

## **Technological research in the healthcare sector is the need of the hour**

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Healthcare is one of the most important, largest, and fastest-growing sectors. According to Global Market insights the healthcare-tech industry is projected to grow at 17% annually between 2021 and 2027. The global COVID pandemic has shown the crucial role technologies can play in delivering healthcare services to the public at large.

COVID-19 pandemic forced us to use technology in healthcare and has proved that technology is time-saving and is more efficient in healthcare delivery and remote care. Artificial Intelligence (AI)-powered chatbots changed the mindset of the anti-vaccine community in Japan and young Americans by providing credible individualized pro-vaccine information to the people and increased the vaccine acceptance rate from 59% to 80%. During the peak COVID time, 80% of the patients were interacting with doctors through telehealth platforms, and in the pre-COVID era, telehealth was in rare usage at less than 1% of total doctor-patient interaction. It is certain that after COVID, telehealth will not go back to 1%. The Govt of India came with telehealth guidelines during this time only.

The leading technologies currently transforming the healthcare sectors are Artificial Intelligence (AI) and Machine Learning (ML), Internet of Things (IoT), Big-data analytics, blockchain, and 3D printing. Artificial intelligence (AI), often called "New Electricity," has resulted in a sweeping impact on improving and supporting the healthcare delivery systems, predictive healthcare analytics, preventive care, disease diagnosis, individualized drug therapy & dosing, positive behavioral change, and drug discovery. AI solutions can be used for healthcare predictive analytics by anticipating bad events before they occur, alerting healthcare providers to make timely decisions that can reduce or prevent the risk. For example, AI models can assist eye doctors (ophthalmologists) in the early detection of diabetic retinopathy. This can help doctors make early therapy decisions before it is blown out to an untreatable condition, ending in permanent blindness.

AI solutions can support the overworked healthcare workers in making timely medical diagnoses, minimizing the workload pressure, saving time, and increasing work efficiency. For instance, doctors are expected to deal with rising volumes of medical images (X-rays, CT scans, MRI scans, and histopathology images) and are expected to provide the reports faster and with better accuracy than before. Deep learning (DL) models can use this big data and support medical practitioners in making a correct diagnosis. For example, the US Food and

Drug Administration (FDA) regulatory authority has approved around 64 AI/ML-based medical devices and algorithms for integration in daily clinical practice.

Currently, AI-based solutions are being developed to identify patients who are at the risk of developing severe disease, identify people who have higher chances of developing heart diseases, identify patients who would develop severe COVID disease and hence, may require ICU care, identify patients who are at a higher risk of death (say as in cancer), and so on. Such technical solutions can support doctors in making decisions about the personalized preventive and treatment strategies for individual patients.

Preventive and individualized medicine helps to solve many healthcare problems. For example, especially in antibiotic drug resistance, it is possible to use an AI model to predict a patient's response to a drug, helping the doctors make drug therapy decisions. This can prevent drug resistance and also drug-dosing mistakes. For example, AI can be used in precision therapy for tuberculosis, the highest killer among infectious diseases after COVID in 2020. Such healthcare tech solutions can reduce the public health burden considerably. Moreover, a one-size-fits-all strategy for treating any disease with a drug is not an effective strategy. With AI Reinforcement Learning and Bayesian network-based algorithms, precision dosing can be determined that can make drugs safer and more effective. Such models can prove very effective in cancer chemotherapy, antibiotic therapy, epilepsy treatment, and kidney transplant therapy.

It is required for the drug companies to monitor the side effects of the newly-marketed drugs. In such cases, drug-owned companies are required to send a Periodic Safety Update Report (PSUR) to the regulatory authority once every 6th month for the first two years of the drug approval. This applies to vaccines as well. In India, COVID vaccination coverage has exceeded 158.88 crore doses. Without tech, it is impossible to timely monitor the vaccinated population. However, using mobile apps and BidData analytics, it is possible to monitor the side effects of any drug or vaccine efficiently.

Developing an accurate AI model, for any purpose discussed above, requires a large volume of labeled digital data. Currently, the healthcare sector alone generates around 30% of the world's data. In 2020, the total amount of healthcare data collected is about 2100 exabytes and it will grow faster at a 36% growth rate by 2025. This is 10% faster than the financial services and 11% faster than the entertainment industry. The problem in India is that data is collected mainly through non-digital methods. The Govt. of India took the initiative to implement the Digital Health platform, National Digital Health Mission (NDHM), through which citizens can store and retrieve the healthcare data by creating a unique health ID. Through NDHM, it is possible to keep all patients' digital-healthcare data at one place. By implementing the EHR with OpenEHR, SNOMED CT, FHIR APIs, Hospital digital health record data can be made interoperable. To tackle the ethical data issues, blockchain can be used to

store the digital healthcare data, where patients can be given ownership of their data and data can be used only with the consent of the patient. Further, blockchain can also be used to trace and track supply chain management that can counter fake drugs in the market. For example, recently, during the second wave of COVID in India, 7-9 different fake remdesivir (COVID drug) were circulating in the market. Distinguishing the fake vs. original drug was a big task for doctors, patients and regulatory authorities. Adopting the NFT (Non-Fungible Tokens) and blockchain can help counter such difficulties.

Presently, a number of healthcare tech publications are the results of medical and engineering research collaboration. Doctors know the challenges in healthcare, engineers can innovate the solutions, and the technology industry partners can translate it into a product. Therefore, doctor-engineer-industrial collaboration can do wonders in the healthcare technology sector. At present, the Govt. of India is pushing for indigineous solutions in the healthcare sector and is providing a lot of funding to researchers, doctors, and engineers to innovate tech solutions and to start-ups to translate these technologies to products. Such efforts can really make healthcare affordable and accessible to all and is the need of the hour.