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# TECHNOLOGY AND ARTIFICIAL INTELLIGENCE IN HEALTH AND EDUCATION.

Dental Science

**Dr. Geetanjali Jadhav*** Research Scholar, Symbiosis Centre for Research and Innovation, Assistant Professor, D Y Patil Dental School. *Corresponding Author

**Dr. Pritesh Gawali** Assistant Professor, D Y Patil Dental School

**Dr. Anand Shigli** Professor and Dean, D Y Patil Dental School

**Dr. Priyanka Garje Vaidya** Junior Lecturer, D Y Patil Dental School

**Muskan Singh** Intern, D Y Patil Dental School

## ABSTRACT

The blockchain is comparatively a new technology used to store and verify transactions records for online cryptocurrencies like Bitcoin, Ethereum etc. The system is distributed and superfluous making it difficult for the transaction to be faked or rescinded. The other implications of blockchain technology include healthcare and educations and research libraries.

Telemedicine and blockchain share a common objective of empowering an individual by amplifying the workflow for the practitioner as does the clinical investment. This model works by elimination of the middle man hence it is both value based and patient centric.

This strategy empowers the patient to make better health choices, have greater access to healthcare and dropped medical costs by making facilities available when needed instead of waiting until its necessary. There is an improvement in quality of each visit as the data gathered is meticulously stored. Additionally an incentive model can be structured based on its ability to accelerate an economy of scale.

Using cashless mode for payments in the form of cryptocurrencies is not novel. Standardization of any process has its advantages and disadvantages. Periodic access to healthcare allows early diagnosis of the disease or the condition and hence lowers the cost of treatment for patients, practitioners and insurance companies.

Blockchain has a long way to go before being incorporated into the field of health and education. However it may evolve faster if focused on direct patient value based model. Understanding this technology could lead us to achieve prompt diagnosis, refine focus and even better the administration.

## KEYWORDS

Technology, Artificial Intelligence, Health and Education, Blockchain, Dentistry

**Introduction:**

In today's era, where the power of information is the validated and unparalleled, information needs to be substantiated. The question of accountability must also arise for the misuse of information. Blockchains aid to solve these problems by forming a digital ecosystem which self-audits the transactions that occur. The transactions are called “blocks". The ecosystem has two significant features which are transparency and security.

Blockchains are utmost secure since the information inside them can only be edited after solving complex cryptographic algorithms. The cryptographic mathematics is almost impossible to hack as the hacker in question is required to overpower and hack nearly 51% of the computer nodes that are running the ledger simultaneously. This would require an incredible amount of computer resources and power.

Block chain technology can be thought of as a databank where anyone with connected to the internet can view it. People can view every transaction that has occurred but not edit or change it. Therefore blockchains decentralized because there is no middle man to keep the archives; instead the archives are kept by the internet.

**Blockchains and cryptocurrencies:**

The blockchain is the main innovation in technology of the cryptocurrencies namely Bitcoin. In 2008, a visionary going by the name Satoshi Nakamoto introduced the first blockchain for Bitcoin. Bitcoin isn't governed by a central authority, instead the users validate and dictate the transactions when an individual pays another for services and goods, making the need for a third party to process or store payments redundant. The whole transaction is publically archived into blocks, eventually leading to the blockchain, where it is relayed and verified by other cryptocurrency users.

According to the Bitcoin procedure, a blockchain spreadsheet is shared by all nodes that are a part of the system. After logging on to the network, each connected system receives a copy of the blockchain, which contains archives and is used as evidence for every transaction ever performed. It can therefore give insight into things like data, how much value belonged to a specific address at any given point in the past.

**Blockchains in Dentistry:**

Outside of Bitcoin, blockchains have administered their place in a variety of fields such as healthcare, healthcare management, real estate, supply chain management, government, car industries etc. Blockchains can make any industry or institution that requires some type of maintenance of archives more transparent, reliable, secure and efficient. In the area of dentistry, blockchains can construct a decentralized system which can record patient details, treatment history and payments made for all institutes. This removes the need to enter into the case paper at each visit to the clinic and it's more convenient for patients to access their records. It is also a more cost-effective protocol for the clinics.

By introducing blockchains into their databanks, the dental industry will be saving money and resources on human effort and the cost of keeping paper records. They will also gain from blockchains being unchangeable means that no false claims can be made. This is a very crucial aspect of executing blockchains. “A thorough knowledge of dental records is essential for the practicing dentist, as it not only has a forensic application, but also a legal implication with respect to insurance and consumerism.”[1] - Dr. Charangowda 2010. This is a revolution that introduces the highest level of accountability by human errors, deficient transactions and issues with consent of exchange.

Focus on quality health care services means making sure patient health is at a utmost level. However, government rules and regulations are making processes more tiresome and at length. Therefore, keeping such protocols intact and still providing functional patient care is not possible in many cases. The most common issue in providing quality healthcare management is the gap between payers and clinicians. Dependency on a third party makes the system more complicated.

In healthcare management, critical patient statistics remain scattered across different systems in different departments. Therefore, data might not be available when needed. The current healthcare protocols

are incomplete as the system is not equipped to handle multiple protocols smoothly. Moreover, it is also insufficient for handling the exchange of data and needs certain changes.

Clinical data is often misused, although the organisation may be fair in terms of the economy inadequate ill equipped processes make it impossible for them to provide better quality care to the patients. Due to this more than half of clinical trials or cases in India are unreported, unless registered on the clinical trial registry India. Records filled up manually have misleading and error filled data.

Many systems used for data keeping are out dated and just maintaining their functionality consumes time, resources and economy. Another resource-consuming and lengthy process that results that are not economical in the healthcare sector is Health Information Exchange. Since patients don't have any control over their records, the possibility of identity thefts, financial record crimes and spamming are rising every day.

This system would be accessible by all the individuals with internet involved in the process irrespective of which electronic medical system is in use. This offers higher transparency and security while allowing clinicians to find more time to devote to the patient care and their treatment. Moreover, it will also allow better sharing of data and statistics of researches which, in turn, would clear the way for clinical trials and treatment therapies for any rare oral disease.

**There are two types of blockchains[2]:**

**Permissioned blockchains.** – This shows real time data shared with permissions. It is accessed by an individual involved in the system and has access to the network. Usually used in organisations and institutes. Once the data is processed it becomes a permanent record and gets added to the chain. This is ideal for the healthcare industry.

**Permissionless blockchains.-** can be accessed by anyone having a website created using their network address .

Holding properties like inflexible, decentralization and trustlessness, the distributed technology of blockchain provides the healthcare industry with opportunities to identify fraud, reduce cost of operation, regulate the process, remove replication of work and apply through transparency in the healthcare process. The cases that effectively use the potential of the technology and could make the healthcare sector more secure, reliable and accessible.

**Community Health Data**

Community health data is the medical information of a particular demographic variable. For example, it may be health risk information men suffering from oral cancer in the group of 25–40 years. To understand the risks across a vast and varied population, the records is usually provided in a total anonymous form and no details such as names are revealed in these cases.

**Decentralized Healthcare Setups**

The current healthcare process and sectors operate through one single central databank. This databank is managed by one individual in the organization. With this approach, the point of error also comes to one single point. In such cases, if an anti-social element or hacker hacks the system, the overall database can be accessed and would put the patients as well as the institution in harm's way. Blockchains have multiple access levels and ledgers with encryption making it almost not susceptible to external attacks[3].

**Payments using Cryptocurrencies**

Another adoptable benefit of Blockchain in healthcare sector is the use of cryptocurrencies as payments in place of cash or plastic money. Through blockchains, not only will it help with eliminating fraud but also automatic bill processing will remove the third parties payments from the process and reduce the overall administrative costs. Moreover, when larger organisations will adopt payment processing through cryptocurrencies, a shift could take place. The money is track able and lessens frauds.

Dentacoin is a blockchain solution for global dental industry was introduced by Dr. Dimitar Dimitrakiev in 2017. 1800 dentist worldwide are a part of this system. The motto of this process is shift of paradigm from sick care to preventive care. Currently (data as of in 2018) the network connects 80 dental labs, 190k subscribers and 1.8k dentist in its ecosystem. There are around 40k dentacoin token holders and has a credited 175k transactions to its name. All of its data is transparent, decentralized and secure[4].

**Drug Tracking:**

Counterfeiting of medication along with fake drugs in the provider chain constitutes a huge loss of billions of dollars per year. According to a Health Research Funding Organization (HRFO), report, almost 10 to 30 percent of medications in developing countries are not original. As per the data, medication counterfeiting causes deaths of hundreds and lacs of people who take the wrong medicine. Distribution of counterfeit drugs is one serious problem in the pharmaceutical sector. Blockchain can increase the security as every new transaction added is a permanent record and can be time-stamped and cannot be altered. The authenticity of the drugs/medication can be assessed as the data is available on the ledger after it has been registered by the companies. Hence there is transparency in the path of production to distribution and fake drugs can be tracked down.

**Clinical Trials and Safe Data Storage:**

Clinical trials are designed in order to analyse and ensure the efficacy of any particular drug that is proposed and developed for curing a specific pathosis. Based on a hypothesis, the proposed medicine can be tested and based on the outcome of the trial , they can be introduced on a larger scale. Therefore, in order to carry out a clinical trial, extensive amounts of databanks are required. The researchers focus on these databanks and conduct regular experiments under different circumstances to generate data, reports, statistics, and efficacy ratio. Based on these, the data set is analysed and further decisions are made. Pharmaceuticals may record and modify data that either interests them or has a certain benefit towards the pharmaceutical space. This bias can be eliminated by recording the data in the blockchain for more transparent and effective trails. Everything from the informed consent, study plans, rules and regulations etc. need to be time-stamped. This increases the credibility. Gives access to the digital foot-prints. Lessens the cost of file loss and replacement and audits.

**Patient Data Management**

The patients have to share their health records or information with the dentist as well as the pharmacist while buying medicines. Additionally, the rise in the number of patients has seen more data management by the healthcare sector. This growing data set leads to ambiguities in managing patient information within hospitals, clinics and teaching institutes.

Blockchain system comes with patient ID's. A blockchain would permit the patients to release limited data, the necessary data could be revealed to the third parties while keeping their identity anonymous. The time duration and access permissions for data set sharing with third parties could also be managed by the patients.

**Centralized Libraries:**

Blockchains can be used to build databanks and extensive metadata centres, protect digital sale rights, connect a network of university libraries making learning more efficient and effective, support communities like a combination of software developer and dentists, facilitate peer-to-peer sharing, facilitate networking between organisations and institutes eg: universities and museums, skill train professionals as this would be transparent, decentralised and authentic[5].

To conclude, the potential of blockchain in healthcare industry largely depends on the adoption of the advanced technology within the healthcare system in order to design technical infrastructure. Though there are definite concerns and conjectures' regarding Blockchains implementation in the current healthcare ecosystems and its cultural acceptance, the technology is still popular in the healthcare industry.
It has taken the healthcare sector by storm over the past year and many solutions are being developed to make it more adoptable. With so many potential possibilities and uses, blockchain is sure to make a place in the healthcare ecosystem landscape for the better good.

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