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The evolving needs and importance of technology in global public health and healthcare

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Abstract
Healthcare is considered a renowned profession in modern science and deals with the prevention, diagnosis, treatment, and cure of various diseases or abnormalities. Healthcare is mainly delivered by healthcare professionals and is associated with various fields such as optometry, nursing, pharmacy, dentistry, midwifery, audiology, cardiology psychology, and so on. It also includes psychotherapy, hydrotherapy, pharmacotherapy, massage therapy, behavioral therapy, cognitive therapy and various other disciplines. Other systems of medicine such as Unani, Homeopathy and Ayurveda are also concerned with the prevention, treatment and cure diseases through various methods and keeping balance in life. The data is collected from various sources, surveys and literature. An extensive literature search was performed along with hospital visits to know various healthcare system technologies. The data is also collected from physicians and patients. The healthcare system mainly focuses on safeguarding the lives of the patients. All these prevention and cure aspects of modern medicine were initially achieved through naturopathy, Siddha, yoga, meditation, homeopathy, and later through physical consultation, medicines and injections and even operations. These all methods have now become much easier, safer and more convenient than earlier due to the use of science and the latest technologies in this field. Due to this advancement, integrating the patient's data, history, monitoring patient condition, online examination and treatment has led to the overall efficiency of the healthcare team. In the recent past, latest technologies have been observed in the medical fraternity such as robotic surgeries, artificial intelligence, websites, videos, m-health, and telemedicine. The application of technology for the healthcare needs is now popularly known as healthcare technology or simply health technology
These all technologies brought new revolutions in healthcare. Additionally, various body parameters and diagnoses of diseases, are measured by electronic methods such as mobile applications, portal technology, real-time tools, self-service kiosks etc. The present narrative review enlightens the readers with information about various healthcare technologies, their needs, uses, importance and the convenience they provide in the field of medicine and healthcare.

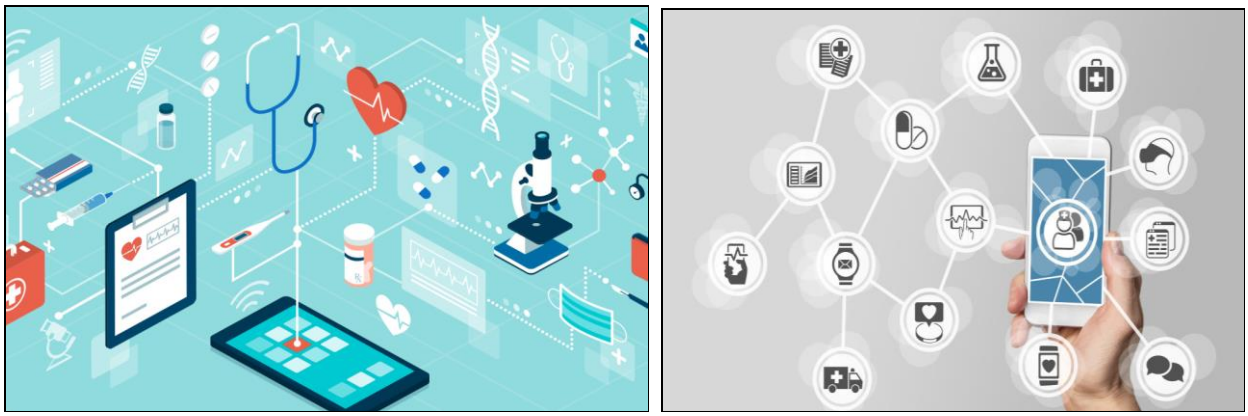
Keywords: M-health, telemedicine, artificial intelligence, robotics, healthcare

Introduction
The traditional system of medicine includes the prevention, cure, mitigation and treatment of diseases through the use of plants or extract, animal-based medicines, spiritual therapies, manual methods, yoga or exercises, meditation and other ritual practices. This system of medicine was so popular due to its safety, simplicity and cost-effectiveness. But at the onset of the 19th century, there was a dramatic increase in sedentary lifestyle, lack of exercise, and availability of packed and wrapped food and packaged drinks. The improved financial condition and easy and convenient method to obtain such things are responsible for the same [1]. Therefore, this eventually leads to various health-related ailments especially diabetes, hypertension and their complications which need immediate attention. Meantime, there was also advancement in the allopathic system of medicine. So due to more convenience, safety and quick, the popularity of allopathic medicines also increased. Other systems of medicines are now used parallel. At the onset of the 20th and 21st centuries, there was a complete revolution in the allopathic system of medicine with the latest advancements in technology, medicine, process, and cost-effectiveness. The use of technology has become so convenient for healthcare needs of patients. These include X-rays, MRI, CT scan, PET scan, digital watches for workout, reminders, robots, telemedicine, ECG, electronic and digital recording meters, mobile app, websites, artificial intelligence, and many more. The pathology tests are also conducted on digital platforms, and biomedical labs have sophisticated instruments [2]. The present review is an effort to highlight one by one some important technologies and their methods, use, needs, importance/benefits used in medicine and healthcare.

Examples of healthcare technology
- The electronic health record EHR)
- Mobile Health mHealth)
- Telemedicine/telehealth.
- Portal technology.
- Self-service kiosks.
- Remote monitoring tools.
- Sensors and wearable technology.
- Real-time locating services
- Pharmacogenomics/genome sequencing
- Robotics
- Artificial intelligence

Electronic health record EHR)
EHR is an application or software which maintains data of patient details in electronic form. This includes the patient's medical history, patient's problems, medication, follow-ups, progress notes etc. It also consists of patient demographics, billing data and administrative data, important body parameters, medications, patient histories, immunization dates, allergies data, diagnoses including all types of tests, radiology diagrams and images, lab results

and blood test results. It depicts all this data in one page in chart form on a computer page [3]. It is known as a record in digital that can tell us comprehensive and detailed health information about the patients. EHR systems are built to share information with other healthcare providers and organizations – such as medical imaging facilities, laboratories, emergency facilities specialists, pharmacies, and school and workplace clinics – so they contain information from all clinicians involved in a patient's care [4-8]. In India, the Ministry of Health & Family Welfare MoH&FW) has defined and circulated standards and guidelines of Electronic Health Record EHR) India in September 2013. HealthPlix is the first choice of EHR for more than ten thousand doctors in India and it offers 100% data security. In the USA about 96% hospitals have implemented a certified EHR system. Africa, Europe, the Middle East and other countries in Asia also use EHR system in healthcare clinics [8].



A B

Fig 1: A) Electronic health record B) m-health Courtesy: google images)

Mobile Health M-Health)

Mobile phones came into the market in the 1980s having good features and facilities. With the advancement in technology and software, it became popular soon and now it has multiple benefits and features. One of the benefit is related to the measurement of body parameters such as heart rate, step count and energy utilization. This mobile phone is now used for detecting health-related parameters such as ECG, oxygen level, and patient details by various software and apps. The National Institutes of Health NIH) defines M-Health as the creative use of mobile phones or other devices to improve health benefits and healthcare practices. Mobile health has become an increasingly important issue in several disciplines such as health communication, public health, and health promotion [4,8]. M-health is also known sometimes as Electronic health E-health) M-Health consist of various mobile apps, computer programs or software that track patient record, keep paperless documentation, keeps the history of patients, keep a record of previous treatment and tests, and tmonitors real-time patient vital signs. Healthcare providers can access patient's information anywhere, anytime through this technology. It is easy to change the dosage, drug and frequency of patient medication. The decision-making speed is increased with the help of such devices, especially for addressing emergency circumstances. M health technology is beneficial more for chronic disease patients who require regular and long-term services. More than 1, 65,000 technologies are available in M health including disease management, self-diagnosis, mental health, medication reminders, patient education etc. They have proved very beneficial in healthcare needs these days [9]. In India, several mobile health applications have come to light such as Practo, mFine, DocsApp, Netmeds, Lybrate, Medlife, Healthians and many more. Not only this, physicians are also using certain software for assessing the risk of coronary artery disease [9].

Telemedicine

It is also called telehealth or e-medicine. It is the delivery of health care services to remote areas or long away from physicians over telecommunication such as phone audio) or video calls through virtual visits. Due to Modern technology, doctors can consult patients by using compliant video-conferencing tools. It includes assessment, tests, evaluation, diagnosis, consultation and management of patient's problems without actual in-patient visits. It is one of the very convenient methods of healthcare services. Robotic technology is also one part of telemedicine in which a physician performs robotic surgery on a patient away from the physician. [10] One of the modest beginnings in telemedicine in India was made by ISRO Indian Space Research Organization) and was made with a Telemedicine Pilot Project in 2001, linking Apollo Rural Hospital at Aragonda village in the Chittoor district of Andhra Pradesh with Chennai's Apollo Hospital. Some telemedicine provides specialized services in rural areas and isolated communities. One such example can be a Doctor-to-Doctor telemedicine service under the Ayushman Bharat-Health and Wellness Centers scheme of the Government of India. Dr. Ganapathy, a prominent neurosurgeon and widely regarded as the father of Indian Telemedicine [10]

(A) B)

Fig 2: A) Telemedicine B) Portal technology courtesy: google images)

Portal technology

A patient portal is a website for the personal health care of patients. The online tool is very important and helps to keep track records of health-care provider visits, prescriptions, billing, test results, and so on. Patient portal system ensures the safety and security of all confidential data to protect the health information of patients. This technology helps to make non-urgent appointments, make referrals, update insurance and edit contact information. Patient portals can enable healthcare providers and patients to access electronic medical records easily and also enable patient-provider secure connection [11]. In India, the portal system is very important in keeping the records of patients safe and easily accessible. It is the same as that of mHealth and HER.

Self-service kiosk

These electronic computerized machines that help in mechanized check-ins, registration, token generation and queuing, online filling of forms, questionnaires, insurance status, payment of bills, outstanding bills, channelizing the time and physician etc. This kiosk does not requires any staff. They are available in a physician's office/clinic, hospital or any healthcare department. They are mostly touchscreen and more advanced kiosks can even able to perform diagnostic tests [12].

Remote monitoring tools

These are various instruments and machines that can check patient parameters anywhere, anytime and quickly. Patients monitor their health and record the data throughout the day at different timings, then electronically transmit the results via messages to their clinicians or technicians [1]. This is called remote patient monitoring RPM). There are multiple benefits to such kind of technology. First clinicians can get data easily and readymade, they can deliver the prescription to patients instantly or advice to visit clinics, with lower cost and more efficiency. E.g. In the COVID-19 pandemic various people purchased oximeters and B.P apparatus and recorded vital signs such as BP and oxygen saturation. Oximeter is included in various health packages of COVID-19 kit. The other examples are weighing balance, stethoscope, thermometer, and glucometer which we can use at home [2-4]. The self-service kiosk is very beneficial and easy to handle. In India, various clinics and hospitals are now available with self-service kiosks in which various health parameters can be easily determined. Patient weight, blood sugar, hemoglobin determination, BMR, oxygen level, body temperature and blood pressure can be monitored [4].

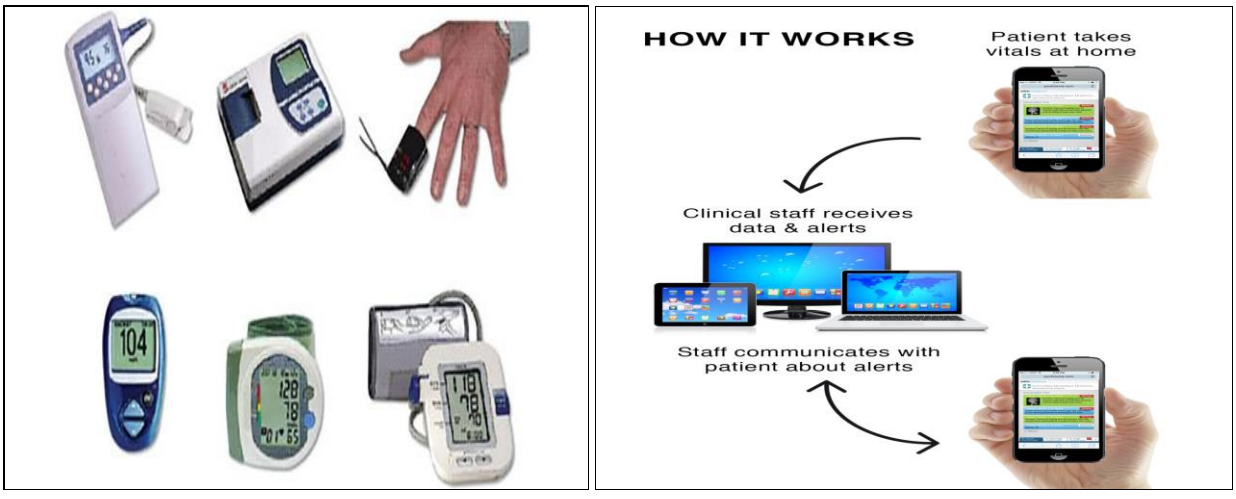


Fig 3: Remote monitoring tools courtesy: google images)

Sensors and wearable tools

Wearable technology literally means the technology that is wearable on the body. One form is wearable fitness trackers, which keep track of user's physical activity and heart rate. They provide wearers with fitness and health recording by synchronizing to various smartphone apps. E.g. apple watch, Fitbit, Samsung Health, smart jackets, other gadgets etc. Some wireless communication involving the use of satellite is also used now for healthcare systems [13-14]. Firebolt, Noise, and boAt are the most commonly used wearable smartwatches in India. They accounted for about 70.8 % share of the total smartwatches in 2022. Nexxbase Noise) dominates India's smartwatch market with a 27.2% share. Realme, and Noise are also used in India. Apple is the largest wearable brand in the World[14]

(A) (B)

Fig.04 A) Sensors & wearable technology B) self-service kiosk courtesy: google images)

Real time locating system RTLS)

This is a new technique in healthcare that provide real-time tracking of the patients, management of medical equipment and the nearest clinic or hospital to the physician. This system is useful in the emergency condition of the patient and helps the physician to provide urgent help to the patient[15]. This system is very rarely used in India. The main drawback of this system is network connection failure, traffic congestion, signals, population and lack of traffic rule awareness. But still, the patient in emergency condition can be tracked by the hospital through RTLS to provide immediate treatment [15].

Fig 5: Real time tracking system courtesy: google images)

Pharmacogenomics/pharmacogenetics

It is the research field in medicine that how a particular person's genes affect responding to medicines. Physicians select such drugs which best suited for a particular person in the management of the diseases [16]. It is a part of precision medicine, in which the particular patient is treated individually. Genes are present in DNA and responsible for building protein molecules. Various diseases are traced by abnormalities in the genetic makeup of a person. The scientist knows the working of drugs. Pharmacogenomics mainly concerned with the gene variations for these proteins. Pharmacogenomics also helps in deciding the possible side effects, exact dose, and differences in effectiveness or efficacy for people who are having variations in certain genes. Various drug companies use pharmacogenomics to market and develop drugs depending on specific gene profiles. Researchers have identified gene variants that affect how people respond [17] The work on various genes, genomes, and DNA is constantly carried out in different parts of the countries through collaborations. Various companies have also tie-ups with hospitals in the metropolitan cities to carry out various research on the gene, DNA sequencing etc. Some companies are developing new tools for the treatment of genetically determined diseases including diabetes, cancer in India. Similar works are going on the Middle East, Africa, and America [17]

Robotics

Robotics in healthcare started about 15 years ago. Smarter and more comprehensive care can be provided to patients by medical robots. Several routine tasks such as drawing blood, observing vital signs, producing 3D images of body parts,

locating veins, maintenance of sanitation and disinfections, in orthopedic department for intensive therapies etc. Robotics are also used to perform various non-invasive or minimal invasive surgeries providing shorter recovery time and more reliable outcomes. It is also used in endoscopies and telesurgeries. The main intention is to provide and improve human health and to reduce human efforts [18-19]. India holds 10th place in robotics and robotic technology. Indiafirst Robotics, are well-known, renowned and reputed name in the year 2002 in the market of Pune Maharashtra). Manav meaning "human") is a humanoid robot built in India in late December 2014 by Diwakar Vaish Head of Robotics and Research, A-SET Training and Research Institutes) in the laboratory of A-SET Training and Research Institutes. Dabbala Rajagopal "Raj" Reddy born 13 June 1937) is an Indian-born American computer scientist and a winner of the Turing Award. He is one of the early pioneers of artificial intelligence and has served on the faculty of Stanford and Carnegie Mellon for over 50 years [18-19].

Fig 6: Robotics in healthcare courtesy: google images)

Artificial intelligence AI) in healthcare

More accurate diagnosis and treatment can be provided in the healthcare field using Artificial intelligence. In this, drug development, personalized medicines, patient monitoring and care are used using machine learning models. Due to this advancement in healthcare technology, rapid accurate data collection and data processing is possible. This is also useful in keeping a record of genomic sequences, health, natural language processing and computer vision, precisions in robotic surgeries etc. Further detection of various diseases in the fields of cardiology, dermatology, gastroenterology, oncology, pathology, ophthalmology and psychiatry is possible using AI [20-24].

India is familiarizing itself with AI technology and trying to fix its foot in the AI industry. AI has spread the branches in almost every sector of Pharma and healthcare, and is expected that it will become an integral part of almost all industries. Many of the healthcare works are carried out through AI. This includes diagnosis, targeted treatment, medical records etc [24]

Future of technology in healthcare

There are predicted to be more than 10 million apps accessible worldwide to support patients in leading healthier lifestyles by 2021. In 2021, offering medical solutions through mobile applications will become a growing trend. It makes sense to let your smartphone determine whether you're leading a healthy lifestyle given that the average Millennial spends 5.7 hours per day on their phones and a startling 13% spend more than 12 hours). In 2017, the market for healthcare apps was only estimated to be worth $2.4 billion globally. It had already increased significantly to $40.05 billion by 2020. From 2021 to 2028, this is expected to increase by a further 17.7%, according to experts. If this pattern holds, the market's estimated value in 2028 might reach a startling $125.32 billion.

The future of healthcare holds many opportunities, and medical technology will play a major role in ensuring that we can address all the biggest health challenges we face. We often think of healthcare jobs as very labor-intensive. For example, doctors and nurses spend a lot of time and manual labor caring for patients. It is new medical technologies that are enabling medical professionals to make progress in the field, helping more patients and fighting new diseases. This article examines global healthcare in its current state and how the industry has changed over the past decade, then discusses seven promising emerging healthcare technologies [25].

Conclusion and implication for translation

Healthcare technology is any method involving various tools, apps, AI and robotic technologies or software designed to accelerate administrative and hospital productivity to provide overall quality of life. The precision and accuracy in diagnoses and treatments are comparatively more by using these healthcare technologies. Patient waiting time in registration and routine common procedures are very efficiently and effectively carried out using artificial intelligence and robotics. Health record is also kept digitally so that doctor can access them anytime and anywhere. Technology has the power to change a variety of sectors, including healthcare. These all technologies need highly skilled and experienced employees with extensive education, it also need high infrastructure and equipment requirements. Global population growth and rising life expectancy create a highly competitive market for healthcare innovation and technology. However, since it seems that industry innovation is quite powerful, the

scenario seems to be changing every year. We conclude that the use of healthcare information technology improves patient safety by minimizing adverse drug reactions, increasing adherence to advised practices and reducing medication errors. Health technology is a vital instrument for improving the quality and security of healthcare, and there should be no doubt about that.

This will help in getting all the healthcare data of patients very easily. Therefore, healthcare technology has proved very excellent tool in the healthcare of patients.

Conflict of interest

The authors declare that there is no any conflict of interest in the publication of this paper.

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