HAMP Hospital Administration and Medical Practices

ORIGINAL ARTICLE

Development status, influencing factors, and prospects for internet hospitals

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Abstract

In this paper, the development history and status, operation mode, existing problems, and other aspects relating to Internet hospitals in China are studied through relevant research literature, government documents, and platform data information released by Internet hospitals. The strengths, weaknesses, opportunities, and challenges of Internet hospitals are sorted, summarized, and compared, considering institutional, economic, social, and technological factors using the strengths, weaknesses, opportunities, challenges and politics, economic, society, technology (SWOT-PEST) matrix analysis method. The competitive strength of Internet hospitals is also analyzed using Porter's five forces analysis mode. Future development strategies and ideas are explored, and Internet hospitals are promoted as an innovative way to optimize the allocation of medical resources, so that patients can enjoy high-quality and convenient medical services.

Key words: China; Internet hospitals; E-health; Health care; Medical informatics

Driven by the creation of Internet plus Healthcare and hierarchical medical system, Internet hospitals have evolved based on information and network hospitals, and have changed the traditional distribution pattern of medical resources. They also meet the strong public demand for health services through the network, and provide patients with convenient, fast, affordable, safe, and reliable medical services. In this study, the strengths, weaknesses, opportunities, challenges and politics, economic, society, technology (SWOT-PEST) matrix analysis framework was used to investigate the operation mechanism of Internet hospitals and to seek directions for path optimization, which is conducive to thorough research on Internet hospitals from multiple perspectives.

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Received: 01 April 2022; Revised: 30 August 2022; Accepted: 14 September 2022; Published: 27 February 2023
https://doi.org/10.54844/hamp.2022.0025

DEVELOPMENT STATUS OF INTERNET HOSPITALS

Definition of Internet hospitals

"Internet hospitals", as a new service form, which integrates contemporary information technology and traditional health resources to realize disease diagnosis and treatment and provide health services, are in their initial stage in China; there is not an authoritative definition for them yet. The Chinese government specifies that Internet hospitals should use physical medical institutions as the main participants, and take one of two forms, namely Internet hospitals as a subsidiary of physical medical institutions, and Internet hospitals independently set up by third-party institutions that rely on physical medical institutions.[1] Generally, Internet hospitals rely on physical hospitals and use the Internet as their foundation. Further, they use cloud computing, big data, and other technical means to extend medical resources from offline to online, and operate online medical and health service platforms centering on residents' health.[2]

Germination and rise

After their creation, Internet hospitals went through the initial stage of survival, the rapid development stage, and the diversified development stage. Guangdong Network Hospital, the first network hospital in China, obtained its license from the health authority in 2014 and relies on the

Guangdong Second Provincial General Hospital. In 2015, Wuzhen Internet Hospital in Zhejiang Province, the first Internet hospital in China, commenced operating, and pioneered the Internet hospital service. Since then, the number of Internet hospitals (including cloud hospitals and network hospitals) has increased rapidly. As of December 2019, according to incomplete statistics, there were more than 270 registered Internet hospitals with certain levels of popularity and representativeness in China, with different operating modes, and of various types. The top five provinces with the highest number of Internet hospitals were Ningxia, Guangdong, Shandong, Guizhou, and Sichuan, among which the proportion of Internet hospitals led by enterprises was high. The supervision platform of Internet medical services has gradually been established throughout China, fulfilling the responsibility of review and approval and the supervision of Internet hospitals. The main causes for the upsurge in Internet hospitals are the following.

(1) Unbalanced distribution of medical resources and patients' needs created the motivating force for development. Prior to the creation of Internet hospitals, the unequal distribution of medical resources in China had not been significantly improved, the total quantity of health resources was insufficient, the allocation of resources was unreasonable, and development was uncoordinated.[3] Moreover, high-quality medical resources had been concentrated in developed areas (cities) for a long time, Grade III hospitals were faced with overcrowding and overload, and primary-level medical institutions had insufficient service capacity (medical care was hard to access and was expensive). Therefore, Internet hospitals had become an entry point for overcoming restrictions of time and space. Additionally, there was a broad medical audience base and a willingness to use. China's Internet medical users accounted for about one-fifth of all Internet users. Among them, online medical services such as appointment registration and online consultations were used frequently before physical office visits (18.4% of overall hospital visits).[4] With the vigorous development of Internet plus Healthcare, services such as simple online appointment registration and health consultations could no longer meet the increasing health needs of the public.

(2) The central and local governments released dividend policies and formed a top-level leadership structure. Since the 1990s, China has issued several supporting policies or measures in the fields of telemedicine and Internet plus Healthcare and health. In particular, the concept of "Great Healthcare and Great Health" was proposed and the national strategy of "Healthy China 2030", which has provided policy support and guarantees for the development of Internet hospitals, promoted the pattern of diversified hospital operations, encouraged Internet enterprises and medical institutions to innovate online modes, and expanded the forms of online medical services before, during, and after office visits. In 2018, through the issuance of documents relating to Internet hospital management measures, the nature, connotations, access criteria, practice rules, supervision, and management of Internet hospitals were officially defined, which meant that the development of Internet hospitals had entered a new period and the initial growth stage had ended. At the same time, local governments had formulated a series of local policies to encourage the development of Internet hospitals according to the actual local medical service level and economic strength.

(3) Hospitals pursued the goal of high-quality medical services and stimulated internal impetus. Mature-scale online light consultation platforms had been created in China. Simultaneously, the portals of some large hospitals provided online consultation services for experts, which laid a practical foundation for Internet hospitals. Medical institutions were encouraged to apply the Internet and other technologies to build an integrated online and offline service mode covering the entire diagnosis and treatment process. Internet hospitals have reshaped the diagnosis and treatment process, improved the quality of medical services and patient satisfaction, promoted the allocation of high-quality medical resources to the primary level, reduced medical costs, and proposed new development directions. Therefore, many institutions or hospitals have begun to try to integrate physical hospitals, doctors, and patients through the Internet to form a more efficient and reasonable diagnosis and treatment platform.

(4) External driving forces caused by technological innovation and progress, as well as the market opportunity period. With the rise of cloud computing, big data, the Internet, and other information technologies, the depth and breadth of medical informatization have been continuously expanded, providing strong technical support for the development of Internet hospitals. "Internet Plus" is firmly entering the medical industry, showing signs of a blue ocean market in the medical and health industry. Although still in the initial stage, social medical capital is driven by profit and attracts the full attention of capital. Internet giants and traditional pharmaceutical enterprises have successively joined the battle of Internet plus Healthcare, which is a big achievement for the Internet medical industry. After exogenous attempts, Internet medical capital has also turned to local governments or large hospitals, making them symbiotic and creating a win-win scenario. Internet medical care has begun to break through from "peripheral services" and has gradually reached core medical resources. The Internet has

ushered in a new market opportunity period that has developed rapidly.

Application scenarios and advantages

In practice, Internet hospitals leverage Internet technologies to integrate online and offline applications (Figure 1), which is conducive to opening the key links of "medical care, drugs, and insurance" and expanding access to medical resources. Medical resources throughout the country, including secondary and tertiary medical institutions, medical insurance institutions, and pharmacies and drug stores are effectively integrated. In Internet hospitals, doctors and patients can realize online connections for accurate triage, online disease consultation, remote diagnosis and treatment, examinations and follow-up, electronic prescription, surgery appointments, and drug distribution, while offline diagnosis and treatment services (examinations, imaging, surgery, rehabilitation, *etc.*) are also provided. Patients enjoy high-quality diagnosis and treatment services, while doctors also create personal brand value; ultimately both doctors and patients benefit from this setup.

The main advantages of Internet hospitals are as follows:

(1) They strengthen the value chain of medical resources and promote the development of hierarchical medical system; they transfer diagnosis and treatment from offline to online, expand medical service space and business scope, rationally divert doctors and patients, and accurately match them to each other; and they promote the flow of high-quality medical resources and expand the brand effect of hospitals. Parallelly, Internet hospitals provide output technical support and training for primary-level doctors and improve first diagnosis ability at the primary level.[5]

(2) They allow patients to conveniently seek medical attention and reduce medical expenses. By optimizing the medical service process, overcoming the limitations of time and space, and reducing waiting time for registration and consultations, the efficiency of diagnosis and treatment can be improved.[6] Particularly in rural and remote areas, patients can seek medical treatment conveniently on their doorsteps, even from famous doctors, without leaving home, which alleviates the contradiction between the imbalance of medical resources among regions and the sharp increase in medical care demands.

(3) Internet hospitals improve doctors' income, broaden the channels of multi-site practice, and promote the flow of doctor resources. They relieve doctors' work pressure, account for the shortage of doctor resources, effectively improve doctors' work efficiency, shape doctors' personal brands, and maximize doctors' value.[7]

(4) They promote hospital information infrastructure and accelerate the sharing of medical big data. Through cloud platforms and mobile intelligent terminals, patients' health data and previous cases can be obtained to realize health monitoring and medical record sharing, which is conducive to breaking through information barriers and information asymmetry among hospitals.

(5) Internet hospitals can reduce the probability of doctor–patient disputes. The Internet leaves a trail for the whole process; thus, the service process is

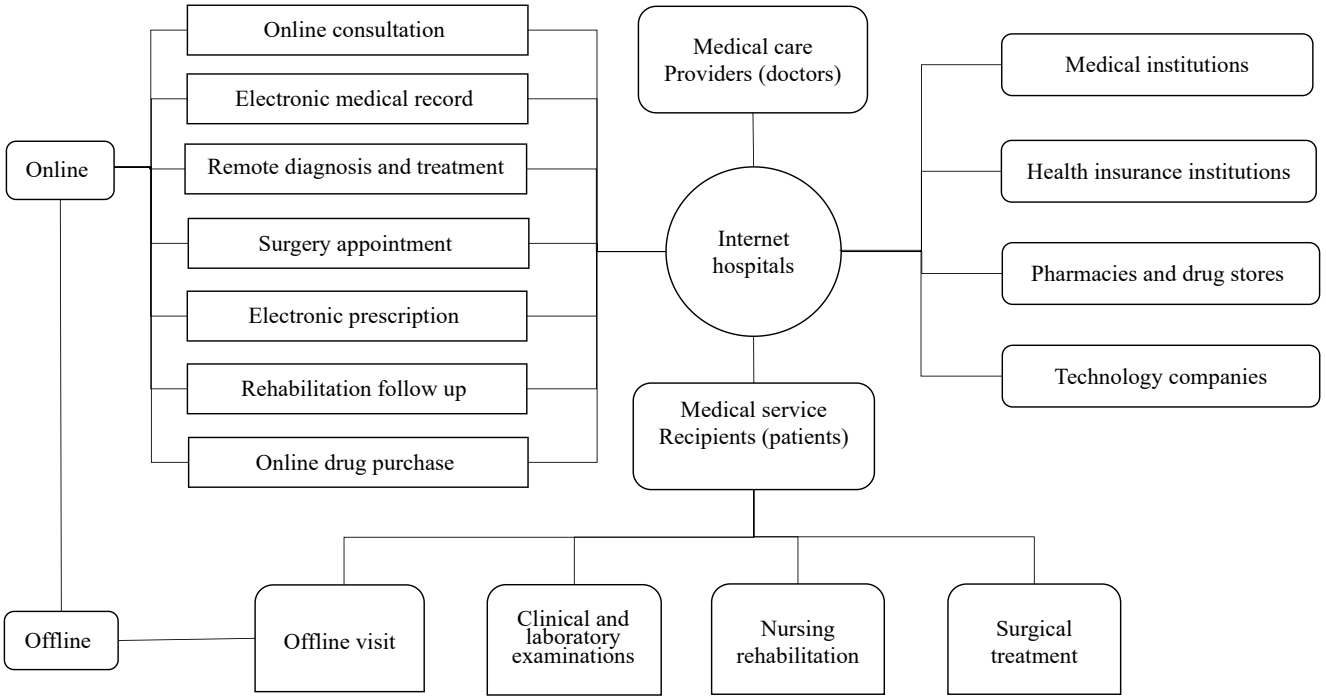

Figure 1. Operating scenario of Internet hospitals.

more transparent. Online communication between doctors and patients can also improve the relationship between doctors and patients, expand the sourcing of patients for hospitals, and have a word-of-mouth effect.

MAIN SERVICE MODES AND FUNCTIONAL POSITIONING

Internet hospitals have transformed from medical service modes such as "light consultation" and "online appointment and registration" to core areas of medical services such as accurate triage, online diagnosis and treatment, and electronic prescription circulation, thus realizing the change in the medical consultation path from offline to online. Based on the opinions of the Internet Hospital Management Measures (Trial), China's legal Internet hospitals are based on physical medical institutions. Primarily, there are two modes of Internet hospitals, as shown in Table 1.

The modes of Internet hospitals are divided according to the type of initiator, and the first mode is led by the hospital. With a single hospital or a medical treatment alliance as the core of the construction, with the Internet as the carrier and technical means, and a self-built network platform or that provided by a third party, an Internet hospital (online hospital) is established, with a downward vertical extension to the primary level. Hospitals move services online or offer drug distribution; Internet hospitals in this mode need to provide medical services with reference to relevant diagnosis and treatment subjects of the associated physical medical institutions. The second mode is enterprise led. Internet enterprises must be affiliated to physical medical institutions to facilitate risk control. Enterprises provide funds and technology, build an Internet diagnosis and treatment platform, and establish partnerships. Internet enterprises, medical institutions, and local governments as a joint network of hospital platforms is currently a common mode with relatively broad influence. The advantage lies in the fact that countrywide, doctors and patients are centralized on the medical care platform in the form of multi-site practice; this ensures that doctor resources are more abundant and doctors can realize their own values. It also promotes the openness and transparency of electronic prescriptions and medical record management.[10]

FACTORS INFLUENCING THE OPERATION OF INTERNET HOSPITALS

The SWOT–PEST analysis matrix is a multi-dimensional analysis method with comprehensive application of the SWOT and PEST modes. It comprehensively analyzes the development environment of Internet hospitals from the perspective of strategic management by analyzing the advantages and disadvantages, as well as the opportunities and challenges. Based on the SWOT–PEST mode, multi-dimensional analysis is shown in Table 2.

Analysis of institutional constraints (P)

The supporting laws and regulations for Internet hospitals are not perfect, the applicability of information standards is insufficient, and a supervision and restraint mechanism are lacking, making them lag far behind the needs of actual development.[7] An exact definition of Internet hospitals is lacking (including cloud hospitals and network hospitals) in policies, and it is also necessary to clearly define aspects such as the scope of responsibilities and risk divisions. Furthermore, the medical legislation relating to Internet hospitals is insufficient,[11] the legal subject responsibility evaluation and assessment standards are lacking, and medical insurance reimbursement is not fully connected to Internet hospitals. Since the social medical insurance system focuses on inpatient medical services (accounting for 70%–80% of medical insurance funds), Internet hospital services as outpatient services cause problems relating to payment scope limitations and expense reimbursement.[9] Doctors are scarce resources, and experts (famous doctors), in particular, are in short supply; thus, due to the policy protection of traditional hospitals, the policy control on the implementation of multi-site practice has not been fully lifted, which has aggravated the "talent shortage" of online doctors. In addition to "peripheral services" such as registration, the current business scope of Internet hospitals is limited to online follow-up visits for some common and chronic diseases, which makes it difficult to involve core diseases in medical care and affects the benefit space.

Analysis of economic constraints (E)

The rights, responsibilities, and benefits of stakeholders in Internet hospitals are diffuse, and the profit and operation modes are not sufficiently mature, which can easily lead to unbalanced benefit distribution. The incentive mechanism for doctors is not strong, and there is a lack of clear and stable sources of financing. Particularly in hospitals dominated by Internet enterprises, the demand for medical investment is large, capital dependence is high, and the refund period is long. When the national economic situation decreases and the hospital cost pressure increases, the risk of withdrawal of social capital investment increases. Excessive infiltration of social capital will impair the public welfare nature of public medical institutions, causing them to only pursue economic benefits and ignore the social benefits of the medical industry. Faced with the payment dilemma between the medical insurance provider and the side demanding payment, it is difficult to connect with the medical insurance system and realize real-time settlement.

Analysis of social constraints (S)

The legal relationships between Internet hospitals and offline medical institutions and doctors are unclear, especially regarding aspects such as disputes, division of responsibilities, and protection of rights and interests;

Table 1. Comparison between "hospital-led" and "enterprise-led" modes of Internet hospitals in China[8,9]

Mode	Originating entity	Entity relied on	Content of the mode	Main features	Hospital representative
Hospital-led mode	Medical institution	Medical institution	Star-shaped connection, with the physical hospital at the center, and establishing the "hospital-drug store" connection with related pharmacies (drug stores) externally; online consultations are provided externally by doctors from the same hospital.	(1) Hospitals have the operational right to network their offline medical services; (2) Enterprises provide technical support; (3) The source of doctors is stable; (4) The procedures for medical consultation are more standardized and better integrated with those that are offline; and (5) Patients are retained by online and offline follow up to reduce the loss of outpatient visits.	Network Hospital of Guangdong Second Provincial General Hospital, Internet Hospital of the First Affiliated Hospital of Zhejiang University School of Medicine, Southern Medical University Shenzhen Hospital, *etc.*
Enterprise-led mode	Internet enterprises, medical institutions, and local governments	Medical institution	Net-like connection, enterprises rely on physical hospitals to obtain qualifications, and mainly rely on the remote diagnosis mode to carry out medical services with different medical institutions, local doctors, and drug suppliers.	(1) Enterprises have strong flexibility and autonomy and significant technical advantages; (2) Affected by financing, doctor sourcing, and health insurance policies; (3) Independent brand value can be produced, and strong joint efforts across areas are possible; (4) The nature of profit-seeking produces induced medical care; (5) Profiting from consultation fees and prescription drug consumption.	Wuzhen Internet Hospital, Yinchuan Internet Hospital, *etc.*

Table 2. SWOT–PEST analysis matrix of Internet hospitals

SWOT–PEST		P (political factors)	E (economic factors)	S (social factors)	T (scientific and technological factors)
Internal factors	S (Advantages)	(1) The internal management mechanism of the hospital keeps changing and developing; (2) Internet hospitals are flexible and creative.	(1) Saving medical resources for physical hospitals; (2) High efficiency of health resource management.	(1) Facilitating the improvement of publicity, credibility, and popularity; (2) The service items are closely related to patients' needs.	(1) The technical entry threshold of platforms is low; (2) Network technology overcomes the limitations of time and space.
	W (Disadvantages)	(1) Industry regulations are not perfect and are scattered, and their applicability is poor; (2) Core businesses involving medical services are limited.	(1) The rights, responsibilities, and benefits are not clear enough, and it is easy to ignore public welfare; (2) Pricing dilemma of the reimbursement mode; (3) Lack of a clear and stable financing mechanism.	(1) Complexity of preferences of those making demands; (2) Uneven management levels; (3) Internal obstacles to multi-site practice; (4) Responsibilities and utility objectives need to be clarified.	(1) Errors in information diagnosis and treatment; (2) Low technical level of primary-level medical institutions; (3) Information barriers and poor transmission mechanism.
External factors	O (Opportunities)	(1) Government support and favorable policies for Internet medical care; (2) Policies are gradually refined, improved, and standardized.	(1) Government health expenditure has increased; (2) People's health needs have increased; (3) The scale of the Internet medical care market has expanded; (4) The financing channels are rich.	(1) Aging has intensified, and the two-child policy has promoted the growth of the new-born population; (2) Patients have gradually adapted to online medical care; (3) The prevalence of chronic diseases and the number of follow-up visits have increased.	(1) Rapid development in new information technology; (2) Progress of medical technology.
	T (Challenges)	(1) A government supervision mechanism is lacking, and the formulation of laws and regulations is lagging behind; (2) The supporting policies are insufficient or have poor applicability, and health insurance and multi-site practice are limited.	(1) Uneven distribution of health resources among regions; (2) High capital dependence and long payback period; (3) Problems in allocating physical and online medical resources.	(1) Patients' awareness is insufficient, and they are bound to traditional concepts of medical treatment; (2) The continuity of medical services is poor and the patient base is unstable.	(1) Lack of guidance by industry information standards; (2) Information security threats; (3) Restriction of hardware facility construction.

Based on the SWOT–PEST matrix analysis results of Internet hospitals, the sections below focus on their constraints.

further, it is difficult to deal with medical disputes and determine responsibility for medical malpractice. High-quality medical resources in society are concentrated in large hospitals in big cities, and the service capacity of primary-level medical institutions is insufficient, which restricts Internet hospitals from developing basic online diagnosis and treatment services. However, Internet hospitals are bound by the traditional concept of medical treatment.[12] This is mainly reflected in the fact that traditional public hospitals reject the diversion of high-quality resources by enterprise-led Internet hospitals, while doctors still have a conservative attitude toward multi-site practice. Compared with face-to-face diagnosis by observation, palpation, percussion, and auscultation, Internet hospitals lack a physical examination process, which affects the quality and reliability of medical services and leads to distrust by patients. Drug abuse, lack of continuity of medical services, and other chaotic online phenomena lead to Internet hospitals' low credibility.

Analysis of science and technology restrictive factors (T)

The construction of Internet hardware facilities among different regions in China is extremely unbalanced. Large medical institutions, with their strong comprehensive strength in hardware and software, are in a favorable competitive position, while small medical institutions have insufficient management and technical levels, thus limiting their development. In remote and rural areas, the hardware facilities are insufficient, and the data transmission speed is slow, which affects accessibility to network diagnosis and treatment. Local information systems are not unified and there is a lack of industry standards, resulting in isolated islands of regional information. The information isolation and asymmetry in Internet hospitals promotes the emergence of new information barriers, which, coupled with the uncertainty of network diagnosis technology and the lack of practical tests, poses great risk to patient safety. The technological level of network diagnosis and treatment equipment is uneven, and the technical means of online information collection and data security are insufficient. Attention should be paid to privacy leakage and the unreasonable development of health data to avoid technical loopholes.

ANALYSIS OF THE COMPETITIVENESS OF INTERNET HOSPITALS

Porter's competitiveness analysis model was put forward by Michael Porter at Harvard University. Based on the SWOT–PEST matrix analysis of Internet hospitals, this paper analyzes the competitive environment and intensity of Internet hospitals through five core elements of the model. These five elements include the bargaining powers of the supplier, the bargaining power of the buyer, the threat of new entrants, the threat of substitutes, and the competitiveness of industry players. (Table 3)

REFLECTION AND PROSPECTS

Although Internet hospitals borrow the technical means of Internet Plus, they essentially provide medical treatment. That is, they only innovatively integrate medical resources, thus improving the efficiency of resource use and the balance between supply and demand. At present, Internet hospitals in China have achieved phased development, but in future practice, optimization and breakthrough are required in many respects.

Government agencies should play an important role in the top-level design of policy making and improve the laws and regulations applicable to Internet hospitals. They should incorporate the management of Internet hospitals into the governance plan of "release, management, and service", clarify their legal status; strictly delimit the content boundary of network diagnosis and treatment; and improve the entry threshold. Parallelly, they should standardize the supervision system and formulate industry standards in detail, such as the intellectual property rights of doctors, the safety of medical data, and the protection of patients' privacy. They should also increase financial input, give full play to the powerful boost of medical insurance policies, make Internet hospitals enjoy the same medical insurance policies as public hospitals, and explore and realize online medical insurance payments. They should also promote the construction of credible systems for Internet hospitals, explore the establishment of network doctors and nurse management mechanisms, and conduct online electronic real-name authentication, training, and assessment to prevent unqualified doctors from endangering medical quality and safety.

Table 3. Porter's five forces model analysis of Internet hospitals

Competency element	Stakeholders	Competitiveness situation
Bargaining power of the supplier	Medical service providers (doctors)	Strong
	Large (small) medical institutions	Strong (medium)
	Technology suppliers	Middle
Bargaining power of the buyer	Medical service providers (patients)	Weak
Threat of new entrants		Strong
Threat of substitutes	Telemedicine, online consultation, and other enterprises	Middle
Competitiveness of competitors in the industry		Weak

Internet hospitals should seize the opportunities presented by favorable government policies, integrate the internal resources of hospitals, balance the benefit distribution of all stakeholders including traditional hospitals, doctors, medical e-commerce, and pharmacies, and stimulate their enthusiasm for participation. They should give full play to the advantages of hospitals' active participation and the provision of technical support services by Internet enterprises, to reduce conflicts of interest and achieve a win-win situation. Internet hospitals should make full use of the policy of doctors' multi-site practice, design reasonable compensation mechanisms, encourage doctors to establish personal brands, and guide doctors to register for practice online. They should strengthen the specialty construction of Internet hospitals, introduce famous doctors and new medical technologies, comprehensively improve the level of specialization, and increase patients' sense of access to medical services. They should also improve their self-regulation ability, ensure information security and privacy protection, improve the medical dispute resolution system, and guarantee the right of patients to diagnosis and treatment safety.

Internet enterprises need to develop their own technology and equipment, explore more scientific, advanced, and humanized technology applications, improve the accessibility of quality services, and enhance the supervision and management of potential technical risks that may arise. As for financing channels, in addition to venture capital, cooperation with commercial health insurance companies can also be explored to solve the financing problems faced by Internet hospitals led by enterprises.

Looking at future trends, it is noteworthy to mention smart hospitals, which are the product of the advanced development of artificial intelligence and Internet technology and will be the next developmental form of Internet hospitals.[13] By applying new-generation technologies such as cloud computing, big data processing, artificial intelligence, and the Internet of Things, the resource supply and matching for Internet hospitals in the whole medical care process will be more digital and intelligent, and the channels of personalized health management will be faster, more effective, and more accurate. In short, the arrival of the "Internet Plus" era has provided new thoughts and methods for Internet hospitals. With the aid of the tide of the times, how to construct Internet hospitals scientifically and healthily? The whole society should participate in the thinking.

Source of Funding

This research was funded by Overseas Scientific Research Cooperation Fund Project of Shenzhen Graduate School of Tsinghua University (HW2018011).

Conflict of Interest

The authors declare that there are no conflict of interests.

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