcare. This is regarded as a major issue, along with data entry and tabulation errors, according to AI and healthcare professionals, start-ups, and thank tanks at an AI workshop in India. One of the regulatory obstacles is the requirement for a suitable certification system.

Since AI is not restricted to just one topic or facet, self-regulation and/or the application of distinct regulators for various aspects—like the medical or data aspects—are also necessary. Furthermore, there isn't a defined set of guidelines for carrying out these kinds of clinical research. Patients and healthcare professionals can develop trust through the use of certification programmes (9). Collaborating with startups and physicians to carry out clinical studies is one potential remedy (6,53). Furthermore, the adoption of a "regulatory sandbox," or testing ground with permissive rules to permit product launch, may be considered. This may provide motivation for those in the AI and health fields to innovate and obtain certification (9,53).

Compatibility

Clinical data in India is dispersed and non-standardized as a result of the healthcare sector's infrequent standardization. The electronic health record policy has not yet been uniformly implemented all pertinent parts of the Indian healthcare industry. Due to this, digital records are interpreted differently and there isn't a complete implementation for all hospital data (9,50). This challenge is made worse by the lack of cooperative efforts from different stakeholders (57).

Absence of alliances and teamwork

In order to prevent duplication of investment, especially with limited resources, public-private collaborations are crucial (9,45,46).



Conclusions

India is seeing an exponential increase in the usage of AI in healthcare due to start-ups and large tech companies offering AI solutions for healthcare challenges (58). Developing countries like India have advantages over superpowers in the form of a big bank of data that is just waiting to be exploited, a blossoming startup environment, and a vast technical staff, even while they trail behind in fundamental research and resources.

India also possesses the determination to carve out a role for itself in a world increasingly driven by artificial intelligence (60) and the entrepreneurial spirit to assist companies in reaping the benefits of real-time data. Healthcare executives will see an exponential surge in the application of AI if policy space is well navigated, stakeholders are coordinated, and the technology's benefits are properly recognized.

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