Original Research Article

Research on the Mode of Medical Synergistic Construction in Provincial Area Based on Cloud Computing Model

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ABSTRACT

This paper was based on the provincial community health information platform cloud computing project of Henan province, which provided business access for the cooperative medical care of provincial, city, county, township and village health institutions. The construction contents included remote consultation, the two-way referral, image collaboration, video conferencing, comprehensive management, medical data collection, distance education, mobile consultation, through the information technology to standardize medical service process, promote the regional medical information system standardization and information interoperability, and gradually guide patients, who stayed in the region, to seek treatment according to type of disease and related specialist orderly, will be effective to solve the problem of 'difficult and expensive to see a doctor', and also for other regional medical cooperation to provide construction suggestion.

KEYWORDS: cloud computing area; medical and health information system; standardization medical; collaborative health information; integrated management system

1. Background

According to the end of 2014 statistics, China's per thousand population practice (assistant) doctors reached 2.12, compared with some developed countries, China's per capita share of doctors is not obvious, even per thousand beds 4.84 share ratio high. But about 80% of the medical resources concentrated in the city hospitals, and only 20% of the rural primary health care institutions, with the economic development and social progress, people's demand for health care services also respond to improve, resulting in a large hospital overcrowding, and grass-roots medical institutions nobody cares, which is 'difficult and expensive to see a doctor', an important reason [1].

Henan Province is a typical agricultural population province, in order to improve the level of information, better for the rural population health services, Henan Province Health Commission to the National Development and Reform Commission submitted a basic medical institutions management information system construction program and be approved. Through the collaborative consultation, the impact of collaboration, two-way referral and online learning, making the region to share medical resources [2], to achieve 'provincial, city, county, village' multi-level medical service, while other provinces regional collaborative medical reference meaning [3].

2. Our province medical cooperation and construction goals

The province's regional collaborative medical construction project is based on the cloud computing model, follow the national and Henan province medical information related to the standard, the establishment and improvement of collaborative medical services, collaborative medical business supervision and telemedicine education three systems. Promote the region's high-quality medical resources sink, build a regional collaborative medical service platform [4], to achieve a variety of medical resources and institutions of mutual cooperation and information sharing. Promote the quality of primary health care and improve the level of service to facilitate the masses of the nearest medical care, to alleviate the grassroots people 'difficult to see a doctor' problem [5]. The specific objectives are as follows:

1. Based on the cloud computing model, the image as a breakthrough, in the provinces, cities, counties, townships and villages at all levels of medical institutions to build collaborative medical processes and services, the establishment of clinical medicine as the core, to patients with clinical data sharing mutual basis of the top-down trans-shipment, referral and transfer services.

2. The relevant technical means to achieve 'one-to-many, multi-point to multi-point' cross-regional, upper and lower doctors' interactive remote consultation services.

3. Through the processing of business intelligence and knowledge management technology, to provide data analysis and monitoring reports, effective monitoring of medical treatment occurred in the implementation of health supervision departments to implement supervision and formulation of relevant policies to provide the basis.

4. Through the construction and deployment of the distance education module, relying on the system to provide curriculum construction, curriculum review, learning management, credit management, learning and monitoring, books and video resources and other functions, the medical staff to carry out professional training to enhance the institutions at all levels physician level of diagnosis and treatment.

3. Regional medical cooperation project in our province

3.1. The overall structure

Henan Province, the overall structure of regional collaborative medical construction to the provincial data center as the core, with a dedicated network, covering the province's 18 cities in the collaborative medical information service platform, to support the province, county, village five Institutions of the collaborative medical business access, to provide users with remote consultation [6], two-way referral, comprehensive supervision and distance education four categories of collaborative medical services [7].

Cloud platform by the provincial hospitals, municipal hospitals and county-level hospitals in three parts, in accordance with the 'classification of medical treatment,' the working principle, by the six provincial hospitals in Henan province for the 18 municipal hospitals and 18 county-level hospitals remote consultation, two-way referral and other services; municipal hospitals as a provincial-level collaborative medical service center application side, down as a county-level hospital collaborative service center; county hospital as a whole collaborative medical service system construction important Of a node, up as the provincial and municipal hospitals to cooperate with the application of the hospital, down as a rural two-level medical institutions collaborative medical service center. The overall logical architecture of the cloud platform is as follows.

Figure 1. overall structure

The whole cloud platform is divided into software as a service (SaaS), platform as a service (PaaS), infrastructure as a service (IaaS) three-tier architecture, Henan Province, collaborative medical service platform is SaaS layer for medical institutions to provide collaborative services application software; The PaaS layer is based on the existing application

support platform and the application of the basic operating environment (including operating system, database and middleware). The IaaS layer and the PaaS layer are based on the existing grassroots medical platform cloud platform in Henan Province. The SaaS layer service provides a unified regional collaborative medical service for users, physicians, supervisors and health authorities who apply for medical institutions. Users only need to configure network access and the necessary application terminals (desktops and mobile phones) of its business.

3.2. Construction content

The construction content of our province is divided into three regions, including: data center, hospital and data access standards, regional medical collaborative construction content is as follows:

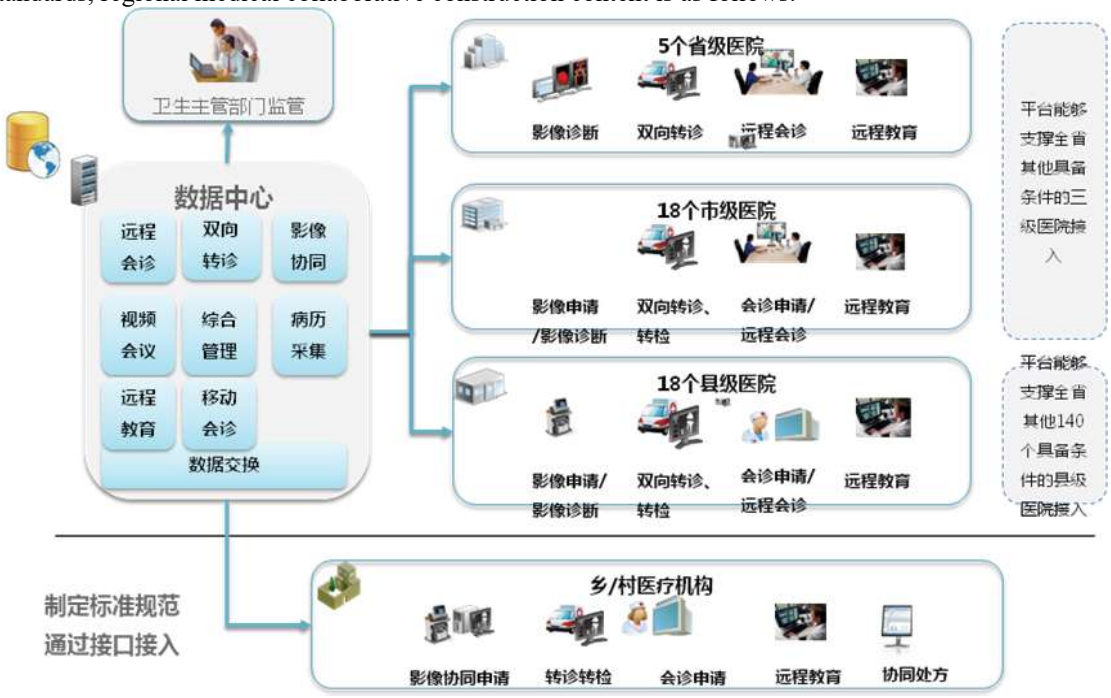

Figure 2. Regional medical collaborative construction content map

3.2.1 Data center

(1) Remote consultation

Remote consultation management module based on the medical institutions specialist experts, the use of video, voice, communications and other technologies, for the lower level of application doctors in the regional collaborative medical service platform to carry out remote collaborative diagnosis, remote consultation, chronic disease, remote treatment guidance, referral and other services ,to truly achieve the purpose of medical resources sharing, including: consultation applications, consultation management, expert management, expert consultation, integrated remote consultation services and management and many other sub-function modules. Through the platform to establish the expert library, medical institutions and patient files, so that patients in situ, the original hospital can accept the diagnosis of distant experts, and under the guidance of experts for treatment and care, saving patients a lot of time, energy and costs. Support both real-time and non-real-time interactive mode, support experts and apply for a doctor between the voice, video and text interaction; support experts on the patient's inspection, testing, medical advice and other medical records to view, the implementation of collaborative process to complete the remote consultation process.

(2) Two-way referral

In the process of remote consultation to apply for doctors and consultation doctors to share patients with images as the representative of the clinical data, and after full communication, to determine the application of medical institutions cannot continue to treat patients, through this function, apply for doctors in the higher level experts referral advice under the guidance of the patient to help apply for a transfer appointment or referral application. After the appointment is successful, the patients are transferred to the higher-level medical institutions according to the appointment period, the appointment department and the appointment experts, and the higher-level medical institutions arranged for the referral to the green channel. The system will be transferred as a referral or transfer process in an important node, by the superior experts recommend whether the patient needs to be transferred to the higher medical institutions for

further examination, the higher the experts through the transfer inspection report to determine the patient is to stay in the original medical institutions to continue treatment or referral or transfer to the higher medical treatment. Through the referral of the referral function, it is possible to make reasonable use of the medical resources of the admissions medical institution, avoid the wasteful use of the medical resources, and improve the validity of the referral. Patients in the higher medical treatment after the end of treatment, the higher the doctor according to the patient's condition can be rotated through the platform to the original transfer of medical institutions for rehabilitation, making the medical resources according to 'disease needs' reasonable distribution.

(3) Image collaboration

Image as a clinical data, because of its diagnostic process relative to the standard, the relative standard of technology, the most representative of the collaborative medical process through the image data as a clinical data to share, for the superior experts to provide a reliable basis for collaborative diagnosis [8]. The process is to apply for medical institutions of radiologists in the higher imaging department under the guidance of experts on the patient to conduct a precise examination, and the inspection image uploaded to the higher imaging experts, imaging experts to apply for medical institutions to initiate the image consultation application for interactive Image diagnosis, and finally issued a video diagnosis report.

(4) Video conferencing

After the user logs in to the collaborative medical service platform, the video conferencing system is automatically activated and authorized. The system includes: remote interactive communication, consultation and instant messaging based on soft video. To achieve effective communication between doctors and experts, experts and experts. Doctors need only equipped with ordinary computer, camera, headset, the use of ordinary home ADSL, you can easily on the Internet for remote video consultation, and the system supports mobile smart phone access.

(5) Integrated management

Through the collection of regional collaborative medical services generated by the summary of the business data analysis, the formation of remote consultation, two-way referral and other business real-time regulatory statements for the provincial, municipal and county levels of health authorities to provide online rapid monitoring of the whole process of collaborative medical the tools and means.

(6) Medical records collection

For collaborative medical services, primary doctors should be prepared to the higher level of expert diagnosis of reference to the use of medical records, superior experts based on these medical records more accurately determine the cause, the implementation of a reasonable treatment program. In view of the importance of medical records, the system provides medical information collection, simulation information collection and digital information collection processing support.

(7) Distance education

Distance education is supported by resources, service oriented, curriculum - centered, student - centered, information resource construction and information application system construction as the core. Integrated network teaching, teacher-student interaction, question with answer and management functions, and effectively enhance the level of basic medical information for the development of basic medical strategy to provide support and protection.

(8) Mobile consultation

Through the regional collaborative medical mobile APP, apply for doctors and superior experts can be anytime, anywhere through the mobile terminal for the most basic interactive mobile consultation.

3.2.2 Hospital side

Hospital collaborative medical service center construction, the initial selection of the province's six provincial hospitals, 18 municipal hospitals and 18 counties (districts) hospitals as a collaborative medical service point, in the collaborative medical service point to install collaborative medical client, transfer/ referral client workstation, based on DICOM3.0 image diagnosis, and post-processing software package (three-dimensional reconstruction, volume matching, cardiovascular analysis, heart image analysis), hospital information system interface, and audio and video exchange client software upper and lower hospital connections, for the county or municipal hospitals to provide difficult diseases of the collaborative medical channel.

3.3.3 Data Access Standard

The development of data interface specification for the primary health care management system access, for the primary health care institutions to provide collaborative medical services applications, including collaborative diagnosis

and treatment, transfer/ referral, audio and video communication software for primary health care institutions and higher hospitals to establish synergy medical channel.

4. Looking ahead

4.1. Compliance with supply side reform

The regional collaborative medical service is a new and specialized medical service based on the construction of the province's health status. Based on the 'cloud computing', the linkage between the upper and lower linkage, the internal and external linkage and the regional linkage, the service has solved the imbalance of the medical resources allocation of the problem, expanded the supply of effective medical services, and realized the reform of the supply of medical services.

4.2. Clear the function and positioning of hospitals at all levels

The establishment of a public hospital and the basic medical and health institutions between the normal division of labor and cooperation mechanism, so that the tertiary hospital gradually focus on the crisis of severe and incurable diseases; secondary hospital to receive tertiary hospital referral recovery patients; county hospitals to provide the county hospital common disease, frequently diagnosed, emergency treatment, and difficult inculcation up to referral, to enhance the public hospital in the region of public welfare and leading role, to promote the city public hospital comprehensive reform goal is to implement the ' Protect the basic, strong basic level, build mechanism' health reform policy of a strong start.

4.3. 4.3 Regulate the medical service process

In the provinces, cities, counties, townships and villages at all levels of medical institutions between the implementation of collaborative medical processes and services, the establishment of clinical specialist as the core, to patients with clinical data sharing mutual understanding based on the upper and lower doctors interactive medical services. And provide referral transfer, remote consultation, distance education and other regional medical services, to effectively use the area of medical resources, reduce medical costs and improve the quality of medical care, the overall level of health care services in our province.

4.4. To promote the regional medical information system standardization and information interoperability

Through the collaborative medical services as the core of the hierarchical diagnosis and treatment mechanism to establish, improve and standardize the medical system at all levels of business systems and regional information system-related data standards and information security standards, the medical information system related functions, business data certification and testing to achieve data in the region between medical institutions and doctors mutual recognition, while the health management departments to provide regulatory and policy basis.

4.5. Gradually guide patients in the region by disease type and clinical specialist orderly treatment

Through the collaborative medical system management and analysis of patient information and medical behavior, in order to help patients choose the appropriate medical institutions to check the inspection and medical services treatment. For the province's regional medical collaborative service network coverage and normalized operation laid the foundation for the province to deepen the medical reform work has made a useful exploration.

4.6. Comprehensively strengthened the construction of medical and health personnel in our province

Through the clinical specialist as the core of the upper and lower linkage of the collaborative medical system, and the implementation of medical institutions at all levels of the distance education system, the relevant medical staff to carry out specialist training, orientation training, demonstration teaching, continuing education and other training, doctors in the level of treatment. Improve the quality of service of primary health care institutions, so that people are more trusted around the medical institutions, patients stay at the grassroots level of the chance to be improved, reducing the patient cross-district treatment of additional medical expenses and associated costs, reducing the government health insurance/ financial burden, so that 'graded clinics' by the people naturally accepted.

5. Follow-up improvement and research

From the relevant experience in the country, although all around are actively promoting the collaborative medical and graded clinics, get a lot of support and attention, but in the actual process of collaborative medical fees, health insurance reimbursement, referral criteria such as referral has not yet thorough solution, grassroots doctors of information technology and medical responsibility division boundaries need to continue to strengthen and research.

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