

The Dilemma of Smart Healthcare Development in China from the Perspective of Public Policy and Its Countermeasures

Taking Hubei Province as an Example

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Abstract—Internet of things, big data and cloud computing as the representative of information technology is very active. The information technology has advanced the sustainable development of health service. However, the development and reform of medical and health services have been affecting increasingly. As an important part of new health care reform under the background of Internet of Things, smart healthcare provides further guarantee to human health by implementing health management. Smart healthcare is a new health care model, and its construction and development would face many new problems and difficulties. Taking Hubei province as the research object, the current status of smart healthcare was investigated. The development dilemma and its cause of smart healthcare in Hubei Province were analyzed. Then based on three levels of human factors, technical and social, countermeasures were presented to promote development of smart healthcare.

Keywords—smart healthcare; development dilemma; public policy; Hubei province

I. INTRODUCTION

Looking forward to the development of medical and health service, informatization, smartization, networking and interconnection have become an irresistible trend for its construction. China's health informatization construction has become an important breakthrough and the origin of force for reform of healthcare system. From the concept of "smart healthcare", Internet of things technology is used in the health of healthcare by the help of digitization and visualization mode to conduct the collection of vital signs and health monitoring in order to realize the share of healthcare resources. In China popularizing smart healthcare will realize the progress of China's healthcare course and is the tendency of the development in public health field. However, as the pioneering work for the reform of healthcare, the development of smart healthcare also faces a different and new dilemma from one that traditional healthcare face: many problems such as the use of public resources, privacy information protection, information technology safety, and risks & incomes, so based

on using the foreign complete research system and frame for reference, integrating with China's actual situation, considering the current research result of Hubei smart healthcare as the foothold, the development dilemma of "smart healthcare" is mainly discussed and effective public policies are put forward.

II. CURRENT DEVELOPMENT OF THE SMART HEALTHCARE IN HUBEI PROVINCE

A. The Overview of Smart Healthcare

In informatization era, smart healthcare, following the step of mobile medical care mode and health informatization construction, enters the view of people and is widely paid close attention to. From the perspective of the author, smart healthcare is the application and product of medical care informatization in particular development phase, and has some common features with mobile medical care. Different concepts and definitions appear due to the difference of function or characteristic attributes between "mobile medical care" and "smart medical care", but they commonly belong to the category of medical informatization. Adopting the statement from the view of mathematics, smart medical care shall be the proper subset of medical care informatization; adopting the statement from the view of philosophy, there exists the relation of element and system between smart medical care and medical care informatization so we think the smart medical care is a new-type medical care service mode in information era, mainly based on the health record as the information platform, in aspects such as health management, chronic disease management, medical resource management, electronic health files, technology of Internet of things is used to enhance the interaction between doctors and patients and realize informatization.

Smart healthcare is composed of three parts, which are smart hospital system, regional sanitation system and family health system. Of which, smart hospital system is divided into two parts which are digital hospital and promotion & application, and the former part is mainly responsible for the process from record-collection to record-application, and the

Fund Project: Planned Soft Science Research Projects supported by Hunan Province Science and Technology (2015BDF079), Hunan Philosophy and Social Science Fund Projects (13YBA257).

latter part is to use technologies like data-processing in the construction of digital hospital so as to increase the medical care service level; the regional health system which are composed of regional health platform and public health system, mainly through the information collected by the system, formulates the planning of going to see doctors, reduces the cost of going to see doctors, and enacts electronic health care; family health system is the most appropriate to the health of people, and provides health guarantee for citizens. Not hard to find, the three constituent parts of smart healthcare have the corresponding relations with international uniform development level of medical informatization, and internationally, the development layer for development level of healthcare informatization is respectively hospital information system, clinical information management system and public health informatization, which is a healthcare informatization course that is developed from "part" to "whole", while smart healthcare is a product of the development from hospital information system to public health system.

B. Development Trend of Hubei Smart Healthcare

1) *Overall development situation:* The acceleration of the construction of medical informatization gives a new mission for the development of smart healthcare. In order to gradually implement the 12th Five-year Plan of Hubei Province Basic Public Service System, complete and develop the construction of Hubei smart healthcare, under the guidance of provincial government and medical treatment and public health departments, the following work are completed efficiently in Hubei Province: (1) For the provincial-level secret key management system for residents' health and the construction of registration management system, from the extent expand the scope and channel of card-issuing, and from the efficiency quicken the issue and application of cards; (2) Construct drug electronic supervision and management system to realize the supervision of drugs "from production to sales"; (3) basically complete the bidding and purchasing work for application software of comprehensive platform in provinces and cities; (4) complete the technical transformation of basic drug purchasing platform and propel the construction of centralized settlement platform for basic drug and electronic supervision and management system for drugs in clinics in villages; (5) complete the update and transformation of web portals, office system and network broadcast system; (6) Cooperate to complete the work of national sanitary survey. The construction of security and protection system like management system of provincial-level secret key and electronic supervision and management system provides a complete and safe information system platform for the construction of smart healthcare.

Up to the end of 2014, in Hubei Province video system for medical rescue covering three levels (province, city and county) has been built and put into production (the coverage rate of health information private network in grassroots units has reached over 80%); information management system for new rural cooperative medical system (NCMS) covered and served approximately 40 million farmers participating in new cooperative medical system and the deployment and construction of management information system of grass roots

medical institutions are realized in 53 counties (cities and districts); long-distance medical care system is established in 69 counties (cities and districts); the coverage rate of electronic medical record (EMR) in third-level hospitals reaches 70%, which is higher than in second-level hospitals by 38%; the construction of health information system has been completed initiatively in two cities which are Wuhan and Ezhou in order to realize the interconnection between information of regional extent. Cities in Hubei begins with basic level, through the gradual completion of hospital information system and regional sanitary system and to stick closely to the content of smart healthcare, the development of three aspects which are hospitals, areas and people are realized.

The development of smart healthcare is like a raging fire. With the deep coverage of mobile 4G network and the gradual enrichment of informatization technology, more and more people will get a taste of the convenience brought by "smart healthcare. Since in 2009 registration service of 12580 mobile phone appointment started, the service has covered over 350 hospitals all over China, and locally there are 22 hospitals such as Tongji hospital, Xiehe hospital, city 3rd hospital, city 5st hospital, and Asia Heart Disease hospital, and up to now, the total number of inquires for registration service for 12580 appointment has exceed 10 million times; in many places like Jinzhou, Hubei Mobile Company successfully established a "Medical Messenger" platform to help hospitals realize informatizaiton office, strengthen the communication with patients, increase the transparent consumption of hospital bills so as to improve the social images of hospitals; as the construction city "Health Cloud", the 4G wireless data dedicated circuit was piloted and applied on the platform of healthcare cloud to realize the access of medical insurance system in community health service station and community out-patient departments in Jinmen; the "Cloud Monitoring" platform was piloted and applied in Huangshi to supervise germs storage rooms all the time for City-level Center for Disease Control and Prevention and settle the safety problem of germ storage. Quyi Net cooperates with Telecommunications 114 jia to specially launch--- through the application of "Quyi Hospital" application and 114 home application, patients who conduct registration can get the registration fee subsidy with a maximum value of 4 yuan each time and everyone gets preference two times at most. The construction of Hubei medical care system is mainly constructed around the pattern of "One main and two vices, and four districts" and informatization platform for health resources is created.

2) *Focus on Wuhan, and the specific development of each city:* In the development of smart healthcare of our province, the situation of focusing on Wuhan and driving the development of every prefecture-level cities appears. As the provincial capital of Hubei Province, Wuhan has advantaged policy advantages and strategic opportunities, and the economic, politic and social development provides advantageous conditions for the construction of medical and health services. The construction of "Big-Wuhan" metropolitan area objectively strengthens the connection between cities and is beneficial to realizing the share and

cooperation between cities and helps these cities developed together.

In order to successfully develop every business of public health field in our province and ensure people enjoy basic health service, every city of Hubei sets about implementing theory system construction, hospital information system construction, medical industry foundation construction and industry software market standards ("three constructions – standards")

a) The construction of theory system: In order to comply with the implementation of the policy of Deepen the System Reform of Medicine and Health and Sanitation Informatization Construction, "Hubei health information internet conference" was held in Shiyan, through "mobile wireless digital healthcare" and "follow-up visit e-connection", the management of hospital service is improved and the efficiency of seeking medical advice of patients is increased. In order to completely enhance the health information level, the rising cloud computing, big data, Internet of things and mobile Internet technology provides good development opportunity and technology guarantee to realize the objectives of smart healthcare. The development tendency of the future healthcare industry necessitates medical personnel to enhance the modern management ability. In order to realize the aim, in 2014 in Yichang city the development forum of smart healthcare and the 3rd Internet of Things Application and Advance Meeting in Health Field were undertaken.

b) The construction of hospital information system: The need of information collection is always the motive power the construction of hospital information system so hospitals shall gradually strengthen management and consider information system as the structural foundation of regional public health information system. In the aspect of informatization, nation, hospitals and software companies invest a large number of resources for the construction and maintenance of hospital information management system. Professional Committee of Hospital management of Chinese Hospital Association made an investigation of the on-line condition of 482 hospitals, and the investigation situation shows that the construction of system is good, and the on-line proportion are all over 90%. Take The Central Hospital of Wuhan for example, through constructing an electronic early warning platform for rational drug use, and set about "mobile health care" and "three-Internet fuse", and in this year realize the first smart healthcare service platform of "Wechat complete flow"; Yaxin hospital follows its step, and through Yaxin Wechat and Yaxin application, just staying at home, patients can experience the medical treatment service provided by specialized hospital for heart specialty, and through the video call function of Google glasses of hospitals, realize the integration and optimization configuration of the world's medical resources. Xiaogan 1st the People's School strengthens the construction of itself medical treatment informatization, applies medical care platform of Fangxun doctor Internet, through "Internet+" and just staying at home,

realize the one-stop medical care service of "go to a doctor+ supervision+ pick up drugs".

c) The construction of medical care industry base: Modern medical care industry base is an all-round big platform combining health management, medical care service, and many platforms including rehabilitation platform, big data and electronic transaction whose aim is to move around Internet of things, education and medical care so as to create high-tech park in multi-level and multi-field. In May, 2015, Wuhan Biolake became the base of "Hubei Province smart medical care industry", and planned to construct Biolake Medical Health Garden and strived to create all-health industry chain of "medicine, education, research and recovery", and constructed a specialized park for medical care and health which integrates service, management, achievement transformation and product popularity and application.

d) Norms of the market for industry software: Influenced constantly by information era, more and more business in medical care industry needs the functions from IT technology to background support and the need of informatization by people takes on a speed-up tendency. Additionally, the deep exploration of smart healthcare, the informatization of hospital enter the integration era from the initial phase, and software and hardware are badly in need of transformation and upgrading to adapt to the need of medical informatization. In order to comply with the development of smart healthcare, the number of relevant software providers is increased rapidly. According to incomplete statistics, there are about 500 software providers for medical treatment and public health in China (of which, medical treatment information system providers accounts for 60%), and large-scale, middle-scale and small-scale production suppliers respectively account for 15%, 60% and 25%. In 2014, 20 leading enterprise alliance of medical care informatization developed activities such as visits between enterprises, common study, business subcontracting, travel & communication, integrated superior resources, extended and created the value chain of smart chains to finally realize the resource replacement such as products, technology and customers between enterprises and reduce the cost of enterprises.

In addition, in recent years Dongruan Group Co., Ltd. plays a great role in promoting smart Yichang, through the fruitful exploration and practice in "Internet+ Health & Medicine" field, Dongruan Group Co., Ltd. developed all-round strategic cooperation in the industry of health and medicine of Yichang intelligence, and meantime, developed talent cultivation planning with local universities and colleges in Yichang, enhanced and expanded the education industry scale of IT and provided human resource guarantee for the rapid and sustainable development of Yichang information industry of medical treatment and public health.

III. DEVELOPMENT DILEMMA ANALYSIS DURING CONSTRUCTION OF SMART HEALTHCARE IN HUBEI PROVINCE

In recent years, because the combined action of many factors such as the enhancement of informatization awareness,

the popularization of smart terminals and the support of national policies, the national medical care informatization level is increased gradually, and the development of smart healthcare reaches a new height. Based on the good development impetus, according to the internal and external factors in medical care industry, we analyze completely, systematically and accurately and discuss the dilemma during the construction of smart healthcare in Hubei Province to provide support for the countermeasure analysis of the following paragraphs.

On the level of formulating technical standards and industry policies, the construction of China's smart healthcare reach the initial results. From the Party Central Committee to each level of government and relevant operating departments bring out the development strategy and industry planning for smart healthcare, but according to the analysis of fulfilling situation, smart healthcare still faces many challenges such as legal system, market norms, cognitive ideas and industrial chain collaboration.

A. Construction Problem of Medical Care System

During the initial period of the development of Internet of things, the construction of up and down industry chains is still not complete. In medical care industry, there are many factors restricting the development of smart healthcare industry such as concepts, systems, technologies and safeties. Seen from the current situation in China, systematical obstacles are the problems that need to be solved first. In fact, because of the systematic obstacles, the information of medical care industry is not easy to be shared, which impedes the construction of basic network for the development of Internet of things.

The current business of smart health care involves many fields, and the industry structure is disordered, and its interest chains are complex, so in order to coordinate the relationships between stakeholders and change the way of benefit distribution, the existing medical care system needs to be improved and the commercial mode and service method adapting to the new circumstances shall be put forward. A good deal of systems and standards are out of data and are not suitable for the development of the existing business, and they needs to be re-formulated to settle the accumulated problems in the past. Each standard is different and complex, which results in the earnings not reaching the relative fairness in each link.

B. Traditional Business Procedure Restricts the Development of the Industry

In traditional management mode of medical care, the management system centers on business procedure, and regards controlling and coordinating each department as the main content of work. The intersectional and multi-layered administrative management control system not only reduces the enthusiasm of work and strangles people's creativity. In medical informatization planning, there are too many department planning and each does things in his/her own way, and cross-departmental systematic planning is very few. For the overall development of smart healthcare, the cooperation and coordination are scarce. The communication between

relevant departments of sanitation and providers of equipment and platforms especially between office of telecommunications authorities (mainly including informatization experts and public service experts) are insufficient. Department of health lacks strategic insight, and lacks acute discernment and foresee ability for the development of relevant technology of information internet and business mode, and cannot grasp the need of application subjects roundly. New-type medical care service mode requires that in hospital management, patient information management and service mechanism, through the standard design, scientific implementation and continuous update & optimization for procedures, the medical care management will be conducted normatively, systematically and scientifically.

C. Medical Care Software/ Hardware Enterprises Lack Advantageous Cultivation Environment

It's understood that in China there are a lot of imported medical care equipment which cost large amount of money. National high-end medical care equipment market just accounts for 30% and most of national medical care markets are divided up by developed countries. Not only for high-end medical equipment market, the markets of China's medical care software have been taken position by many foreign providers in advance, and these transnational corporations established professional and standardized medical care informatization institutions to enter the industry of China medical care informatization with their all strength.

Analyzing the maturity of existing smart healthcare products, our products of smart healthcare and technological standard are not wholesome, and there exists the phenomena of applying mechanically non-professional standards; the design thought of products is numerous and jumbled, and the use process is complicated, which are not easily to be mastered. In addition, because the construction of China's smart healthcare is still at the starting and groping stage, the immature market access policy increase the difficulty for new enterprises obtaining relevant qualification, which is not easy to reach the access conditions stipulated by the market and standard requirement, and these all hinder the formation of the principle of market fairness.

D. The Gap of Scientific Research Support and Talent Cultivation Is Big

After the reform of medical and health system, the contraction between informatization construction speed and reserve of talents has become more obvious day by day. All the time, because the investment of informatization construction is unbalanced, and marginalized information department is underappreciated, the cultivation of informatization talents in health care industry is impeded. The shortage of talents for health care has become a difficult problem for medical reform in China. Facing a huge talent need, in modern medical care industry, there exists the shortage of specialized talents who not only know about the medical care business and are proficient in IT technology. Apparently, the shortage of talents has become the strategic pass for the development of smart healthcare.

IV. CONSTRUCTION COUNTERMEASURE ANALYSIS OF SMART HEALTHCARE IN HUBEI PROVINCE

At present, there exists the outstanding development issues in China, and the reform of medical system is extremely urgent. In order to meet the health need of patients, new-type medical system is approaching the life of people. Undoubtedly, the new medical idea in its formation and development will face challenges from many aspects, and we will put forward pertinence measures for the construction of smart healthcare from three decision perspectives of “human”, “technology” and “society”.

A. Human Element

1) *Patient entrance:* The development from traditional medical mode to smart medicine will face opposition from all parties when it initially entering the view of patients. The change of payment method and the habit of going to a doctor, to some extent, need enhancing the degree of awareness of the public to smart healthcare. Smart healthcare is an important content and inevitable tendency of new medical reform, which needs that the public change some conservative ideas in concepts, and through educational training, community services and policy guidance of government departments, the public trust network and mobile healthcare, and enhance the confidence for network safety and network data information, and by doing so, it will ensure the completion of basic work in smart healthcare in the aspect of many patients.

2) *Doctor entrance:* According to the statistics, at present the informatization degree of China's various hospitals is generally not high, and just through sporadic hospitals to drive the development of medical informatization in China, provinces and cities, there will be very difficult for medical informatization. How to let medical experts accept and favor this fresh word smart healthcare is an important breakthrough for the development of China's smart healthcare. Smart healthcare is closely related to big data, cloud computing, Internet of things, mobile internet technology, which needs the relatively high requirement for the computer operating level and data-processing ability of medical care personnel at present, and meantime, high professional quality and solid& reliable medical specialized knowledge is the necessary career requirement of modernization medical care personnel.

B. Technical Point of View

1) *Information system construction of hospitals:* Medical informatization has developed rapidly all over the world and set off a upsurge of every nation's construction of smart healthcare. However, for traditional sanitation business system, its operation is independent and data are not intensive and cannot realize effective information-share, which results in the occurrence of “the lonely island of medical information”. The increase of volume of business and scattered, many and diverse medical data seriously reduce the performance of business system, even in severe cases the breakdown of system and the stop of the operation of the system will happen, which will influence the normal operation of medical institutions, so in addition to raising the employment standards of modern medical staff, hospitals shall increase the investment and construction of hardware and software for hospital information

system according to the content of the 12th 5-year plan of national public service system; the providers of software/hardware shall actively develop high-performance software and hardware equipment which is suitable for the application of China's smart healthcare.

2) *Market construction of hardware/ software:* Under the background of China's medical-sanitary system reform, smart healthcare becomes the necessities of people's life. In future years, there will be a pretty big growth space for China's market of smart healthcare, and the related up and down industry scope is wide and the varieties of products are diverse. The rise and development of markets of smart healthcare not only influences the medical industry itself and but also drives the development of its related industry benefit chain.

The chain reaction arising from smart healthcare not only needs the high standards for patients, medical staff and hospitals but also puts forward a high request of the software and hardware of medical and health service. Formulate the industry standards for hardware/software market to make full use of and share the information resources of medical treatment and public health.

3) *Team construction of technical personnel:* China has a large population, combined with the degree of aging gradually becomes deep, which provide the impetus to the development of smart healthcare, but because there exists contraction between the imbalance of medical resources and the growing need of health and medicine by the public, many patients put forward new development demands for China's scanty medical resources. In today's medical service innovation, technology plays a decisive role. Focus on the change of technology, and combine with technology and education, research, and training to create an all-around industry chain, strengthen the construction of professional talent team and actively promote the reform of medical service.

C. Social Element

1) *Support of public policy:* As the main implementer and performer of policies of the State Council, the government shoulders the important responsibility in the development of smart healthcare. At first, the government leads each department to build network information platforms and public opinion platforms and provides the platform of understanding smart healthcare for the public. Second, the government strongly supports the construction of information system of hospitals, and provides guarantees for modernization reform of hospitals in many aspects such as person, property and object; Moreover, the government organizes and coordinates related industries in medical industry, and deal with the contradictions between up and down industrial chain in supply and demand; Finally, the government supervises the standard operation of industries, formulate policies and regulations, protect privacy and data safety, and standardize market operations.

2) *Guarantee of laws and regulations:* Aiming at ethical issues like privacy protection and data safety, the government and relevant legislative branches shall formulate related laws and regulations to standardize and supervise the operation of medical industry. On the premise of “human-centered”, the government and relevant legislative branches shall formulate

laws and regulations from different subjects such as public, medical industry, society, and government, especially for problems of personal privacy and information safety which are closely related with the public, the special legislation shall be conducted to ensure the interest of patients.

V. CONCLUSION

The development of smart healthcare in Hubei Province begun to show early results, but as a new mode of medical care, in its construction, new problems and dilemmas that traditional modes of medical care don't have will undoubtedly appear, which needs the harmonious operation of all stakeholders (Different value latitudes such as person, society, hospital and government) to realize the further stable and orderly development of our province's work of smart healthcare. As the crux of the 12th Five-year Plan of Hubei Province Basic Public Service System, improve the service system construction for smart healthcare, establish a complete set of information network service system, In addition to the reduction of the time cost and expense cost, provide high-quality and considerate service for patients to improve the satisfaction and happiness of patients and meet the physical and mental requirements of patients.

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