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A Systematic Research of the Internet Hospital in China: Breakthroughs and Challenges in the Development of Internet Hospital under the Influence of COVID-19

Roujia Li [1,a,*]

[1]*University College London, London WC1E 6BT, United Kingdom*
a. roujia.li01@gmail.com
**corresponding author*

Abstract: In the age of advanced digital technology, the traditional medical industry is gradually expanding its Inter-net medical business. Internet hospitals are gradually coming to the public. Internet Healthcare refers to a new type of medical and health service industry that uses the Internet and information technology to collaborate with traditional healthcare. Its main functions include remote diagnosis, online e-prescription, online medicine purchase, home delivery of medicines, medical condition tracking, patient electronic medical record formation management and disease management, etc. Because the Internet hospital is still in the initial stage of development, many functions are not available, and many relevant regulations are not detailed enough. However, the covid-19 outbreak has to some extent driven the sudden progress of Internet hospitals. This article analyzes the progress and breakthroughs made by Internet hospitals during the outbreak and the development prospects of Internet hospitals in the post-pandemic era in a macroscopic manner through known data and reports. In addition, this article analyzes the problems that Internet hospitals may encounter, and more importantly, this article will suggest corresponding solutions. Ultimately, this article concludes that Internet hospitals have good prospects for development, which will not be possible without technological breakthroughs, government policy support, user perceptions, and Internet hospitals' innovation.

Keywords: internet hospital, covid-19, China

1 Introduction

With the continuous development and innovation of the Internet, the medical industry continues to break through existing models. Internet hospitals, as one of the prominent ones, have made significant breakthroughs in remote diagnosis, remote treatment, remote consultation, and remote therapy [1]. Influenced by covid-19, the attention of Internet hospitals has seen explosive growth. Because of various reasons such as epidemic control, the number of people choosing remote treatment and consultation services has been growing. At the same time, more and more hospitals are discovering the need and joining the construction of Internet hospitals [1]. Data released by the National Health Care Commission shows that there are at least 1100 Internet hospitals in China, and more than 7700 level II hospitals providing online services.

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At present, there are few systematic studies that analyze the development prospects of Internet hospitals in China in the post-epidemic era. The purpose of this article is to analyze the development prospects, the existing shortcomings, possible difficulties, and countermeasures of Internet hospitals in the post-epidemic era.

2 Result

2.1 The Development Prospects of Internet Hospitals

First, Internet hospitals can alleviate the problem of uneven medical resources to a certain extent. From the contemporary distribution of medical resources in China, Internet hospitals will break the situation of being limited by regions. China's high-quality medical resources are unevenly distributed. According to the Fudan edition of the 2020 China Hospital Comprehensive Ranking, Beijing, Shanghai, and Guangzhou, the top 3 in terms of quantity, have 23, 19 and 9 respectively, accounting for about 50% of the total number of top 100 hospitals [2]. Wuhan, Cheng-du, Nanjing, Shenyang, Tianjin and other provincial capitals and municipalities directly under the Central Government account for about 40%. It can be concluded that the quality medical resources are concentrated in these large cities. These hospitals admit thousands of patients from other regions every day. The vice president of Pe-king Union Medical College Hospital introduced this set of data. The average daily outpatient volume of the hospital is about 13,000, among which patients from other provinces and cities reach 60% [3]. However, as the epidemic spreads, provinces and cities have introduced policies to prevent and control the epidemic, which makes it difficult for some people to travel from their cities to these larger cities with abundant medical resources for treatment. Still using Beijing as an example, as of May 2022, people with a travel history in counties with land border crossings within 14 days are not allowed to enter or return to Beijing unless necessary [4]. This has resulted in a portion of patients being unable to be diagnosed in hospitals in Beijing. Internet hospitals can address this issue to some extent. According to Ye Quanfu, director of the Institute of Hospital Management of the National Health and Wellness Commission, in 2020, the number of online medical consultations in hospitals under the National Health and Wellness Commission increased 17 times more than in 2019, while at the same time, the number of online medical consultations in other platforms has risen at least 20 times [5]. Beijing Union Medical College Hospital Internet Hospital is the first approved Internet Hospital in Beijing. During the epidemic, from March 2021 to August 2021, Beijing Union Medical College Hospital has 36 departments and more than 1,200 doctors have opened Internet consultation privileges, serving 60,000 patients in total [5] Furthermore, during the epidemic, there were many patients who mistook their fever or cough for signs of coronavirus, leading to an influx of patients in hospitals to the point of cross-contamination between patients and doctors. Numerous Internet hospitals provided free COVID-19 online counselling and home isolation guidance during the outbreak [6]. This is the place where Internet hospitals have an advantage in the face of the epidemic.

Furthermore, ageing and people's concern about the state of health will promote the development of Internet hospitals. China is gradually entering an ageing society [7]. Population health behaviour transformation is accelerating and the demand for healthcare-related services is expanding. In 2019, there will be 164.5 million Chinese people aged over 65 and 26 million aged over 80 in China [7]. Moreover, about 75% of older people have non-communicable diseases such as cardiovascular disease, and hypertension [8]. It is worth emphasizing that the elderly are susceptible to covid-19 and that the virus is more damaging to the health of the elderly than the young [9]. Hence, avoiding the risk of cross-infection during hospital visits is important for older adults. In the past few years, the Chinese government has been increasingly investing in chronic diseases. In 2016, China spent about 324.45 billion yuan on chronic diseases, making up about 70% of total health costs. For patients with chronic diseases, the Internet hospital provides follow-up visits to their conditions, medication guide,

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drug delivery, a medical consultation, and other medical services, which significantly reduce the probability of infection [6]. Moreover, the data from the 'Report on the Search Behavior of Chinese Internet Users Demand for Science Popularization in the First Quarter of 2019 ' In the first quarter, searches for health and medical care ranked first, accounting for 73.8 per cent of eight science topics [10]. Whether it's an active or passive choice, more and more people are prepared to try Internet hospitals.

Moreover, government policy support is required to boost the development prospects of Internet hospitals. The Chinese government has made policies to support the development of Internet hospitals. Because the establishment of Internet hospitals is still in the development stage, some of the functions that offline hospitals have are not yet carried out online. For example, one of the main concerns is social health insurance. In the beginning stage, some of the Internet hospital fees are not part of social health insurance, so many patients will choose to go offline for consultation because of this [11]. The government is also aware of these problems, and better serves the public. During the epidemic, the National Health Insurance Bureau and the Health and Welfare Commission [12] issued a document to include online follow-up consultations for common diseases and chronic diseases in the scope of payment by the health insurance fund. Government departments have encouraged patients with chronic diseases to be reimbursed for online medical services and medications and plan to establish a nationwide integrated online and offline health insurance system by 2030. Huabo Huang, director of the medical administration department of the National Healthcare Security Administration mentioned, that as of June 2020, 12 medical institutions have achieved real-time online medical insurance settlement, with more than 17,800 settlement visits and a total cost of 2,598,200 [13]. The promotion of online payment by medical insurance will greatly enhance users' willingness to be paid for chronic diseases and increase the rate of online treatment for chronic diseases, thus opening the market scale of Inter-net hospital services.

In addition, with the development of 5G, artificial intelligence, blockchain and other technologies, internet hospitals will make greater breakthroughs. With the development of intelligent terminals, users' health data will be more comprehensive, and doctors will be able to conduct remote real-time consultations, emergency rescue guidance, intelligent room checks, etc. [14]. In the consultation session, Internet hospitals can substantially improve efficiency. Internet hospitals can create an AI consultation system through data collection, algorithms, and testing. Most of the patient's questions can be asked through this system instead of the doctors. Studies have shown that an average of 13 questions can be used to diagnose a patient's condition through the information collected by this type of system [15]. In addition to the diagnosis of the condition, 5g, artificial intelligence and many other high technologies make up the remote surgery robot. Modified robots perform surgery without direct contact with the patient by the doctor through communication. In the future, doctors can even operate on patients from the other side of the world [16]. With the policy promotion, cloud computing, 5g, AI and other technologies help to tap into the potential needs of users, making the selection of medical content more targeted and better meeting the expectations of the public.

2.2 The Development Prospects of Internet Hospitals and Their Countermeasures

First, Internet hospitals are not able to complete medical diagnoses in all disciplines. Whether a medical condition can be diagnosed over the Internet varies in different situations. For example, in skin diseases, doctors can confirm the diagnosis by reading high-definition picture information remotely. But in gastrointestinal oncology surgery, physical diagnosis is a necessary part of the process. In Chinese medicine, four diagnostic methods, such as observing Qi, listening to sound and breath, asking for symptoms, and feeling pulse, are very necessary, but only some of them can be done online. This will greatly affect the judgment of the condition. This problem is indeed an obstacle to the de-

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velopment of Internet hospitals. There are two main ways to work around this problem. First, technological innovation can break the traditional Internet Hospital's dilemma. As mentioned earlier, cutting-edge technologies such as 5g, 3d imaging, artificial intelligence, etc. have the potential to enable remote surgery in the future [16]. Secondly, a collaboration between Internet hospitals and offline hospitals and social health institutions can enable patients to receive treatment from tertiary hospitals more efficiently. In other words, if patients need to get to a tertiary hospital in another city for treatment, then they could first go to a local primary and secondary hospital for basic routine checkups. Through the connection of Internet hospitals at all levels, the patient's electronic medical records and examination reports will be uploaded from the local electronic information base to the hospital where the patients want to be served medical treatment, which makes it possible for patients to locally have the diagnosis and treatment of top hospitals in other cities.

Second, Internet hospitals may increase competition between tertiary care hospitals and non-tertiary care hospitals. According to the guidance on the construction of a hierarchical medical system launched by China's State Council, the main purpose of the hospital hierarchy in China is to enable the effective sinking of quality healthcare resources [17]. There are three principal types of the tiered hospital system. The government encourages and guides those patients with common and multiple diseases who will first go to primary health care institutions and will be referred from primary health care institutions to higher-level hospitals for treatment of diseases that are beyond the functional positioning of primary health care institutions [3]. Secondly, to clarify the function of acute and chronic disease diagnosis and treatment services, patients with acute and acute illnesses can go directly to hospitals above the second level. The higher the level of hospital, the higher the severity of the corresponding disease [18]. Excellent doctors bring a strong sense of trust to patients; hence, patients may choose higher tertiary hospitals because of the convenience of access to them [19]. For this problem, first of all, the current medical resources of tertiary care hospitals are relatively tight, so even though many patients wish to be treated at tertiary care hospitals, they cannot admit so many patients, so they still have to choose other levels of hospitals. In 2020, there were 2996 tertiary hospitals with 2777932 beds, 10404 secondary hospitals with 2665974 beds, and 12252 primary hospitals with 651045 beds. We can find that the number of tertiary hospitals is much smaller than the other levels, and the number of beds is roughly the same for tertiary and secondary hospitals. The number of tertiary hospitals is much smaller than other levels of hospitals, and the number of beds is roughly the same for tertiary and secondary hospitals [20]. However, according to the huge population of China, the number of beds in tertiary hospitals is not enough [20]. We suggest that the Internet Hospital platform establish-es a guide system to intelligently analyze the patient's condition through an artificial intelligence system, thus helping to match the patient with a hospital suitable for his or her condition. For instance, a patient with a common cold can be diagnosed and prescribed medicine without a tertiary care hospital, which will alleviate the waste of medical resources in tertiary care hospitals to a certain extent.

Third, the lack of security of patient information is one of the reasons why many people do not choose online healthcare. First, because Internet hospitals are still in their infancy, many supporting laws and management regulations have still not been established, and users are concerned about information security. For patients, personal pathology records and additional biological information are very private, and such information needs to be protected to prevent dissemination. However, in the online consultation session, patients may use text, images, videos, and other forms to help doctors better understand their conditions, but in mobile medical devices, network dissemination and other links, there is a possibility of information leakage of users' privacy [15]. The Chinese government has issued policies on ensuring cyber security, such as the "Guidance on Information Security Classification and Protection in the Health Sector", with the aim of forming a secure technical system for Internet hospitals [21]. Awareness of information protection for Internet hospitals and the government

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is a necessary part of the process. Regular retrieval and elimination of Trojan viruses, a methodical inspection of network security vulnerabilities, continuous improvement and upgrading of network firewalls, and relevant penalties for those who actively disclose patient privacy are effective ways to combat information leakage. In addition, the lack of accuracy of doctor-patient information also hinders the development of Internet hospitals. Internet hospital consultation sessions are online communication, which includes text, pictures, voice, and video. Many Internet Hospital platforms are mostly for text and picture communication for efficiency. So, a portion of patients is not able to see the doctor in person, which means that the side of the Internet connection may not be the doctor himself, which is also a concern for patients. To address this point, relevant laws and regulations, technical support and platform supervision efforts are particularly important. With the current face recognition technology, the doctor can first conduct facial recognition authentication for online consultation to ensure that it is the doctor himself. Secondly, if it is found that there is a case of replacing the doctor to diagnose, the applicable punishment policy should be improved. Moreover, some patients have concerns about whether the effectiveness and quality of online diagnosis are significantly lower compared to offline. Therefore, the corresponding scoring and complaint system should be as good as possible. If a patient finds that the doctor's attitude or workability is unique compared to offline, he or she can give feedback to the doctor through the complaint mechanism and scoring system. Of course, relative measures to protect the reputation of doctors are also necessary. To avoid malicious evaluations and slander, the platform should set up a relevant complaint mechanism. If a doctor has doubts about the authenticity of a review, he or she can mail it back to the appeals platform to be judged by the platform's experts. Such a judging mechanism will, to a certain extent, promote joint restraint between doctors and patients, making the medical environment of Internet hospitals more harmonious and effective.

3 Discussion

China's Internet hospitals are still in the initial start-up stage, many offline hospital functions online hospitals do not yet have, there are still technical barriers to breakthroughs, relevant policies and laws are not perfect, and the user understanding, and use of such hospitals are not yet fully popular. However, it is not hard to find that there is a lot of room for development in this area of Internet hospitals. First, the outbreak of covid-19 has led to unprecedented promotion and progress of Internet hospitals. The impact of epidemic prevention and control policies has led people to actively or passively choose Internet hospitals to diagnose their conditions, write prescriptions online, and use contactless drug delivery services, which have greatly broadened the user market. More and more people understand and utilize Internet hospitals, so in terms of user groups, although the number of Internet hospital users is currently much smaller than that of offline hospitals, the trend is increasing. Secondly, China's population is ageing more and more seriously, and health care is of great concern to the national government and the people. And the increasing incidence of chronic and conventional diseases is also an important reason why people are increasingly concerned about medical care. Because of the outbreak of covid-19, to avoid cross-infection during hospital visits, the government is encouraging people to seek medical treatment online at Internet hospitals, and patients themselves are more willing to use Internet hospitals. In addition, the policies promulgated by the Chinese government, such as the inclusion of some internet hospital services in social health insurance, paved the way for the development of Internet hospitals. Therefore, the social structure of China, the influence of covid-19, the supportive attitude of the government, and the change in people's perceptions and preferences are all significant factors and boosters for the sustainable development of Internet healthcare. Then how to solve the problems faced by the Internet hospital is the focus of our discussion. For the Internet hospital cannot complete the screening of all disease types, such as palpation, auscultation, etc., our solution is in two directions, firstly, the innovation and application of technology, and secondly, the

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combination of Internet hospital and offline hospital. For the issue of doctor-patient trust and information security in Internet hospitals, we suggest that Internet hospitals establish a face recognition program to ensure that the doctor who diagnoses is the doctor himself, and we suggest that they build a complete scoring system to ensure the user's medical experience and effectiveness and pay attention to protecting the privacy and reputation of doctors. Relevant laws and regulations are also quite necessary, and we should make relevant constraints for both doctors and patients. Another concern is that Internet hospitals may aggravate the gap between large tertiary hospitals and general hospitals and social health clinics. Because people prefer top hospitals, the convenience of Internet hospitals will lead more and more people to choose larger tertiary hospitals instead of smaller ones. The loss of users has a significant negative impact on public hospitals, which also dissipates the role of China's hospital hierarchy and upsets the balance. For this issue, firstly, the medical resources of large tertiary hospitals are also limited and tight, and many patients still choose local hospitals or other second-tier hospitals for medical treatment. Secondly, we suggest the Internet hospital platform establishes a guide system to help patients match the most suitable choice for them now after an intelligent analysis of their condition.

4 Conclusion

This article provides a detailed summary of the advantages of Internet hospitals and lists the difficulties they may encounter. More importantly, the article provides suggestions and possible solutions for the development of Internet hospitals.

Overall, internet hospitals have a strong potential for development worth exploring. The development of Internet hospitals is based on two points: the first is that national macro policies provide guarantees for the development of all kinds of Internet hospitals. With policy guidance and advice, Internet hospitals will step by step to get rid of policy problems such as the inability to use social health insurance online. Solving such problems will also attract more patients to move to online consultation. The second point is that user demand in the post-epidemic era will continue to climb in the long run. The reason for this conclusion is the case that, from a macro perspective, China's ageing population will continue to climb and the number of people with chronic diseases will break new highs. Internet platforms can largely accomplish the diagnosis and tracking of chronic and geriatric diseases. Secondly, the covid-19 prevention and control policy has also prompted more and more patients to use Internet hospitals for treatment.

Detailed judgments and recommendations on the problems encountered by Internet hospitals and their corresponding possible solutions are also given in this article. In general, the problems encountered by Internet hospitals can be divided into technical problems, resource problems and trust problems. In terms of technology, we expect that cutting-edge technologies such as 5g and artificial intelligence will enable remote surgery and simulated physical touch to be envisaged in the future. Secondly, the combination of internet hospitals and offline hospitals, and a developed guidance system, could alleviate the problem of scarce and unevenly distributed resources. In other words, patients in areas where medical resources are scarce can enjoy more abundant medical resources through internet hospitals, and at the same time, a comprehensive guidance system can help to maximize the use of medical resources by preventing patients with basic diseases from wasting top medical resources. For the trust issue, this article summarizes three directions of the solution, which include face recognition, a scoring system and improvement of laws.

In summary, there are still some shortcomings in the Internet hospital, but with the support of government policies and related laws, the increasing number of users, the evolving technology and the innovation and improvement of the Internet hospital, the potential and positive prospect of the field are foreshadowed.

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