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A Critical Review of AI in Healthcare from an Indian Perspective

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ABSTRACT

India's AI development is still in its infancy, and the country lacks a regulatory body dedicated to the technology exclusively. Notwithstanding, the Indian government has recently initiated several initiatives pertaining to artificial intelligence, such as the establishment of the Artificial Intelligence Task Force, the National Strategy for Artificial Intelligence #AIFORALL by NITI Aayog, the establishment of four AI Committees under the Ministry of Electronics and Information Technology, and others. Tamil Nadu's Safe and Ethical Artificial Intelligence Policy 2020 and Face Recognition Attendance System, West Bengal's AI-Powered System for Monitoring Driving Behavior, Maharashtra's AI System to Combat Agricultural Risks, Karnataka's creation of the Centre of Excellence for Data Science and Artificial Intelligence (CoE-DS&AI), and other state governments in India have also taken action. Like any other technology, artificial intelligence has both advantages and disadvantages. mining medical records, creating treatment plans, predicting health occurrences, helping with repetitive activities, conducting online consultations, supporting clinical decision-making, managing prescriptions, creating novel pharmaceuticals, assisting individuals in making healthier decisions, and addressing public health issues are just a few of the many tasks for which artificial intelligence (AI) may prove beneficial in the healthcare sector. In order to use AI systems effectively, handle sensitive health data with care, and stop data theft, staff training is necessary when implementing AI-based healthcare. Additionally, it is imperative that healthcare decisions based on AI solutions be explicable and supported by logic.

Keywords: Artificial Intelligence, healthcare, government policies, initiatives, AI-based healthcare.

INTRODUCTION

Artificial intelligence (AI) has changed the game in many fields in recent years, including Indian healthcare. As the country faces a slew of healthcare infrastructure concerns, including limited access to healthcare services, a dearth of skilled medical experts, and an overworked healthcare system, artificial intelligence (AI) is being viewed as a viable solution. Understanding the landscape of AI in healthcare in India necessitates a thorough examination of its uses, benefits, problems, and future potential for revolutionizing healthcare delivery in the country's detailed analysis of these legal requirements and the policy concerns presented is not possible due to the article's scope. Furthermore, because the business is still in its early stages, the legal and regulatory environment for AI in health care is constantly evolving. Artificial intelligence (AI) poses significant prospects and hazards for governments around the world, and India is no different. India has a sizable and expanding high-tech labor force. Health promotion is essential to the advancement of a country. When it comes to resources for socio-economic development, nothing

could be more important than the health of the populace. Notwithstanding this insight, the majority of the population in developing nations, particularly the 80% who reside in rural regions, have limited or no access to contemporary medical treatment. This inevitably leads to a high rate of preventable disease-related mortality and morbidity. This state of despair and annoyance among people is caused by inadequate health service administration rather than a lack of professional expertise or understanding. Only when these services are well-planned and executed can the public profit from contemporary science and technology.[1]

Healthcare, which includes illness prevention, treatment, and management to enhance well-being, is a vital component of human wellbeing and is widely recognized in countries across the globe. It is an intricate ecosystem made up of patients, healthcare professionals, government agencies, and cutting-edge technology. Transformative technologies, especially artificial intelligence (AI), are becoming more and more integrated into the changing healthcare scene. Global healthcare systems will be significantly impacted by AI's capacity to increase operational efficiency, optimize resource allocation, customize treatment programs, and improve diagnostic accuracy. But as artificial intelligence becomes more and more integrated into healthcare, a number of ethical, legal, and regulatory issues arise. The fair distribution of AI-driven discoveries as well as concerns about data privacy, security, informed consent, and algorithm openness are among these difficulties. Technology known as artificial intelligence (AI) enables robots with intelligence comparable to that of the humans to carry out certain jobs assigned by humans such as speech recognition with virtual assistant like Alexa and Siri and face recognition for person identification. Most of the technological developments make us fear negative consequences. Just like, introducing Artificial intelligence (AI) and robotics throughout the society can make us think of the loss of jobs, loss of control, and instils from the future of humankind. It is also a general tendency to underline the negative aspect of new technology when we do not understand the technology and, its whole range of repercussions.[2] At its inception, artificial intelligence (AI) can be broadly classified into three categories: Artificial General Intelligence (AGI), Artificial Narrow Intelligence (ANI), and Artificial Super Intelligence (ASI) are the three types of artificial intelligence.

Presently, the developments in the domain of artificial intelligence (AI) majorly falls under the category of Artificial Narrow Intelligence, which gives the ability to machines so that they can copy human capabilities in specific domains. In contrast, if we look at Artificial General Intelligence, it will have human capabilities across several domains, making it human-equivalent to artificial intelligence (AI).

A completely new category, artificial super intelligence surpasses the best human brains in almost every domain, including social skills, general knowledge, and scientific innovation. A lot of people are concerned about this level of artificial intelligence (AI). In order to forecast possible health concerns, healthcare artificial intelligence (AI) systems can examine trends in a patient's medical history and present health data. Better patient's outcomes and lower health costs are eventual results of healthcare practitioners being able to deliver proactive, preventive care; thanks to this predictive capability.

Healthcare is now heavily reliant on artificial intelligence (AI). With the quick development of analytical methods and the growing amount of healthcare data available, artificial intelligence (AI) has a wide range of uses in diagnostics, robotic surgery, and research. The purpose of artificial intelligence (AI) is to have

[1] '"Responsible Use of Artificial Intelligence in Clinical Medicine" or "Ethical Integration of Artificial Intelligence in India's Healthcare System": A Framework for Responsible Innovation' <https://japi.org>

[2] Ashish Makani, Anurag Agrawal and Anjali Agrawal, 'Artificial Intelligence-Powered Healthcare for India: Promises, Opportunities and Challenges' (2024) 37 The National Medical Journal of India 177 <https://doi.org/10.25259/NMJI_1193_2024>.

knowledge that is comparable to that of humans but more effective in terms of clearly accurate memorization. Although the procedure takes longer, a robot's sutures, accuracy, and consistency are far better than a physician's, which lowers the chance of failure. A robot is equally as skilled as a surgeon.
Artificial Intelligence is the use of robots and algorithms to simulate human intelligence. AI technologies used in healthcare include robotics, computer vision, natural language processing (NLP), and machine learning (ML) algorithms. These technologies are intended to analyze enormous amounts of medical data to help healthcare practitioners diagnose, treat, and manage patient care. AI applications in healthcare include predictive analytics, personalized medicine, remote monitoring, drug development, and medical imaging. AI is also playing an important role in automating administrative chores like scheduling and patient management, which helps to streamline healthcare operations and increase productivity.

REGULATORY FRAMEWORK RELATING TO ARTIFICIAL INTELLIGENCE AND HEALTHCARE IN INDIA

In order to encourage the appropriate application of AI in societal contexts, the proclamation emphasizes how important it is for the government to collaborate with industry and educational institutions. By fostering a responsible attitude toward AI in commercial organizations, it highlights the significance of capacity building, regulatory and policy initiatives, and encouraging moral behavior.[3]
DPDP Act: The Indian President signed the Digital Personal Data Protection Act, 2023, on August 11, 2023. With immediate effect, this Act covers the processing of digital personal data in India, regardless of its original source, and resolves several privacy concerns associated with AI platforms.[4]
On May 26, 2022, MeitY issued the draft National Data Governance Framework Policy (NDGFP). The objective of this approach is to improve and update government data management and collection procedures. The proposal states that the primary goal of the NDGFP is to establish a comprehensive dataset repository to enhance an environment that supports AI and data-driven research and businesses in India.
The Indian Penal Code offers further remedies for cybercrimes connected to deepfakes under Spreading hate along community lines is covered under Sections 153(a) and (b), 499 (criminal defamation), and 509 (insulting a woman's modesty), among other sections. Notably, the illegal use of copyrighted content to produce deepfakes is forbidden by Section 51 of the Copyright Act of 1957. Furthermore, recent cases demonstrate how law enforcement employs elements linked to forgeries in deepfake incidents.
Additionally, India is one of the members of the Global Partnership for Artificial Intelligence (GPAI). GPAI specialists recently gave presentations at the 2023 GPAI Summit in New Delhi on data governance, responsible AI, the future of work, innovation, and commercialization. According to the GPAI website, "as a vital branch of the initiative, GPAI's Experts produce deliverables that can be integrated into Member's national strategies to ensure inclusive and sustainable AI development". Under the 2023 themes of societal resilience, global health, and climate change, experts sought to guarantee that artificial intelligence is used ethically to address global concerns. In contrast, the 2023 Ministerial Declaration, which reiterated GPAI member's commitment to the OECD AI Principles and the responsible stewardship of AI, was ratified. Additionally, they pledged to put these ideas into practice by developing rules, guidelines, policies, and other projects. They emphasized initiatives to bridge the gap between theory and practice in order to develop AI that is sustainable, inclusive, and accountable to all people.

[3] '9147562941489753121.Pdf' <https://mohfw.gov.in/sites/default/files/9147562941489753121.pdf>
[4] 'Digital Personal Data Protection Act 2023.Pdf'
<https://www.meity.gov.in/writereaddata/files/Digital%20Personal%20Data%20Protection%20Act%202023.pdf>

INDIAai: India's National AI Portal- On June 1st, 2020, the Indian government introduced it. It was established with the goal of preparing the country for the future of artificial intelligence. It serves as the only comprehensive knowledge base on artificial intelligence and associated topics for the upcoming CSD Working Paper Series: Artificial Intelligence and Healthcare in India.[5]

Niti Aayog, Intel, and the Tata Institute of Fundamental Research (TIFR) announced on September 11, 2020, that they will be working together to build a prototype International Center for Transformative Artificial Intelligence (ICTAI) in Bangalore, India. The center will concentrate on ai-based research initiatives in three crucial fields: smart mobility, agriculture, and healthcare. the center also intends to create information technology (IT) and artificial intelligence (AI)-related policies, frameworks, standards, tools, and assets. working together with start-ups, ai firms, and industry experts to commercialize ICTAI-developed technologies and intellectual property is another area of interest for the organization.[6]

TRANSFORMING INDIAN HEALTHCARE: THE KEY ROLE OF AI

1. *Medical Imaging and Diagnostics:* Medical imaging is one of the most promising uses of AI in healthcare. In order to detect abnormalities such as infections, fractures, or malignancies, AI-powered algorithms may evaluate medical imaging such as X-rays, MRIs, and CT scans. This enables radiologists to make more accurate and timely diagnosis. In India, where radiologists are in short supply, artificial intelligence can be a significant tool for diagnosis, minimizing human error and increasing patient outcomes.[7] Artificial intelligence (AI) is a technology that analyzes medical imaging data, including MRIs, ultrasounds, and X-rays, using computer algorithms to aid in disease diagnosis and treatment. AI can provide thorough profiles for individualized treatment regimens by combining imaging data with genetic and medical history. Early diagnosis and treatment of conditions like cancer and heart problems can be facilitated by AI. AI is applicable to several imaging modalities utilized at various tumor therapy stages. Numerous medical imaging specialties, such as cardiology, cancer, pulmonary, orthopedic, and ophthalmology, are utilizing AI. By 2032, the global market for AI in medical imaging is expected to have grown from its 2022 valuation of $1.9 billion to $29.8 billion.[8]
2. *Telemedicine & Remote Healthcare:* AI-powered solutions can support remote consultations, health monitoring, and individualized treatment regimens. Since ISRO's Telemedicine Pilot Project in 2001, the idea of telemedicine has advanced greatly, grown dramatically during the current pandemic-induced era, and expanding gradually in the upcoming years. Its increasing demand can be attributed to a number of factors, including last-mile contact with patients, prompt guidance, and the quick interchange of patient data. By 2025, the Indian market is projected to develop at a Compound Annual Growth Rate (CAGR) of 31% to reach US$5.4 billion. India is witnessing groundbreaking technological advancements that are transforming healthcare and enhancing people's lives. Telemedicine is a relatively new concept that allows patients to consult with doctors through video chat on a range of communication channels, such as mobile, laptop, and wireless devices. In addition

[5] '9147562941489753121.Pdf' (n 4).
[6] 'NITI Aayog, TIFR and Intel Establish International Center for Transformative Artificial Intelligence - Intel Community'<https://community.intel.com/t5/Blogs/Intel/Policy-Intel/NITI-Aayog-TIFR-and-Intel-Establish-International-Center-for/post/1333053>
[7] 'Medical Imaging and Diagnostics | Physics' <https://courses.lumenlearning.com/suny-physics/chapter/32-1-medical-imaging-and-diagnostics/>
[8] Ohad Oren, Bernard J Gersh and Deepak L Bhatt, 'Artificial Intelligence in Medical Imaging: Switching from Radiographic Pathological Data to Clinically Meaningful Endpoints' (2020) 2 The Lancet Digital Health e486 <https://doi.org/10.1016/S2589-7500(20)30160-6>.

to supporting the three A's of affordable, accredited, and accessible healthcare, telemedicine, online prescriptions, and virtual patient diagnosis are opening the door for the six P's of healthcare: personal, primary, preventive, precise, proactive, and predictive.

3. *Predictive analytics for disease prevention:* Epidemiological trends and disease outbreak forecasting can be done with artificial intelligence. Machine learning systems, for example, may examine health data from multiple sources to predict the occurrence of diseases such as dengue, malaria, and COVID-19. This predictive skill enables health authorities to conduct preventive interventions and distribute resources more efficiently.
4. *Drug Development and Discovery:* Artificial intelligence is altering the drug discovery process by allowing for speedier identification of prospective drug candidates and decreasing the duration and cost of clinical trials. AI-powered simulations and modeling can forecast therapeutic efficacy, detect side effects, and optimize treatment regimens. This is critical for India, as the pharmaceutical industry contributes significantly to both domestic healthcare and worldwide exports.[9]
5. *Personalized Medicine:* By using their lifestyle, genetic makeup, and other personal health information, AI can assist patients in receiving prescriptions that are customized for them. It tailored approach results in more effective treatments and improved patient outcomes. In a heterogeneous country like India, tailored medicine is a viable approach for meeting the varying needs of patients across regions and demographics.
6. *Enhancing Clinical Workflows:* AI is improving clinical workflows by streamlining them, lowering administrative responsibilities and enabling medical staff to concentrate majorly on the issue relating to patient care. Algorithms that are used as Natural Language Processing (NLP) can create clinical notes, update electronic health records, and automatically transcribe and summarize doctor-patient conversations. AI-powered scheduling systems can also improve hospital resource allocation, reduce wait times, and streamline patient flow.[10]

HOW AI IS TRANSFORMING HEALTHCARE IN INDIA: KEY ADVANTAGES

India, which is confronting enormous healthcare difficulties, stands to profit greatly from AI in healthcare. AI-powered technology provides remote consultations, diagnostics, and health monitoring, bridging the gap between urban and rural areas with inadequate healthcare resources. Furthermore, AI improves efficiency by automating administrative activities like data input, patient administration, and billing.[11] This reduces costs by decreasing errors and maximizing resource use, making healthcare services more inexpensive. Furthermore, AI improves diagnostics and treatment by enabling early detection of diseases through enhanced data analysis and assisting doctors in making more accurate and individualized treatment decisions. By harnessing these characteristics.[12]

Particularly in diagnostic domains like radiology and pathology, AI has been shown to be just as effective- and in certain situations, perhaps more so. The Centre for pushed Research in Imaging, Neuroscience, and

[9] Natesh Singh and others, 'Drug Discovery and Development: Introduction to the General Public and Patient Groups' (2023) 3 Frontiers in Drug Discovery <https://doi.org/10.3389/fddsv.2023.1201419>

[10] 'Six EHR Optimization Tactics to Streamline Clinical Workflows | TechTarget' (*Health IT and EHR*) <https://www.techtarget.com/searchhealthit/feature/Six-EHR-Optimization-Tactics-to-Streamline-Clinical-Workflows>

[11] Sudip Bhattacharya, 'Artificial Intelligence, Human Intelligence, and the Future of Public Health' (2022) 9 AIMS Public Health 644 <https://doi.org/10.3934/publichealth.2022045>.

[12] Abhishek Mahajan and others, 'Artificial Intelligence in Healthcare in Developing Nations: The Beginning of a Transformative Journey' (2019) 2 Cancer Research, Statistics, and Treatment 182 <https://doi.org/10.4103/CRST.CRST_50_19>.

Genomics, or CARING, has pushed state-of-the-art clinical and scientific research while focusing on creating relevant products in collaboration with others. Along with integrated research in genomes and neuroscience, they have also used AI in imaging. In collaboration with Tata Memorial Centre Imaging Biobank, NITI Aayog is working on an AI-based Radiomics project that includes two partners: the Tumor Radiomics Atlas Project for Cancer and the Machine Learning and Artificial Intelligence Database. With NITI AAYOG, a number of other intriguing breakthroughs are taking place. At the moment, it is utilized in psychiatry, medical diagnostics, and the therapy of specific medical conditions. Primary care centers will now do DR screenings because to this AI breakthrough. The Remidio FOP's Medios AI automatic referable DR screening is implemented on a camera smartphone and operates offline. It uses non-mydriatic images and output, visualizes the lesions found, and refers the patient to an ophthalmologist. Both TB screening with X-rays and histopathological image analysis have AI advancements. AI-enabled gadgets include ECGs, thermometers, weighing scales, and wheelchair sensors for automated wheelchair parking. After the test is over, the results may be communicated by email or text message in less than 1.5 seconds, and using the easy-to-use equipment doesn't require any prior medical knowledge.

USING AI IN THERAPEUTIC INTERVENTIONS

Founded in March 2017, the startup is situated in Kochi. The scarcity of blood in rural India is addressed by the BAGMO (blood bag monitoring) gadget. It helps with communication and logistics problems. Prantaeis is a biotech company based in Bhubaneswar that was founded as a result of the founder's experience with pre-eclampsia, a pregnancy condition. The company primarily creates gadgets and diagnostic tools for pregnancy-related medical care. There are currently four products available: EyeRa for preeclampsia early identification; ProFoIU for kidney health monitoring; Salubrious for hidden hunger alleviation; and Embargo for antibiotic detection in food goods. The "Biocalculus", a wearable electrocardiography (ECG) gadget made by Waferchips Techno Solutions in Kollam, Kerala, uses Bluetooth to send data to an Android app in the event that a smartphone is not available. The data will be stored for up to one month after it is recorded. The gadget creates a clinically actionable report for additional diagnosis and therapy using artificial intelligence.

In the healthcare sector, early problem diagnosis is often the key to treatment; here is where artificial intelligence (AI) can be a helpful tool. As AI algorithms develop, they are being trained on vast collections of patient data, images, and medical scans.[13] They can identify trends and abnormalities through the study of this data that even seasoned medical professionals could miss. This data-driven strategy has the potential to enhance illness identification. Imagine a situation in which the doctor analyzes the patient's MRI or X-ray data using artificial intelligence. The AI system can identify anomalies with exceptional accuracy because it has been trained on millions of examples. This kind of early diagnosis could be revolutionary, enabling doctors and people to monitor health issues and enabling intervention when treatment is most effective.

Beyond identification, there are other benefits of employing AI for diagnosis, which could improve precision. Artificial intelligence (AI) offers a perspective and serves as a useful second opinion in difficult cases, whereas human radiologists may become fatigued and overlook information. As a result, there are

[13] Rahul Shrivastava and others, 'Development of an Artificial Intelligence–Guided Citizen-Centric Predictive Model for the Uptake of Maternal Health Services Among Pregnant Women Living in Urban Slum Settings in India: Protocol for a Cross-Sectional Study With a Mixed Methods Design' (2023) 12 JMIR Research Protocols e35452 <https://doi.org/10.2196/35452>.

fewer mistakes and incorrect diagnoses, which eventually improves patient outcomes. But there are certain issues that must be resolved. If the training data is skewed, biases may also appear in AI algorithms. Diverse datasets are necessary for AI system training in order to guarantee equity and inclusivity. To construct a depiction of human health, researchers, healthcare practitioners, and AI specialists must work together. AI is intended to supplement physicians, not to replace them. AI has the ability to revolutionize disease identification by providing a tool and steadfast assistance. With AI acting as a perceptive companion on the path to better health.

ETHICAL IMPLICATIONS OF AI FOR HEALTHCARE DELIVERY

Concerns about inequality surround India has a number of obstacles when it comes to the use of AI in healthcare. These include the tendency for higher-income populations with better access to technology to benefit more from it, the underrepresentation of minority groups in the data used to develop algorithms and solutions, and the gender biases in technologies caused by the dominant male presence in the software industry. Data integrity is another important consideration. Datasets from a broad and diverse population are required to address biases. Otherwise, the already growing social gap can get bigger.[14] If caution is not exercised, AI design is likely to mirror all of society's biases. Data generated by algorithms may be based on age, gender, color, or religion, leading to unjust outcomes and discrimination that may benefit particular Indian demographics more than others. There are various ethical issues with the gathering and application of patient data in AI-powered healthcare. To stop data breaches and illegal access, for example, it is crucial to guarantee the security and privacy of patient data. Additionally, it should not be expected that patients completely comprehend the ramifications of giving their data; instead, they should be educated about how their data will be used in AI systems and given the option to opt out. Some groups may benefit while others experience worse health outcomes, thereby perpetuating unequal access to healthcare. Getting informed permission and protecting patient autonomy are especially difficult in AI-powered healthcare. The most important requirement for gaining informed permission is to provide concise, unambiguous explanations of the AI's intended use and any possible hazards. Patients might not fully comprehend how their data will be used in AI applications, which raises data privacy concerns. The key issue of informed consent expiration and how to address it arises from the speed at which AI advances can occur. The many duties that healthcare workers who use AI tools have may change as the technology develops. Healthcare providers need to make sure that AI-powered healthcare choices are in the best interests of their patients. Healthcare workers also need to be open and honest about how AI is being used in the field. Patients should be aware of how AI tools are being used to affect their treatment. It is essential that we maintain a balance between the ethical issues surrounding the use of AI in healthcare and its developments. Ensuring that AI-driven technology benefits patients while also defending their rights and wellbeing is the answer to this dilemma. This entails putting in place robust measures to protect patient privacy, obtaining informed consent, and guaranteeing openness regarding the use of patient data. Healthcare systems can optimize AI's benefits while reducing dangers like bias, data misuse, and unequal access to care by protecting patient autonomy and giving ethical issues top priority. Developing a balanced strategy that improves healthcare results without jeopardizing people's fundamental rights should be the main goal.[15]

[14] Rajeev Pandya, RS Shaktawat and Namita Pandya, 'ICT Enable Artificial Intelligence in Healthcare Management in India' in Sheng-Lung Peng, Nilanjan Dey and Mahesh Bundele (eds), *Computing and Network Sustainability* (Springer 2019) <https://doi.org/10.1007/978-981-13-7150-9_49>.

[15] Anupama Reddy and Padmalatha, 'EXPLORING THE INFLUENCE OF ARTIFICAL INTELLIGENCE ON THE BUSINESS LANDSCAPE IN INDIA: AN IN-DEPTH ANALYSIS AND IMPLEMENTATION IN BANKING SECTORS:

OVERCOMING THE CHALLENGES OF AI IMPLEMENTATION IN INDIAN HEALTHCARE

For AI to reach its full potential in India's healthcare industry, a number of issues must be resolved, despite its enormous potential.

1. *Infrastructure Limitations:* A major barrier to the wider adoption of AI technologies in India's healthcare facilities is the scarcity of critical technology infrastructure, especially in rural and semi-urban areas. Only 45% of India's 7,821 Health and Wellness Centers, according to a recent survey, have access to energy backup, highlighting the difficulties these facilities face. It becomes extremely difficult to integrate AI tools and systems into these healthcare settings in the absence of dependable power sources, sufficient internet access, and contemporary medical equipment. Urban and rural people continue to have different access to and quality of healthcare due to this infrastructure disparity, which also restricts the ability to adopt new technology. Significant investment in fundamental infrastructure, such as dependable electricity, communication, and equipment, is necessary to facilitate the adoption of AI in these fields. Even though the Indian government has raised expenditures in the healthcare sector, its public financial investment in this sector is still relatively limited when compared to other growing nations.[16] In India, there is little government funding in AI primarily connected to health. The lack of adequate healthcare infrastructure is the major issues facing India's healthcare system. There are roughly 1,185,242 beds in the private sector and 7,13,986 beds in the public sector. As a result, India has an average of fewer than 1.4 beds per 1000 people, which is much less than the 3.5 beds per 1000 people that the WHO recommends. Less than 2% of GDP is spent by the government on healthcare, while less than 3% is paid by the private sector. These two amounts fall well short of the global average of 9.5% of GDP spent on healthcare. A major obstacle to making health and wellness accessible to the general public is the lack of money and the scarcity of beds.[17]
2. *Data Privacy and Security:* In India's healthcare industry, the lack of trustworthy, publicly available medical datasets seriously impedes the uptake and efficient application of AI. It becomes difficult to create precise AI models suited to India's heterogeneous population without access to extensive, standardized data. For legal and other reasons, accessing healthcare datasets can be challenging. Since larger players frequently already have access to such data, this presents a unique difficulty for start-ups.[18] When open data from different settings is used, algorithms are developed that reflect the bias of the data and are tailored to a particular population. Retraining solutions on Indian data and accounting for inherent biases in the use of AI technologies would be essential, especially when it comes to drug discovery and genomics. The National Cancer Registry and the state of Tamil Nadu are two sporadic instances of open-source data in the Indian setting; however, they are not enough.
3. *Lack of professional staff:* Implementing AI in healthcare requires a professional staff to create, manage, and use AI technology. In India, there is a shortage of healthcare workers who have been trained to use AI tools. To address this issue, educational institutions and healthcare providers must

EXPLORING THE INFLUENCE OF ARTIFICAL INTELLIGENCE ON THE BUSINESS LANDSCAPE' (2024) 30 The journal of contemporary issues in business and government 39 <https://doi.org/10.61841/cibg.v30i2.2784>.

[16] Jatinder Bali, Rohit Garg and Renu T Bali, 'Artificial Intelligence (AI) in Healthcare and Biomedical Research: Why a Strong Computational/AI Bioethics Framework Is Required?' (2019) 67 Indian Journal of Ophthalmology 3 <https://doi.org/10.4103/ijo.IJO_1292_18>.

[17] Dr Ajmer Singh Malik Phalguni, 'THE FUTURE OF HEALTHCARE IN INDIA: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING-DRIVEN PREDICTIVE ANALYSIS FOR QUALITY HEALTHCARE DELIVERY IN HEALTHCARE SECTOR' [2024] Bulletin of Pure and Applied Sciences-Zoology 938.

[18] Keerti Pradhan, Preethi John and Namrata Sandhu, 'Use of Artificial Intelligence in Healthcare Delivery in India' (2021) 5 Journal of Hospital Management and Health Policy <https://doi.org/10.21037/jhmhp-20-126>

engage in upskilling and educating healthcare workers. The persistent problem is made worse by a lack of qualified medical personnel.

For example, the Community Health Centers (CHCs) lack between 74.2% and 81.6% of the necessary number of surgeons, obstetricians and gynecologists, general practitioners, and pediatricians. Similarly, there are 3.3 million registered nurses, which is less than the required one-third doctor-to-nurse ratio.

4. *Integration with Existing Healthcare Systems:* The process of combining information from many healthcare sources, such as electronic health records and medical equipment, is called healthcare data integration. It is an essential part of contemporary healthcare systems that enables healthcare professionals to; optimize processes and obtain a comprehensive picture of patient health. Lack of standardization, fragmented systems, a lack of integration standards, a shortage of human resources, and security threats are a few obstacles to healthcare integration. It can result in inefficiencies and worse than ideal patient care if healthcare is moved to primary care without sufficient worker upskilling. The integration of care is further hampered by disagreements among healthcare professionals, misunderstandings about the goals of care, and reluctance to change. In addition to impeding cooperation, these obstacles postpone the delivery of efficient, patient-centered care, which keeps the system from reaching its full potential in terms of enhancing health outcomes.[19] HL7 FHIR (Fast Healthcare Interoperability Resources) is an open-source technology standard that specifies how healthcare data should be moved between different IT systems. This makes it possible for systems to interact and communicate irrespective of the way data is stored. In general, integrated health systems are thought to function better in terms of safety and quality. Standardized protocols and efficient communication are to blame for this.[20] Rural healthcare facilities in India often uses antiquated infrastructure. Integrating AI technologies into these systems can be complicated and expensive. There must be major investment in updating healthcare infrastructure and ensuring that AI tools work with existing systems.
5. *Regulatory Challenges:* In India, regulations for AI in healthcare are constantly changing. There are currently no comprehensive criteria or protocols for the safe and ethical application of AI in medicine. Clear laws are required to ensure that AI technologies are used responsibly and ethically, with patient safety as the first consideration. The intangible character of AI concepts is currently the problem. To achieve the aforementioned concrete consequences, AI systems must become more transparent, precise, and consistently correct. To address information imbalances, legislative initiatives such as the General Data Protection Regulation (GDPR) and continuing debates on AI regulatory frameworks are being pursued. By preserving individual privacy, guaranteeing data security, and establishing moral standards for AI research, these projects hope to promote increased openness and responsibility in the use of data and the application of technology. Despite emphasizing openness, these rules are vague and mostly concentrate on particular behaviors, particularly those related to data, intellectual property (IP) rights, and privacy.[21] In order to manufacture their products, medical device makers are required

[19] Jessica Morley and others, 'Governing Data and Artificial Intelligence for Health Care: Developing an International Understanding' (2022) 6 JMIR Formative Research e31623 <https://doi.org/10.2196/31623>.
[20] Olga Kozlowska and others, 'Barriers and Facilitators to Integrating Primary and Specialist Healthcare in the United Kingdom: A Narrative Literature Review' (2018) 5 Future Healthcare Journal 64 <https://doi.org/10.7861/futurehosp.5-1-64>.
[21] Hua Wang and others, 'An Artificial Intelligence Chatbot for Young People's Sexual and Reproductive Health in India (SnehAI): Instrumental Case Study' (2022) 24 Journal of Medical Internet Research e29969 <https://doi.org/10.2196/29969>.

by the FDA to establish a quality system. Throughout its existence, this system should be committed to producing, distributing, and maintaining consistently high-quality products that operate in accordance with their specified requirements and applicable laws.

6. *Ethical and Cultural Considerations:* Given India's huge variety, implementing AI in healthcare presents complicated ethical and cultural challenges. AI systems must be taught on a consistently reliable data foundation in order to make decisions based on ongoing data, information, and knowledge development, collection, and verification. This will make AI systems more ethical. This highlights how important it is for AI algorithms to be transparent so that patients and healthcare professionals may make informed decisions.[22] The standard and applicability of inputs determine how accurate AI results are. Establishing protocols for data validation and control during training is therefore essential. At the same time, methods for evaluating particular results in the use of AI systems in real life must be created. Beyond just providing explanations, this assessment includes documenting the creation and testing of AI, tracking every stage, and putting data governance and management protocols into place. In order to advance justice and diversity, efforts must be taken to address algorithmic biases in ethical AI-enhanced healthcare. The main goals are to empower patients and clinicians, protect their data, and work toward equity in the use of AI technology. Healthcare practitioners must have the resources necessary to make well-informed decisions when using AI tools for shared decision-making. Patients must have access to thorough information about their health, including details about diseases, related risks, prospective treatment outcomes, costs, and viable alternatives, in order to guarantee that they completely comprehend and actively engage in their healthcare decisions. Patients are empowered to make knowledgeable decisions regarding their care when this transparency is provided. Technology that complies with ethical norms not only helps patients but also raises the bar for patient-centered care and equity by improving healthcare's overall quality and accessibility.
7. *Cost and Resource Allocation:* AI's promise to lower costs while increasing efficiency is one of its biggest benefits for the healthcare industry. Healthcare professionals may concentrate on patient care by using AI to automate administrative duties like patient data entry, appointment scheduling, and billing. Additionally, by offering precise answers from non-invasive tests, AI-driven diagnostics lessen the need for costly and intrusive procedures. AI can assist healthcare practitioners in providing high-quality care at a reduced cost by optimizing workflows and allocating resources, hence making healthcare more accessible to India's large population. India's healthcare spending was 1.84% of its GDP in 2021-22. Whereas with a constant increase, India's healthcare spending was 2.1% of its GDP in 2022-23, according to the Economic Survey 2022-23[23].

THE FUTURE OF AI IN HEALTHCARE IN INDIA

India can take some steps for effectively implementing Artificial Intelligence in healthcare likewise; With the help of contemporary AI technologies. By merging the National Health Resources Repository (NHRR) with AI-ready data standards, India may fortify it and build a stronger AI healthcare infrastructure. India could set the stage for a comprehensive, data-driven healthcare system that uses AI to improve patient outcomes by integrating the NHRR with the National Digital Health Mission (NDHM). An excellent

[22] 'AI in Healthcare: Ethical & Regulatory Hurdles' (*Birlasoft*) <https://www.birlasoft.com/articles/artificial-intelligence-in-healthcare-addressing-ethical-and-regulatory-hurdles>
[23] Dr DY Patil, 'AI in Healthcare: What to Expect in the Coming Years' <https://www.dypatilonline.com/blogs/ai-health-care-future-expectations>

illustration of the effectiveness of this strategy is Estonia's e-Health system, which effectively handles 95% of the country's medical data, showcasing the revolutionary potential of centralized, AI-ready health data. The government can work with educational institutions and tech firms to create AI models that are especially suited to the particular requirements of India in order to solve the problem of these models not being appropriate for the diverse country's population. Diverse datasets that represent India's genetic variety, regional disease patterns, and socioeconomic factors that affect health outcomes should be used to train these models. As an illustration of how AI may be used to address urgent healthcare issues in India, researchers at IIT Delhi have created AI-based diagnostic tools for conditions like malaria, TB, and cervical cancer. India can guarantee that AI technologies are efficient, fair, and in line with the health requirements of its people by concentrating on these regional models. Comparable to Google's successful AI for Social Good initiative, the government may issue a challenge called "AI for Indian Healthcare" and ask researchers and businesses to create solutions specifically suited to India's unique healthcare problems This strategy would support the development of suitable legislation in addition to encouraging innovation. AI Technologies which have effectively aided in the creation of numerous cutting-edge financial technologies, is a prime illustration of this type of strategy. India may offer a controlled setting where AI technologies might be tested, improved, and assessed prior to being widely used by modifying this framework for the healthcare industry. Also, India should create thorough ethical standards that are adapted to its own cultural and socioeconomic setting in order to handle the ethical issues raised by AI in healthcare. Important topics like algorithmic bias, data privacy, and the use of AI in healthcare decision-making should all be covered in these guidelines. To monitor the ethical ramifications of AI in healthcare, a special committee made up of ethicists, medical practitioners, and AI specialists might be formed under the Ministry of Health and Family Welfare. In order to promote patient safety and equity in healthcare results, this committee would make sure that the creation and application of AI technologies are consistent with Indian values and handle any potential ethical issues. India must concentrate on building healthcare facilities with AI-ready infrastructure. This entails making sure healthcare facilities have a steady supply of electricity, strong internet connectivity, and the required gear.[24] The government may include changes to internet infrastructure into already-existing programs like the National Rural Health Mission.

For example, Chhattisgarh's successful installation of solar-powered primary health clinics, which guaranteed electricity around-the-clock, might be duplicated and extended to incorporate digital infrastructure.

With ongoing research and development aimed at realizing its full potential, artificial intelligence holds great promise for the future of Indian healthcare. As AI technologies advance, they will be further integrated into the healthcare ecosystem, providing solutions that are more efficient, accurate, and tailored. The Indian government's support for AI innovation, together with private-sector investments and cooperation with global technology companies, is anticipated to boost AI adoption in healthcare.[25] Furthermore, as AI gains traction, it is predicted to deliver significant improvements in healthcare accessibility, affordability, and quality.

Evaluating the landscape of AI in healthcare in India exposes both enormous prospects and substantial problems. By harnessing AI technologies, India has the ability to transform its healthcare system,

[24] Girish Kumar and others, 'Analyzing Barriers in Adoption of Artificial Intelligence for Resilient Health Care Services to Society' (2024) 25 Global Journal of Flexible Systems Management 179 <https://doi.org/10.1007/s40171-024-00373-4>.

[25] Rahul Joshi, Krishna Pandey and Suman Kumari, 'Exploring Various Government Health Schemes and the Use of AI in the Changing Dynamics of India' *2024 5th International Conference for Emerging Technology (INCET)* (2024) <https://doi.org/10.1109/INCET61516.2024.10643415>

benefiting millions of people across the country. However, for AI to be truly effective, it must solve the issues of data protection, workforce training, infrastructure, and legislation. Previously, diagnoses and past population trends served as the foundation for treatment programs. However, by customizing therapies to meet the unique needs of each patient, AI opens the door for customized medicine, which is transforming the way healthcare is provided. AI's ability to evaluate enormous volumes of health data, such as genetic data, comprehensive medical histories, lifestyle factors, and other important health indicators, is enabling the creation of extremely targeted and successful treatment regimens. By taking into account each patient's particular genetic composition and medical history, this method not only guarantees more accurate treatment but also increases the possibility of better results. AI has the potential to change healthcare from a one-size-fits-all approach to one that is flexible and extremely sensitive to the needs of specific individuals as it develops further. AI can identify clear trends and variations in this health data, resulting in more individualized treatments. This approach is in line with the growing emphasis on precision medicine, which uses a patient's unique traits to tailor treatments. It is similar to optimizing treatment regimens using insights from data. AI is very good at analyzing data to identify patterns, predict how patients will react to specific medications, and recommend different treatment options depending on the unique biology of each patient.

The benefits of customized care are substantial since it contributes to improved treatment efficacy. Imagine a scenario in which a cancer patient receives a treatment plan designed to specifically target their mutation, increasing the chances of a favorable result. Additionally, adverse effects may decrease as a result of personalized treatment. The dosage of a drug can be changed by predicting the patient's potential reaction. This lowers the likelihood of complications while also improving comfort throughout the procedure. AI is a useful instrument that, by offering insights and assisting in decision-making, can greatly improve patient care. But it's crucial to understand that AI should be viewed as an addition to medical practitioner's knowledge and discretion, not as a substitute for it. More efficient, individualized, and comprehensive healthcare results are guaranteed when technology and medical expertise work together. The skills and knowledge of medical professionals will always be needed to interpret AI results and develop treatment plans.

With the use of AI, surgical robotic devices that were previously only found in science fiction are now getting more sophisticated and practical. Imagine a situation where a surgeon performs operations with unparalleled control and precision while employing an AI-guided arm. This exemplifies the future that robotics driven by AI is bringing about. The potential of AI to increase accuracy in surgery is a key benefit. AI algorithms allow the robotic arms to move by analyzing real-time data from the operation site, including tissue feedback and instrument placements. This could improve overall surgical precision and decrease human error. AI is also capable of evaluating pre-operative images and creating visualizations to provide surgeons with a thorough strategy for the process. Surgical planning and execution are improved by this improved visualization, which produces more successful and predictable results. Beyond accuracy, AI-assisted surgery has other advantages. AI-guided robotic arms have a greater range of motion than the human hand. This enables minimally invasive operations by giving surgeons access to difficult-to-reach parts of the body. Patients can benefit greatly from minimally invasive surgery. Shorter hospital stays, less post-operative discomfort, and quicker healing are all results of smaller incisions. AI can also help with delicate tissue manipulation and blood artery identification, reducing surgical trauma and possible consequences.

The scope of healthcare is growing beyond the confines of clinics and hospitals. AI contributes to this development by bringing about a period of proactive healthcare and enabling remote patient monitoring. Imagine a period in the future when medical personnel, wherever you may be, may monitor your symptoms and health indicators in real time. AI is influencing reality; therefore, this is not simply wishful thinking. AI simplifies patient monitoring through the use of devices and sensors. These devices collect a wide range of data, from blood pressure and heart rate to activity levels and sleep habits. After that, sophisticated computers sort through this data flow, identifying trends and possible anomalies. This feature enables medical professionals to monitor patients, act quickly when required, and guarantee treatment when required. AI's true power is its capacity to predict health issues before they become more serious. A subfield of artificial intelligence called predictive analytics can look at a patient's past, present, and lifestyle information. AI has the ability to predict health problems before they arise by identifying patterns and risk factors. This makes it possible to take actions like changing one's lifestyle or taking medication adjustments to prevent serious health issues. Proactive healthcare and AI-driven monitoring have numerous benefits. One notable advantage is improved patient safety. We can stop health problems from developing into more serious illnesses by identifying them early. This strategy not only improves patient outcomes but also lessens the burden on healthcare systems by lowering the need for prolonged inpatient treatment and emergency interventions. Preventing health problems before they become serious not only improves long-term health but also reduces the risk of readmissions to hospitals, making the healthcare system more effective and sustainable in the long run.

SUGGESTIONS AND CONCLUSION

With its promise of improvements in efficiency, precision, predictability, and personalization, with its enormous potential to improve patient care, diagnostics, and efficiency, artificial intelligence has the ability to completely transform the healthcare sector. But there are still a lot of obstacles to overcome before AI systems can be clearly held accountable. The intricacy of AI technologies and the requirement for more exact definitions of duty are two of these difficulties. A comprehensive strategy that incorporates artificial cognition, organized procedures, and human-driven regulatory frameworks is needed to guarantee efficient data and AI governance. Modern data architectures and reliable AI platforms that guarantee openness and moral decision-making are essential components of this strategy. By putting in place a data fabric architecture, policy orchestration can be efficiently streamlined, making AI audits less complicated and allowing for more dependable and accountable AI applications in the healthcare industry. Including AI ethics and principles in governance policies gives firms the ability to continuously examine and enhance their operations. To facilitate corporate and governmental monitoring of AI development and guarantee that the technology is developed and applied ethically, standardization is essential. Experts and authorities from the legal, technical, and business domains must be involved in this. The establishment of an ethical framework for AI that prioritizes patient empowerment, inclusion, and fairness should be the main goal as we negotiate the challenges presented by AI in healthcare. A future where AI improves treatment while upholding ethical norms will be possible with the support of such an approach, which will assist in fusing cutting-edge technologies with the fundamental ideas of responsible, compassionate healthcare. In a nation like India, where healthcare access and quality vary by location, artificial intelligence is more than just a tool for bettering healthcare; it is a force for change. AI has the potential to solve some of India's most urgent healthcare issues by facilitating early diagnosis, enhancing

telemedicine, customizing treatment, and enhancing healthcare in rural areas.[26] With AI's continued development, the incorporation of this technology into India's healthcare system promises a time when everyone, regardless of location or financial means, will have access to high-quality medical care. Leveraging AI technologies can enhance healthcare delivery to eliminate inequities between urban and rural healthcare access, overcome gaps in medical competence, and reach underserved areas. AI-powered solutions can provide rapid interventions, individualized treatment plans, and remote diagnostics, guaranteeing that people from all socioeconomic backgrounds get the care they require. In doing so, AI has the potential to completely transform India's healthcare system, making it more patient-centered, efficient, and equal. The secret to a healthier and more just future for India lies in combining human talent with technology.

AI is changing healthcare at a never-before-seen rate, from enabling remote patient monitoring to revolutionizing illness identification. AI systems that have been trained on datasets are showing great promise in identifying illnesses, which may lead to improved patient outcomes and treatment approaches. AI's ability to analyze patient data is enabling personalized healthcare, opening the door for individualized treatment regimens that meet the needs of every patient. By providing improved control and precision, AI-powered robotics is transforming surgery and resulting in shorter recovery times and less patient discomfort. However, as we move forward into this future, we must be extremely cautious when addressing data privacy issues and any biases in AI systems. In order to maintain equity, transparency, and patient data security. In the future, AI's potential in healthcare seems to be endless. It investigates AI's impact on improving healthcare outcomes, lowering costs, and increasing efficiency. The study also covers ethical, privacy, and regulatory problems, investigates implementation difficulties, and assesses AI's future potential in revolutionizing healthcare practices, focusing on technology integration and the responsibilities of healthcare professionals. AI has the potential to transform medication research and open the door to the creation of more potent treatment options because of its capacity to process and evaluate vast amounts of data. AI has the potential to revolutionize healthcare by improving patient outcomes, customizing therapies, and increasing diagnostic accuracy-all while providing previously unthinkable creative solutions. However, issues of data privacy, ethical considerations, and infrastructural limits must be addressed. The article recommends encouraging interdisciplinary collaboration, updating legislation, and investing in training to promote the appropriate and effective integration of artificial intelligence into healthcare systems Virtual assistants with AI capabilities may also be crucial in-patient education and assistance, encouraging people to take a more active approach to their own health care. AI's continued development in healthcare facilities is paving the way for a future in which preventive treatment is prioritized, making society healthier and more proactive.

Even while they lack the superpower's basic research and funding, emerging countries like India have benefits like a sizable engineering staff, a thriving startup culture, and a wealth of data that is just waiting to be used. India also possesses the will to establish a position for itself in a world driven by artificial intelligence and the entrepreneurial spirit to assist companies in extracting value from real-time data. The exponential growth in use will be ingrained and integrated into the Indian healthcare system with proper policy space navigation, coordination amongst many stakeholders, and greater advantages of AI among healthcare executives.

[26] 'Undefined' (*IndiaAI*) <https://indiaai.gov.in/article/revolutionizing-healthcare-in-india-the-transformative-role-of-ai-in-expanding-access-and-improving-care>