Future of Healthcare using AI and ML

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Future of Healthcare using AI and ML

6.1 Evidence based medicine, Personalized Medicine, Connected Medicine, Digital Health and Therapeutics, Conversational AI, Virtual and Augmented Reality, Blockchain for verifying supply chain, patient record access, Robot - Assisted Surgery, Smart Hospitals
Book: Arjun Panesar

Evidence based medicine

Randomized controlled trials (RCTs) are deemed as the most robust and reliable form of evidence for assessing the efficacy of a treatment. Evidence demonstrates that **many factors can influence the reliability of RCTs, including methodological quality, reporting quality, and source of funding**. Pharmaceutical companies fund the majority of clinical research that is undertaken on medications and face a conflict of interest.

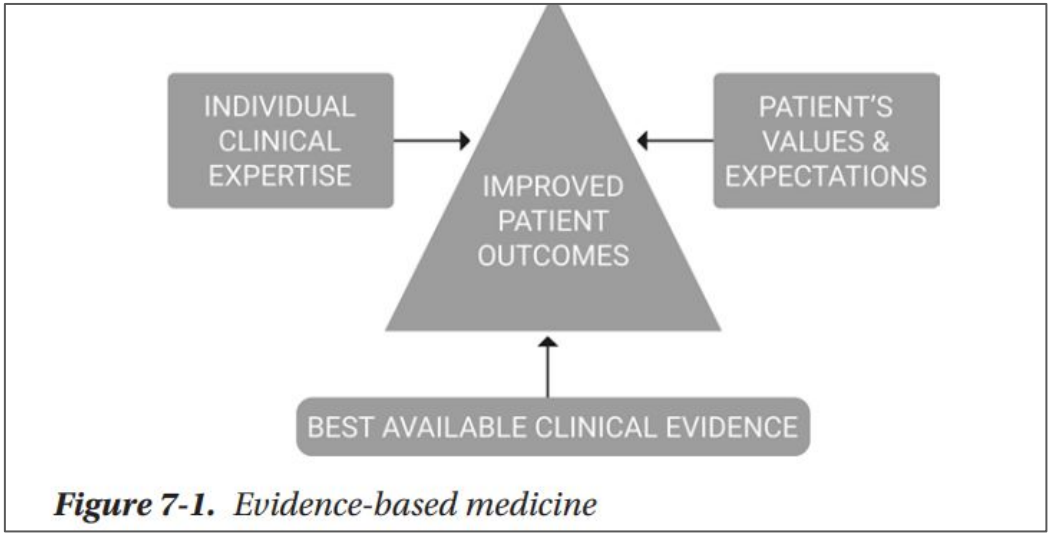

Figure 7-1. *Evidence-based medicine*

Evidence based medicine

Datafication of human experience through mobile phones, social media, digital communities, health apps, nutrition tracking, wearables, and health IoT has empowered patients to become their own evidence base and influence healthcare academia and understanding.

For example, a trial for type 2 diabetes medication may focus on people who have type 2 diabetes only and no other comorbidities; whereas in the real world, the comorbidities of hypertension and high cholesterol are often present in people with type 2 diabetes.

This approach means there is often **a gap** between what is reported in RCTs and what is reported by patients. This is where digital technology can help bridge the gap between **pharmacological intervention and real-world patient experience**. Digital communities, for example, can provide real-world evidence on **medication side effects.**

As an example, health community Diabetes.co.uk provides medication side effect data back to pharmaceutical organizations through a mobile application in the form of analysis of patient discussion and reported side effects. The world's second-most commonly prescribed drug for diabetes, Metformin, for instance, has a side effect of diarrhea reported to affect 1 in 10 people taking the drug. Real-world evidence from Diabetes.co.uk members demonstrates this is 400% more common and reported by over 48% of people with type 2 diabetes

Evidence based medicine

As David Sackett said, “**half of what you learn in medical school will be out of date in 5 years of your graduation; the trouble is nobody can tell you which half.**

The most important thing to learn is how to learn on your own.”

Patients now use the Internet, themselves, and their peers as the evidence base; and ubiquity of real-world evidence and AI in healthcare means that healthcare professionals can **no longer be ignorant to change in the evidence base and biased toward old paradigms.**

This data is a wealth of opportunity for AI and machine learning. **Healthcare can adopt a data-driven approach, utilizing a variety of data sources to improve the patient experience and reduce costs.** The exploration of this data over the ensuing decades will significantly progress healthcare and facilitate precision medicine.

Personalized Medicine

Personalized medicine, also known as **stratified or precision medicine**, is an approach that stratifies patients into groups and makes informed clinical decisions for the delivery of treatment and interventions based on the patients' anticipated response.

For example, our genetic variations determine how our bodies would respond to a particular drug. One drug might not fit everyone's requirement.

Connected Medicine

Wearables and the IoT hold the key to connected medicine. Data captured by sensors in these contraptions are playing an increasingly powerful role in healthcare, facilitating the development of patient centric healthcare systems.

Many factors are accelerating the acceptance of wearable healthcare solutions, particularly their use in clinical trials and academic studies to monitor patient health and lifestyle factors.

For example, studies can record participants' health vitals using an Android Watch, Apple Watch, Garmin, Fitbit, or another smartwatch device.

Participants use apps to record their lifestyle habits, nutrition, activity, and medication adherence and to monitor medication side effects among others.

Wearables and patient data are beginning to be used by insurance companies to incentivize wellness. Insurance companies have historically targeted such insurance products toward digital-savvy buyers, offering the latest gadgets to incentivize health improvements.

Digital Health and Therapeutics

Digital therapeutics, or digital health, is an enhanced form of telemedicine that **brings together digital and genomic technologies with health, lifestyle, and human factors to deliver personalized medicine to patients, enhancing the efficiency of healthcare delivery**

Conversational AI

Conversational AI refers to systems that can talk. Rather than a user interface based on text or code input, individuals can interact with conversational AI system with their voice. Users are increasingly using chatbots to communicate with products and services. Voice-driven AI such as Amazon's Alexa can synthesize natural language to provide recipes or exercise tips, order products, or call a cab.

As AI chatbots develop, so too are their capabilities. **Intelligent personal assistants** will act as healthcare assistants. By virtue of being voice-controlled, there are immediate applications for those less-abled, where only the voice needs to be used to perform tasks or instructions.

For instance, **new parents** could bombard a conversational AI with questions without fear of embarrassment or consuming healthcare professional's time. Questions such as what temperature a baby should bathe in, how often a baby should sleep, or whether there are developmental milestones taking place can all be instantly answered by an AI speaker. Many individuals turn to search engines to find the answers to their questions.

Conversational AI

Five Prerequisites for Implementing Conversational AI in Healthcare

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Conversational AI

With the assistance of a medical AI chatbot, patients can receive immediate assistance.

Continuing the preceding example, if a child's new parents had a medical question or were concerned by a symptom (say, a chesty cough), it would be burdensome for them to visit the doctor for a response to every question. However, there is a need for medical confirmation. This cannot currently be detected through algorithmic means; and hence, the evolution of conversational AI in healthcare will be digital health assistants supported by and learning from healthcare teams and the world around them.

As conversational AI develops, cognitive systems will analyze conversation to detect early signs of mental, physical, or neurological illness. Voice-enabled devices such as Alexa will one day be able to identify symptoms of Asperger's, anxiety, psychosis, schizophrenia, and depression from conversational tones. This will assist doctors to predict better and monitor and track disease. Imagine how much time and resources will be saved when **virtual assistants, healthcare chatbots, and digital tools give answers to basic medical questions** that do not require the intervention of a medical professional

Virtual and Augmented Reality

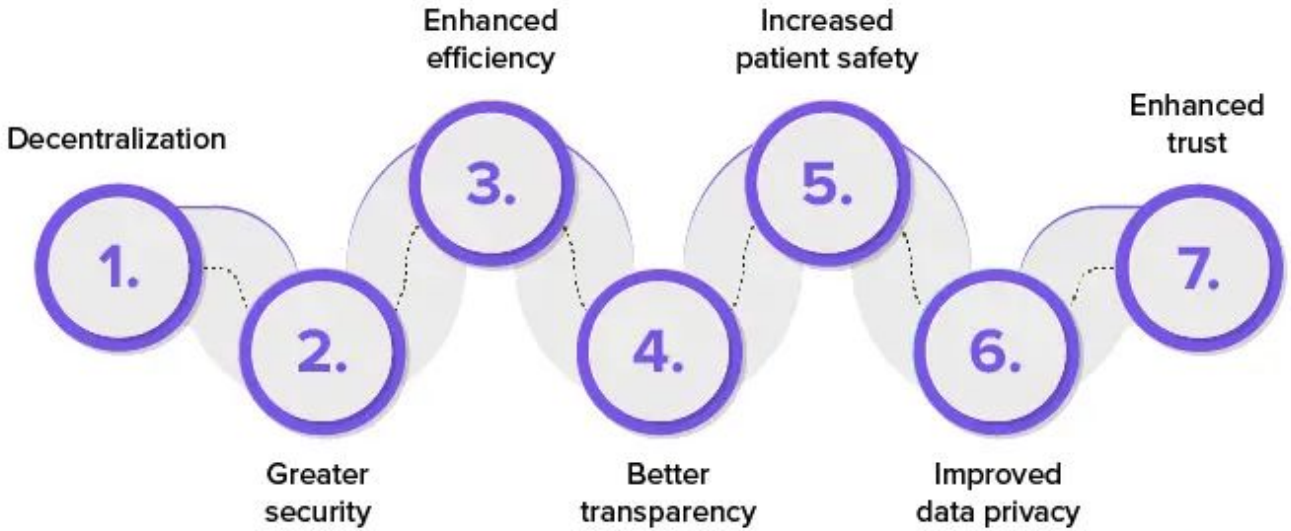
Blockchain for verifying supply chain

Transitioning of traditional patient health records to the EHR is considered to be enormous progress for healthcare. The digitalization of patient records mitigates some of the traditional risks of centralized data stores. However, this model still places the medical records in the hands of the provider. Blockchain technology, popularized by the bitcoin cryptocurrency, has the potential to revolutionize data access, privacy, and trust.

PayPal, Visa, and Mastercard, for instance, act as central authorities for financial transactions: trusted institutions that act as intermediaries.

Blockchain technology aims to solve data management, privacy, and security issues, improving interoperability and easing the flow of data between doctors, hospitals, healthcare systems, and insurance providers through the use of a decentralized, immutable database.

Benefits of blockchain in the healthcare supply chain



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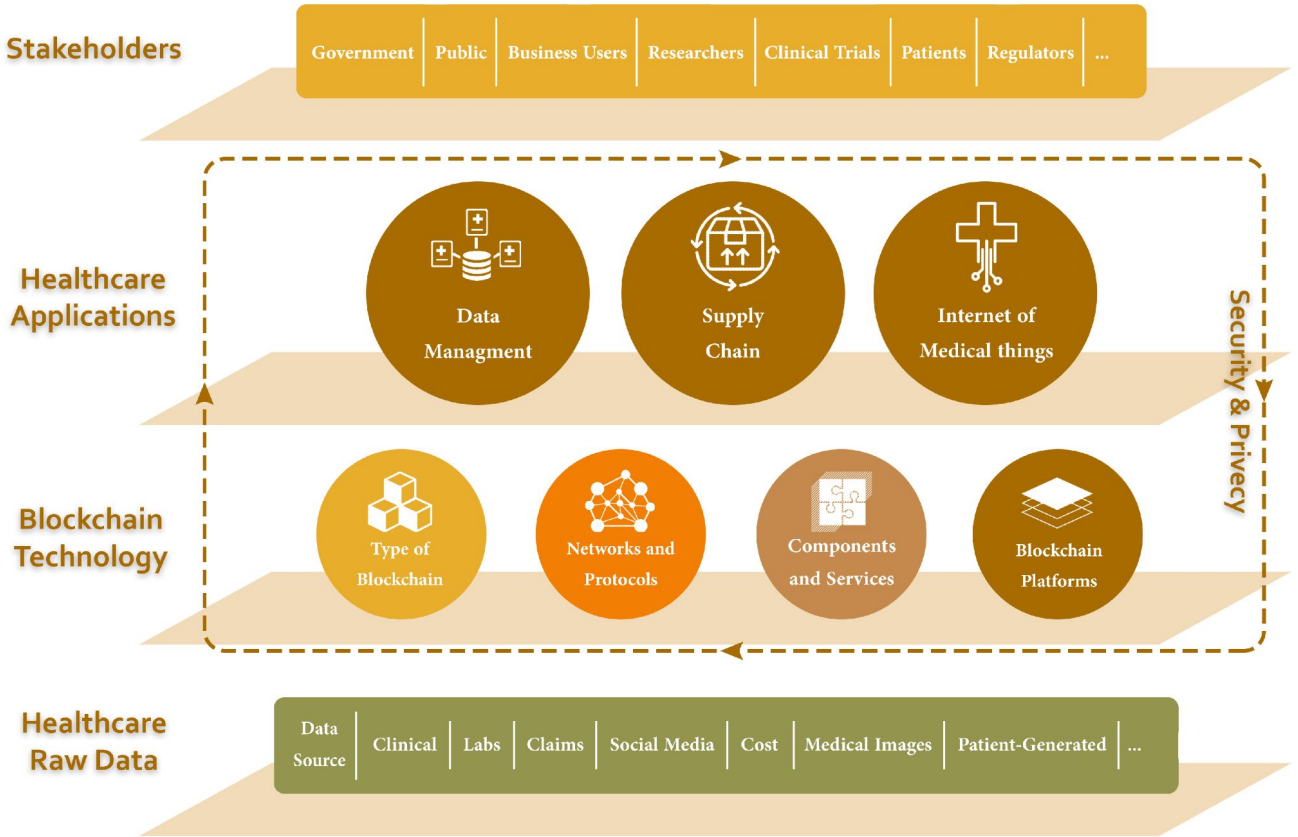
Blockchain for verifying supply chain

Through creating a common, distributed, immutable database of healthcare information, doctors and healthcare providers have the potential to access medical data from any system, with improved security and privacy, less administration, and better sharing of results.

- Single points of failure are eliminated by decentralizing and encrypting the data.
- The blockchain is democratized. Anyone can contribute or store a version of the truth.
- Through ensuring consensus on events, the most likely version of the truth is held
- A transparent and auditable ledger of events is provided through time-stamping.
- Game theory, crypto-economics, and hashing incentivize good behavior and ensure the events are without censorship.

Blockchain for verifying supply chain



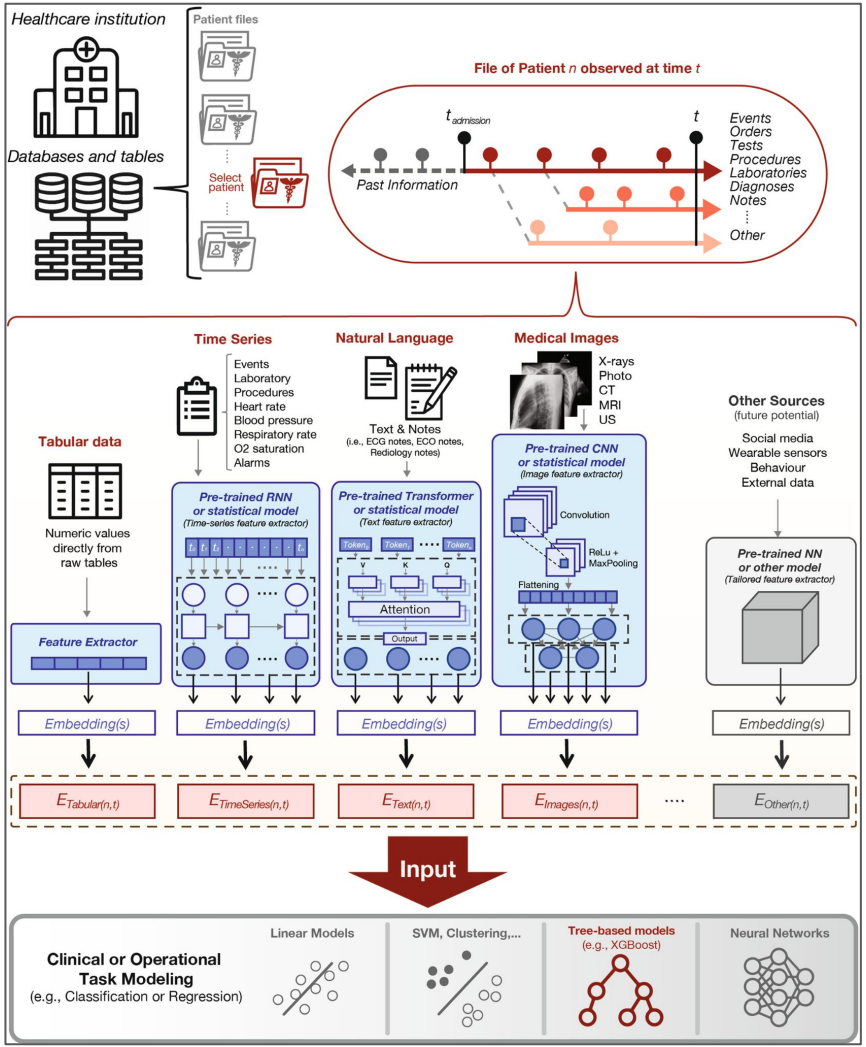
Patient record access

Patients are demanding access to their health record.

This poses a significant challenge as to how to best share sensitive medical data with unknown third parties. For third parties, there is also a challenge to verify the integrity of the data while ensuring privacy for the patient. Presenting patient records on an appropriately permitted blockchain would give cryptographic assurance on data quality without any need for human involvement. Providers or consumers uploading health data would generate transactions. Users provide a signature and timestamp, alongside a private key to access data. By using digital signatures, all records stored on the blockchain can be identified and used to create a comprehensive patient health record. The use of digital signatures and cryptographic encryption ensures data travel securely and are accessible only by those with the relevant public keys.

By using blockchain technology, each addition to the EHR can be logged, with an immutable, auditable trail of transactions, while ensuring the most current version of the record is used. Patients would be able to verify all attempts to access or process data. Blockchain’s decentralized structure enables any approved stakeholder to join the ecosystem, without the need for data integration or manipulation concerns

Patient record access



Robot - Assisted Surgery

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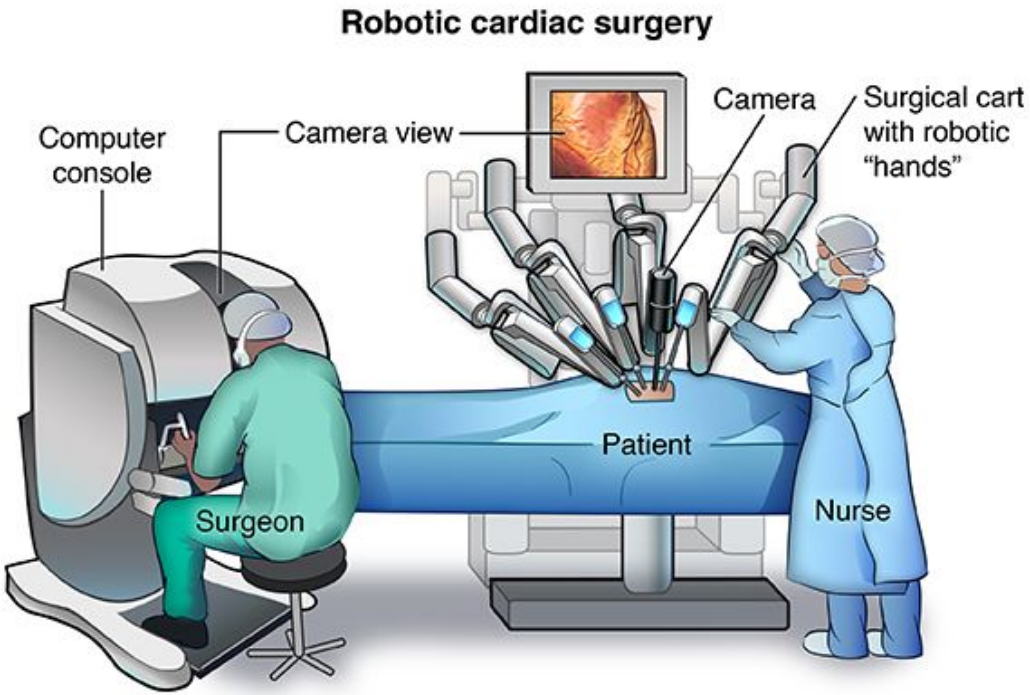

Smart Hospitals