

The Exploration of the New Mode of Medical Consortium under the Development of Modern Internet Technology

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Abstract: The government work report for 2020 clearly points out that China needs to develop “Internet plus medical health”. However, the current medical consortium is facing a series of problems: high operating costs due to internal geographical isolation, and low efficiency of medical data management and sharing. Under the current Internet technology conditions, these problems can be solved by using telemedicine technology to break geographical isolation and thus reduce operating costs. Blockchain can also be used to realize low-cost and safe storage and sharing of medical data. This paper aims to analyze the development pain points and causes of medical consortium in China, and reshape the new model of medical consortium by virtue of the advantages of telemedicine and blockchain which are subversive to the medical industry.

1. Introduction

In 2018, the Opinions of the General Office of the State Council on Promoting the Development of “Internet plus Medical Health” clearly pointed out that medical consortium should be encouraged to provide two-way referral, telemedicine, telemedicine education at the grass-roots level with the help of artificial intelligence. We will promote real-time access and mutual recognition and sharing of examination results among medical institutions within medical consortium; We will promote the establishment of an orderly tiered diagnosis and treatment system to ease the difficulty of getting medical treatment for the general public. Medical institutions are encouraged to cooperate with Internet enterprises to strengthen the integration of regional medical and health information resources. On October 24, 2019, at the 18th group study session of the Political Bureau of the CPC Central Committee, General Secretary Xi Jinping emphasized “accelerating the development of blockchain technology and industrial innovation”. In view of this, this paper applies telemedicine and blockchain to the optimization of medical consortium mode, which has policy feasibility.

2. Construction Status and Operating Pain Points of Medical Consortium

2.1 Construction Status of Medical Consortium

In 2012, The 12th Five-Year Plan for The Development of Health Undertakings in China emphasized the clarification of hierarchical functional positioning of medical institutions, and formed a new medical alliance model under the hierarchical medical system.^[1] On January 23, 2017, the national health development planning commission (now the national WeiJianWei) issued “about carrying out medical association construction pilot work guidance”, points out that we should accelerate the construction of medical couplet body. By 2020, all the tertiary public hospitals in China had participated in the construction of medical consortium, and there had be 1,408 urban medical groups and 3,346 county medical communities.

2.2 Operating Pain Points of Medical Consortium

2.2.1 The Operation Cost of Medical Consortium is High

2.2.1.1. High Cost of Offline Referral

Two-way referrals within the medical consortium are conducted offline, and generally referred patients need to go to the receiving hospital for consultation by themselves. For patients with special upward referral, such as critical and urgent patients, the hospital shall be responsible for the referral. Additional costs such as transportation expenses and patient care expenses during the referral increase the actual cost of the referral. Travel along the way of referral will delay the patient's time to see a doctor and bring secondary harm to the patient.

2.2.1.2. High Cost of Offline Assistance Provided by Superior Hospitals

The higher level hospitals in the medical consortium should provide assistance to the lower level hospitals, such as talent training, expert dispatching and two-way referral. There are two main ways to cultivate talents: doctors from higher hospitals provide technical guidance to lower hospitals or act as academic leaders; Medical staff from lower hospitals come to the hospital for further study, and participate in ward rounds, case discussions and academic exchanges at higher hospitals. The living and transportation subsidies involved in the period when doctors from the higher level hospitals carry out training and experts are stationed in the lower level hospitals, as well as the resettlement and training expenses of doctors from the lower level hospitals who go to the higher level hospitals for further study, have all become the expenditure burden of the higher level hospitals. As well as the indirect economic loss and inconvenience caused by the transfer of medical personnel, so the situation of high cost assistance in higher hospitals is caused.

2.2.1.3. The Cost of Medical Data Centralized Security Management is High

By the end of 2015, 76.4 percent of residents in China had electronic health records, and currently medical institutions have adopted a centralized way to manage electronic health records. Although in order to prevent data tampering or theft, each medical institution adopts local area network (LAN) and the network is not linked to the external network^[2], this still cannot avoid the technical disadvantage of data centralization -- easy to be attacked and result in data batch leakage. In 2019, for example, the healthcare industry had 224 data breaches, which is the most of any industry. In order to prevent the occurrence of such public security leakage, medical institutions need to pay the high cost of medical data security management.

2.2.2 Low Efficiency of Medical Data Sharing

At present, all medical institutions implement the centralized management of medical data by relying on their own centralized data management system. However, the sources of the system of each institution are different and there is no consistency. Data sharing among medical institutions in a medical consortium cannot be realized from the hardware level. Medical data involves patient privacy and medical security, but the security authentication of relevant data exchange has not been solved yet, so data sharing cannot be realized from the technical level. In addition, the different input standards of medical data and the complicated format lead to the low degree of data structure - - at present, about 80% of medical data in China are unstructured data. Low structured data sharing is prone to ambiguity and causes medical accidents. Various reasons eventually lead to the non-sharing of medical data among hospitals in the medical consortium, which hinders the communication among medical institutions, which is not conducive to the health management and follow-up treatment of patients, and may even lead to repeated diagnosis, resulting in the waste of medical resources and increasing the cost of patients' medical treatment.

3. Optimization of Medical Consortium from the Perspective of Modern Internet Technology

3.1 Optimization of Medical Consortium from the Perspective of Telemedicine

3.1.1 Reduce the Cost of Offline Referral

Telemedicine enables patients to receive remote medical services from doctors of superior hospitals within medical consortium at the first consultation hospital, realizing remote face-to-face consultation. This move improves the “offline referral” into “online referral”, which can save the extra transportation cost and patient care cost, and also avoid the possible secondary injury and missed medical opportunity in the offline referral.

3.1.2 Reduce the Cost of Offline Assistance Provided by Superior Hospitals

The application of telemedicine can break the geographical isolation and transform the offline assistance from the superior hospitals in the medical alliance to the online assistance. The offline flow of medical staff can be eliminated during the assistance process, and the radiation scope of the remote assistance is larger, which can improve the efficiency of resource utilization.

3.2 Optimization of Medical Consortium from the Perspective of Blockchain

3.2.1 Reduce the Cost of Security Management of Medical Data Centralization

Block chain is an end-to-end network composed of many nodes in the virtual space of the Internet. It is a completely decentralized integration. In the absence of a central processor, data storage and management can be realized to avoid the risk of medical data centralization, and to reduce the excessive cost of data security management.

3.2.2 Realize the Safe Sharing of Medical Data

Blockchain provides a decentralized and distributed healthcare database, which can records, verifies, and updates personal healthcare data generated by users while they are active in a healthcare facility. These data can be shared in real time in the process of full circulation of medical treatment through the “whole network broadcast principle” of block chain. Moreover, the block chain uses a variety of encryption algorithms, including hash algorithm, asymmetric encryption, digital signature and intelligent contract to encrypt and protect the data on the chain. Hashing algorithm is a one-way cryptographic algorithm, which is an irreversible mapping from plaintext to ciphertext. Asymmetric encryption technology, on the other hand, makes use of the difference and pairing between private and public keys to encrypt data and conduct digital signature. Even if the data is acquired by hackers in the process of transmission, they cannot decrypt the content of the data, which ensures the confidentiality and authenticity of the data transmission process. Intelligent contract technology can grant differentiated rights to different participants on the block chain, so as to achieve differentiated accurate confidentiality of data on the chain, ensure a high degree of security of medical data sharing, and finally achieve regional medical information integration.

4. The Proposal of a New Model of Medical Alliance under the Development of Modern Internet Technology

4.1 A New Model of Medical Consortium

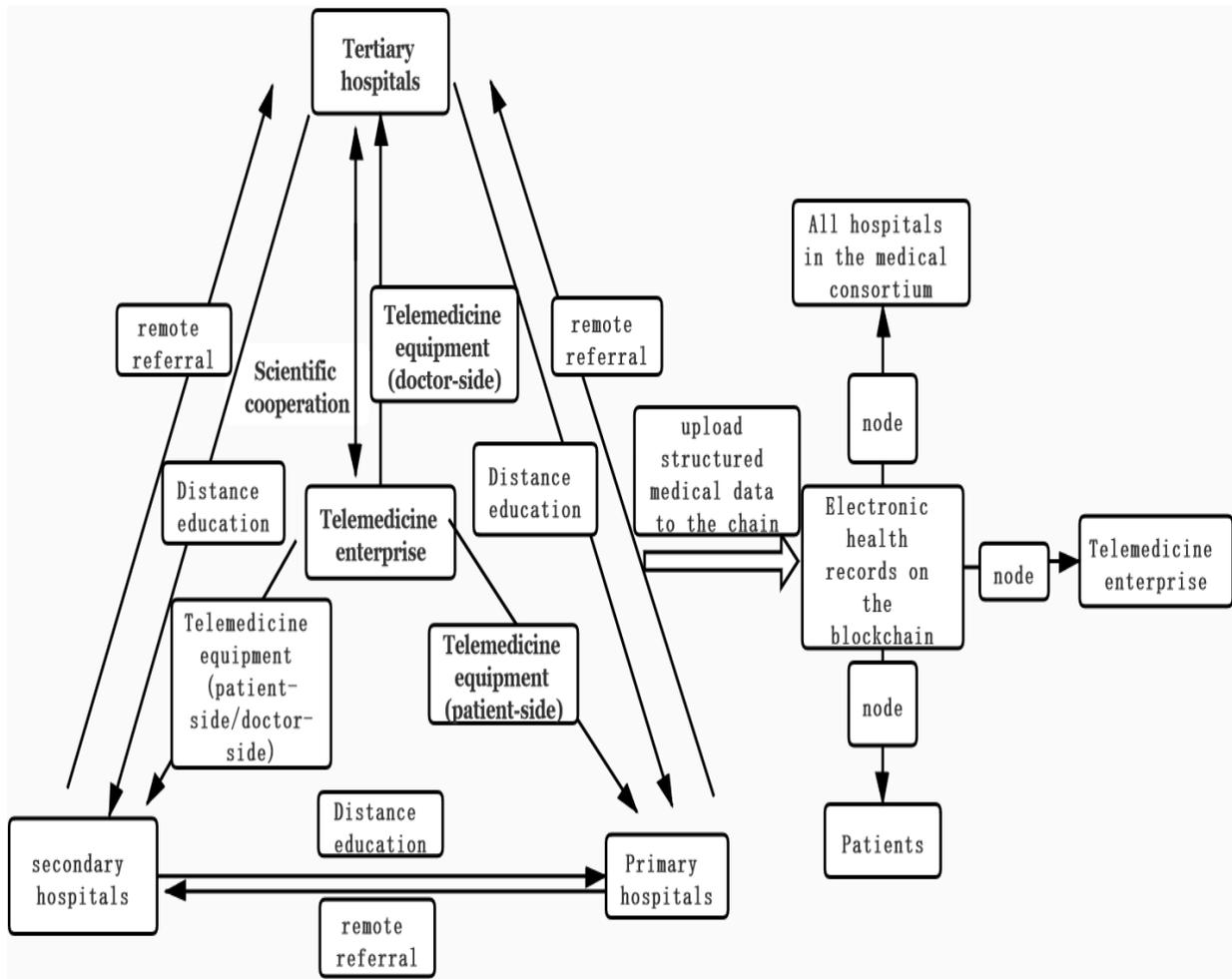


Fig.1 New Mode of Medical Consortium under the Development of Modern Internet Technology

4.2 How the New Model of Medical Consortium Works

4.2.1 How the Telemedicine Section Operates

The telemedicine enterprise provides the doctor end of telemedicine equipment to the higher level medical institutions within the medical consortium, and provides the patient end of telemedicine equipment to the lower level medical institutions receiving assistance. Each medical institution carries out remote referral and distance education with the help of equipment. In addition, the tertiary hospitals and telemedicine enterprises in medical consortium carry out scientific research cooperation to continuously deepen the application of telemedicine in medical consortium.

4.2.2 How the Blockchain Section Operates

Block chain can be divided into public chain, alliance chain and private chain according to the degree of openness. Based on the higher security requirements for data storage and sharing in the medical industry, it is more appropriate to select the alliance chain. Members of the consortium include all hospitals within the consortium, telemedicine enterprises and residents within the consortium's jurisdiction. Alliance members are predefined as participating nodes in the alliance chain. All hospitals in the medical consortium are providers and users of medical data. They have access to all electronic health records, and medical data must be structured before being uploaded to the chain. Telemedicine enterprises and residents are only users of medical data. Telemedicine enterprises have access rights to electronic health records with the privacy information such as residents' names and ID Numbers hidden. With the development of telemedicine, its network

algorithm can process or operate the data while it is still in the encrypted state. In order to avoid misinterpretation of medication information due to lack of professional knowledge, residents only have access to personal electronic health records with specific medication information hidden. There are two options for the secure sharing of medical data:

4.2.2.1. Mode 1: Partial Multi-Centralization Mode-- Do Not Upload “e-Health Record” to the Chain

For medical consortium that already has a relatively complete electronic health record system, the blockchain technology will be deployed on their original system. The original system is not changed, and the electronic health records are still stored in this system. Only the block chain technology is used to change the entry, interaction and sharing of underlying data, and only the secure index records of the electronic health records are kept on the chain.

All hospitals in the medical consortium participate in the consensus process as the data entry end, and continue to use custodian billing and distributed management. Telemedicine enterprises and residents only participate in transactions, but do not interfere with the accounting process. The advantage of this model lies in the organic integration of the existing file system of medical consortium and the blockchain technology according to the current status of digitization of health archives of medical consortium. The transformation is low cost and easy to operate, and can realize efficient data management and secure sharing. It can be used as a transitional mode of complete multi-center mode.

4.2.2.2. Mode 2: Fully Multicenter Mode -- Upload “e-Health Record” to the Chain

For the medical consortium that has not yet established the electronic health record system, a large block chain sharing network can be built. Each participant can be connected into a wide area network through the bridge or router to expand the network scope. Electronic health records and their safety index records are stored on the alliance chain. The advantage of this model lies in the realization of complete multi-centralization, and the security and management efficiency of files are higher than that partial multi-centralization mode.^[3]

5. Conclusion

The construction of medical consortium undoubtedly promotes the establishment of a reasonable medical order, and can also solve the problem caused by the inherent uneven distribution of medical resources in China. People from all walks of life should unswervingly develop and constantly improve medical consortium. At the present stage, telemedicine technology is gradually maturing, and the application of blockchain in the medical industry is also emerging. The market should seize the opportunity of The Times and technological opportunities. Under the guidance of national policies, actively apply emerging technologies such as telemedicine and blockchain to medical consortium.

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