American Journal of
Biomedical Science & Research

www.biomedgrid.com
ISSN: 2642-1747

Review Article

Research on Internet Medical Service Mode and Management Path Based on Blockchain Technology

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To Cite This Article: *Song Hu, Xuanxuan Wang, Zhenchuan Jiang, Xinyu Zhang, Xun Gong* and Hongwei Xiong*, Research on Internet Medical Service Mode and Management Path Based on Blockchain Technology. Am J Biomed Sci & Res. 2024 22(2) AJBSR.MS.ID.002946,* DOI: 10.34297/AJBSR.2024.22.002946

Received: : April 25, 2024; **Published:** April 29, 2024

Abstract

With the outbreak of the new crown epidemic, people's lifestyles have been greatly affected, and new methods such as distance education and remote work are becoming more and more common, and the impact of the Internet on the world has become even greater. At the same time, Internet medical is being applied by more and more people because of its advantages of convenience and speed, and its impact is increasing. However, the problems that follow such as doctors' misconduct and leakage of private information are also becoming more and more serious. China has also proposed plans for the supervision of Internet medical care. However, these methods cannot adapt to the rapid development of Internet medical, in order to better prevent and treat risks, blockchain technology should be applied to Internet medical due to the decentralization, openness, independence, tamper-proof, security, distributed and asymmetric characteristics.

Keywords: Blockchain, Internet, Hospital, Service Model, Management paths

Background

Since the outbreak of COVID-19, Internet medical have developed rapidly due to the remote, efficient and convenient advantages. According to relevant statistics, as of June 2021, there are more than 1,600 Internet hospitals in China, and an online and offline integrated medical service model has initially formed [1-5].

However, behind the rapid development there is an imperfect service model or regulatory system. It is easy to bring new medical risks, resulting in potential quality problems in its medical services, and even endangering the safety of patients' lives and medical insurance funds. As a special field related to the life and health of the public, medical care is the new challenge faced by the current Internet-based virtual medical system.Based on the above problems, some documents have detailed the definition, scope and standardization of Internet diagnosis and treatment at the national level, and clearly require the establishment of a supervision platform to ensure the quality and safety of medical services [6,7].

However, compared with the market demand and rapid development of Internet medical, these basic normative documents do not provide specific management forms and means, which do not match the development of Internet hospitals [8,9].

Internet medical is the Internetization of physical hospitals, and their diagnosis and treatment behaviors are totally different from those of physical hospitals. Only by formulating matching supervision models and means and standardizing constraints can Internet hospitals develop healthily, in a standardized way, and efficiently [10-13].

As a decentralized system, the blockchain system uses the principles of cryptography to decentralize and record transaction and operation data on the peer-to-peer network in real time, which can ensure that the data recorded in the block cannot be tampered with or damaged by the storage system. At the same time, based on the consensus and trust of all parties, the integrity of the system and software can be monitored to ensure that the data transmitted by the system has not been tampered with. From the source, the authenticity, integrity, security and traceability of the data are guaranteed, and the loss of resources is effectively reduced [14].

Existing Internet Primary Medical Service Models and Management Paths

The United States

As the first country to regulate the field of mobile health, the United States mainly regulates mobile health applications through the Health Insurance Portability and Accountability Act (HIPAA) and the regulatory system of the Food and Drug Administration (FDA). The FDA released the Mobile Medical Application Guidance for Industry and Food and Drug Administration Staff in September 2013, becoming the first instructional operating procedure document designed to regulate medical Apps [15,16]. Although not legally mandatory, the guidelines have become an important basis for market access and related regulatory work for medical apps in the United States. In recent years, The Interstate Medical Licensure Compact, which has linked 26-state medical boards, made it easy and fast for doctors to apply for multi-state medical licenses, while facilitating the regulation of practitioners practicing medicine remotely [17,18].

The EU and the UK

The EU's regulation of medical applications can be divided into two types: "need to be regulated" and "completely exempted", and the EU has less centralized power on the certification and approval process for mobile health applications than the United States, but it is more efficient [19-23]. Although the scope of devices that can exercise discretion has not yet been delineated, in order to reduce the waiting time for developers and increase the consistency of regulatory enforcement, the EU's regulatory approval for mobile application has been decentralized to more than 70 bodies in its member states to speed up approval. Once a medical device is approved by one of them, the device is allowed for sale throughout the EU [24-27].

The EU and the UK are in the process of establishing a clear regulatory framework when it comes to the standardization regulation of mobile health software. The French government issued the "Clinical Guidelines for Physician Services" and gave it strict legal effect. Thereby, the regulatory information system to facilitate the supervision and review of doctors' diagnosis and treatment behavior had been established [28,29]. The Germany's National Association of Statutory Health Insurance Physicians and the Federal Association of Physicians have established a nationwide system for reporting major incidents (www.cirsmedical.de), which enables health practitioners to report medical errors or suspected medical errors voluntarily and anonymously. Since 2013, the UK National Health Service (NHS) has launched a mobile health application recommendation website to recommend mobile health applications that have undergone its security review to patients and medical professional [30,31]. In order to improve the efficiency of system processing, it has developed a unified terminology on errors, adverse events and patient safety, designed standard paper and electronic formats for recording adverse events and suspected errors, and developed a standardized process for reporting relevant information [32,33].

Other Countries

In Australia, the Medicare Benefits Schedule is primarily responsible for mobile health regulation. It clearly stipulated the legal qualifications, legal service scope, and standardized operating procedures of practicing doctors and medical institutions.

Japan, South Korea and other countries urged major application platforms such as Apple App Store, Google App Store to be strictly reviewed to achieve indirect supervision of mobile medical quality, among which Japan officially established the Japan Telemedicine and Telecare Association and published the "Telehome Medicine Guide" in 2011 to make a specific division of the responsibilities of doctors and patients, as well as instructions on informed consent, moral hazard, medical record keeping, quality management, etc.

China

As of 2021, in China, the central and local governments have successively issued more than 110 policies related to Internet healthcare, of which 90 are directly related to Internet hospitals. Since 2011, China has begun to explore telemedicine, and in 2015, Guizhou and Yinchuan issued pilot policies for Internet hospitals. In 2018, the requirements for the Internet hospital supervision platform were put forward for the first time. The provincial health administrative departments and the Internet hospital registration authorities jointly supervise Internet hospitals by building a provincial Internet medical service supervision platform, focusing on the supervision of doctors, prescriptions, patient privacy protection and information security of Internet hospitals. At the same time, the Internet hospital will be included in the local medical quality control system. These measures mark the initial completion of the construction of the administrative regulatory framework system for the development of Internet diagnosis and treatment activities, the access and operation of Internet hospitals, and the telemedicine activities. At present, 27 provinces in China have established provincial-level Internet hospital supervision platforms [34].

As the earliest experimental pilot, Yinchuan City built an "Internet Hospital Supervision Platform" based on the characteristics of online traces of Internet diagnosis and treatment behavior, realizing that in the early stage of the construction of Internet hospitals,

in the basic business links such as contracted doctor registration and electronic prescription issuance, the supervision of doctors' medical qualifications, prescription content supervision, electronic prescription tracking and other regulatory contents were formed, and the Yinchuan smart medical monitoring screen was used to realize real-time summary of global data traffic [35].

Since January 19, 2019, Beijing has established a Beijing Internet medical service supervision platform while implementing Internet hospital access management, docking with the Internet hospital information platform to achieve real-time supervision, and the public can report illegal Internet diagnosis and treatment services; Zhengzhou adopts a new online and offline service model of "door-to-door slow prescription sharing, online registration, video consultation, and drug delivery to home", relying on the outpatient chronic disease prescription sharing platform to realize the interconnection and information sharing supervision of medical insurance designated Internet hospitals and pharmacies [36].

Although China has introduced some policies to make the growing Internet medical care have standards and fill the gap in the supervision of Internet hospitals, how to carry out effective supervision and improve relevant laws and regulations is the core and key to forming a complete top-down supervision system, and it is also an urgent need to solve in the current rapid development of Internet hospitals [37].

The Application and Development Trend of Blockchain Technology in the Internet Medical Service System

Blockchain technology is an Internet database technology called distributed ledger technology, which is another great application technology after cloud computing and big data. It is a decentralized shared ledger that combines data blocks into specific data structures in a chronological order, cryptographically guaranteeing immutability and unforgeable. It can securely store data and can use cryptographic structures to verify and store data, distributed node consensus algorithms to generate and update data, and intelligent code to program and operate. Enables direct data exchange between distributed network participants.

Due to the advantages on decentralization, openness, independence, security, distribution and asymmetry of the blockchain, the blockchain can effectively ensure the transparency of the data of each node. It is beneficial for multi-party participation in the supply chain, information exchange, process documentation, etc. At present, the third generation of blockchain technology has been extended from the initial application in the financial field to other fields and benefits, so it is considered to be a general technology used in supply chain management, work ownership identification and digital copyright protection, insurance, public services and other fields [38].

At present, blockchain technology has achieved considerable results in the regulatory process in other fields, but the regulatory application of Internet hospitals is still in its infancy. After analyzing a total of 65 related papers on the application of blockchain technology in the field of healthcare, Cornelius concluded that the management of electronic medical records (EMRs), drug supply chain, biomedical research and education, remote patient monitoring, health insurance claims and health data analysis (HAD) are the main application scenarios of blockchain technology in the medical and health field. Therefore, there is a large space for development in the application of medical supervision, and related businesses such as Philips, IBM, Google and other enterprises have begun to deploy the application of blockchain technology in medical product traceability and industry supervision. *Yue, et al*. proposed a blockchain-based medical data network App that can be used for medical data sharing. Burniske believed that blockchain technology can improve the ease of operation of electronic medical records. Engelhardt and Mettler described a series of use cases of blockchain technology in prescription drug fraud detection, patient-centric medical records and dentistry, public health administration, medical research, and counterfeit drug review in the pharmaceutical industry, respectively. *Kuo, et al*. explained how blockchain technology can be leveraged to improve medical record management, enhance insurance claims processes, improve clinical research, and improve healthcare data ledgers.

Relevant personnel of the National Health Commission emphasized that the scene selection of blockchain was the most critical, believing that multi-subject participation scenarios, multi-subject data sources and no public third party were the key elements to test whether to apply blockchain technology, and tend to apply this technology to the supervision of medical waste in medical institutions. Liu introduced the smart contract characteristics of MedRec, Alice, MeDshare and other medical blockchain platforms, and accessed electronic medical data through the Ethereum platform to realize data-oriented and user-oriented blockchain privacy protection methods to meet the needs of different users [39].

The above literature showed that the development and application of blockchain technology has been perfected day by day, but the application in the medical and health industry is limited to the traditional medical information field such as electronic medical records and health data. The governance path applied to the provision of medical services and related services is still in partial and one-sided exploration, and there is still a large distance from forming a system architecture that can be applied to the supervision of the entire medical industry. At the moment when information technology and Internet hospitals are in rapid development, the update and improvement of laws and regulations will still lag behind for a period of time, blockchain technology with its immutability, traceability and smart contracts and other characteristics, can effectively support and supervise the provision of Internet hospital services and the security application of its data information, or will promote the Internet hospital autonomy, industry self-discipline, government supervision, social supervision combined with the establishment of a sound regulatory system core driving force, but also the future Internet hospital health, Necessary constraints for sustainable development.

Conflicts of Interest

The authors declare that they have no competing interest.

Data Availability Statement

The data used to support the findings of this study are included within the article.

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