Frontiers in Computing and Intelligent Systems
ISSN: 2832-6024 | Vol. 4, No. 3, 2023

Exploration on the Construction of County Medical Community Information Platform

Luyao Zhang [1, 2, *], Lecai Cai [2]

[1] School of Automation and Information Engineering, Sichuan University of Science & Engineering, Zigong, China
[2] Sanjiang Research Institute of Artificial Intelligence and Robotics, Yibin University, Yibin, China

Abstract: By combing the development status and key problems of the county medical community model, analyzing the practical scenarios of the county medical community, combining Big data, cloud computing, artificial intelligence related technologies, designing the architecture model of the county medical community information platform, and exploring the construction methods of the county medical community information platform that meet the social development status and meet the people's health needs. It provides reference for the landing and development of future medical informatization, medical Big data platform and county medical community information platform.

Keywords: County Medical Community; Big Data; Artificial Intelligence; Informatization.

1. Introduction

The contradiction between the insufficient and unbalanced development of medical resources in China and the increasing health needs of people has become a major contradiction that affects the quality of life of the people. To address this issue, in May 2019, the National Health Commission issued a notice on promoting the construction of a compact county-level medical and health community [1]. Since then, China has officially started the construction of a medical community. The so-called "medical community", also known as the medical community, refers to the integration of medical and health resources at the district and township levels, led by district level hospitals, to form a medical system, maximizing resource and technological advantages, gradually improving the quality of medical and health services at the county level, constructing a new order of graded diagnosis and treatment, reasonable diagnosis and treatment, and orderly medical treatment, and focusing on enhancing the public's sense of health gain, happiness, and security [2]. The construction of the medical community will fundamentally solve the problems of people's "difficulty, annoyance, and high cost of medical treatment". Using cloud computing, Big data, artificial intelligence and other related technologies to build a reasonable and advanced Big data cloud service platform to provide services and assistance for patients, medical personnel, and scientific researchers will become an important research and work direction of hospital informatization in the future.

2. Current Situation Analysis

2.1. Proposal of County Medical Community

The Guiding Opinions of the General Office of the State Council on Promoting the Construction and Development of Medical Federations (Guo Ban Fa [2017] No. 32) issued in April 2017 clarified the pilot tasks for exploring the framework and forms of medical consortium construction, and requested the formation of a relatively complete policy system for medical consortium by 2020, with specific goals for comprehensively promoting the construction of medical consortium [1]. Among the four modes of establishing medical communities, the concept of "mainly establishing medical communities in counties" is proposed [3]. At this point, the county-level medical service community was officially launched in national policies for the first time, becoming an important lever to enhance the capacity of grassroots medical services and assist in the construction of graded diagnosis and treatment systems. In April 2018, the Opinions of the General Office of the State Council on Promoting the Development of "Internet plus Medical Health" (Guo Ban Fa [2018] No. 26) was released, which proposed the requirements of promoting the gradual extension of telemedicine services to community health service institutions, township hospitals and village clinics, and improving the capacity and efficiency of primary medical services [4]. In August of the same year, the "Notice on Further Improving the Key Work Related to the Construction of Graded Diagnosis and Treatment System" (Guo Wei Yi Fa [2018] No. 28) was issued, emphasizing the need for coordinated planning and accelerated promotion of the construction of medical consortia [4]. The formation of county-level medical communities and urban medical groups was proposed for the first time, and the capacity building of county-level hospitals became a top priority in promoting urban-rural separation and county-level graded diagnosis and treatment.

2.2. Concept of County Medical Community

2.2.1. Medical Community

The so-called medical community refers to the organic integration of regional health resources in a region, mainly referring to grassroots hospitals and health institutions within the county. With county-level medical institutions as the main leaders, they contact several township or village health centers to establish and promote mutual cooperation and integration of interests, responsibilities, and services, and promote the optimization, integration, rational utilization, and sinking of medical and health resources to the grassroots level, A medical and health service community that guides the public to receive initial diagnosis and treatment at nearby grassroots medical institutions in the early stages of illness[5]. Try to provide basic and effective solutions for the diagnosis and treatment of most common and frequently occurring

diseases within the county.

2.2.2. County Medical Community

County level medical community is a county township integrated management system led by county-level hospitals, with township health centers as hubs, and village clinics as the foundation, effectively connecting with rural integrated management [6]. Fully leverage the urban-rural linkage and leading role of county-level hospitals, form a division of labor and cooperation mechanism for county-level and rural medical and health institutions, and build a three-level linkage county-level medical service system [7].

2.3. Current Situation of the Construction of County Medical Community

In 2019, the National Health Commission launched a pilot project for the construction of a compact county-level medical community nationwide, identifying 754 counties in Shanxi and Zhejiang provinces, as well as 567 counties (cities, districts, etc.) in other provinces [8]. In 2020, out of the 754 pilot counties, 535 met the standards of a compact county-level medical community, accounting for 71% [8]. The construction of county-level medical communities has reached consensus in most provinces and is showing a trend of comprehensive promotion [8]. In 2021, Xinjiang will be added as a pilot province. As of April 2023, the National Health Commission reported that China has piloted the construction of a "compact county-level medical community" in over 800 counties and cities. More than 70% of the more than 800 "tight county medical community" pilot projects nationwide have implemented unified management of personnel and drugs, over 90% have achieved mutual recognition of inspection and testing results within the medical community, and the county level medical treatment rate in the pilot areas has exceeded 90%.

3. Requirement Analysis

3.1. User Requirements

Government: Through the construction of county-level medical communities, achieve the optimization, integration, and rational utilization of medical and health resources within the county; Real time supervision of hospitals at all levels within the medical community, timely understanding of the needs of the people within the county, guiding them to seek timely treatment nearby, and enabling the diagnosis and treatment of common and frequently occurring diseases to be addressed within the county.

Hospitals: County level hospitals efficiently and reasonably utilize existing resources, establish health records for residents within the county, comprehensively grasp patient information, assist grassroots doctors in diagnosing difficult diseases, and play a leading role in providing health protection for residents within the county; Grassroots hospitals achieve daily diagnosis, collect health information from residents within the county, and create a solid foundation for the construction of medical communities.

Doctor: Specialized doctors provide personalized diagnosis and treatment plans for patients, assisting grassroots doctors in completing disease diagnosis and follow-up; Grassroots doctors complete disease diagnosis and information input with the assistance of specialized doctors.

Residents: The demand for medical treatment has been improved, mainly reflected in convenient and efficient medical services, uninterrupted health information, and full lifecycle health management, achieving the goal of not leaving the county for major illnesses and not leaving the countryside for minor illnesses [9].

3.2. Functional Requirement

3.2.1. Resource Sharing

Utilizing existing medical resources, establish an open and shared resource sharing center within the medical community for medical testing, imaging diagnosis, electrocardiogram diagnosis, pathological diagnosis, clinical medical records, and medical data. Relying on the medical community platform, connect medical and health institutions and business systems at all levels, break down information barriers between different levels, and fully utilize existing medical resources.

3.2.2. Data Management

Establish a medical big data center to integrate the "heterogeneous" data of different systems, data types, and data structures in existing medical institutions. At the same time, establish a unified standard to ensure information interoperability, reduce repeated information entry, and achieve one-time entry and multiple use. Establish multiple databases to classify and store different business data, facilitating data analysis and mining.

3.2.3. Intelligent Diagnosis and Treatment

According to the disease diagnosis process, help collect diagnostic and treatment information standards, provide standardized diagnostic assistance, push disease related knowledge to help grassroots doctors comprehensively understand, recommend personalized diagnosis and treatment plans based on patient conditions, and recommend corresponding specialized doctors to use remote medical technology to assist grassroots medical personnel in providing professional treatment for patients.

3.2.4. Information Security

Due to the unique nature of medical data, it is necessary to ensure its privacy, availability, and controllability. While data is open and shared, it is necessary to ensure that patients' privacy rights are not violated; While collecting and transmitting data, it is necessary to ensure the accuracy of the data to avoid uncontrollable errors and diagnostic biases in subsequent analysis; When accessing data, different permissions should be designed based on different roles to ensure data controllability.

4. Construction Plan

The overall framework of the system is the county medical community model, the bottom is the Cloud computing# Private cloud resource pool, and the top is the platform construction. The first is to open up the hospital led by the medical community, and then the hospital led by each medical community and the county health platform, to achieve information exchange and data sharing. Further up, it is the business system in the whole county, including the data center, Business support system and various application systems, such as family doctor service management, various businesses of medical community, clinical auxiliary diagnosis and treatment decision-making, medical management decision-making, comprehensive management, Internet based online services and other applications. The overall architecture of the county medical community is shown in Figure 1.

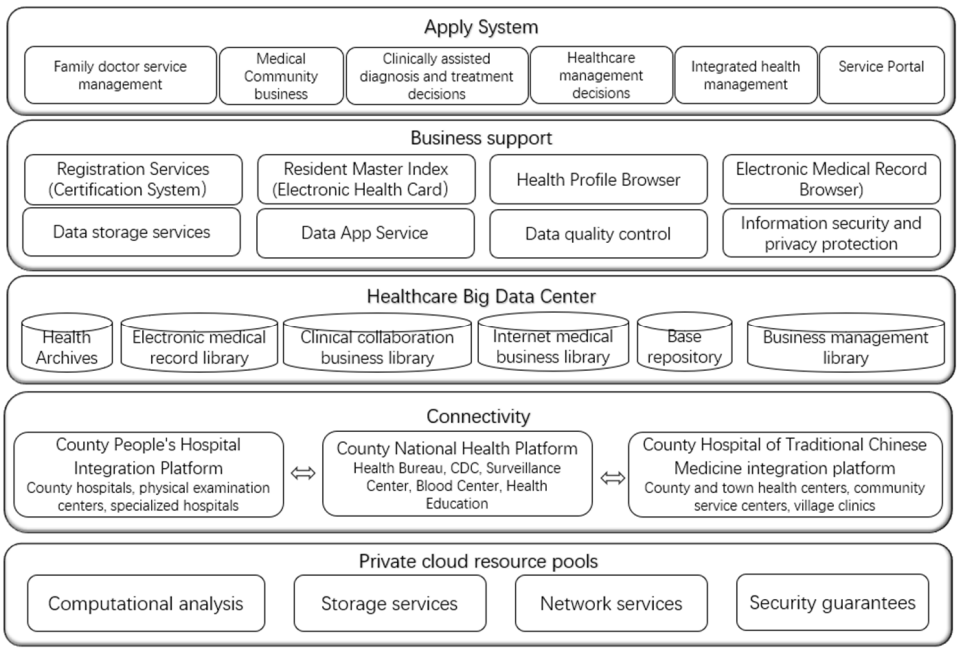

Figure 1. Overall Architecture of County Medical Community

4.1. Medical Big Data Center

In order to solve the problems such as information barriers, data islands, and data structures that exist in current medical data, the medical informatization industry coincidentally began to build medical Big data centers. It aims to integrate the "heterogeneous" data of different systems, different data types and different data structures in medical institutions through the medical Big data center. The medical Big data center consists of six parts: data resources, data collection and conversion, data storage, data analysis, data value mining and application, and user subjects, as shown in Figure 2.

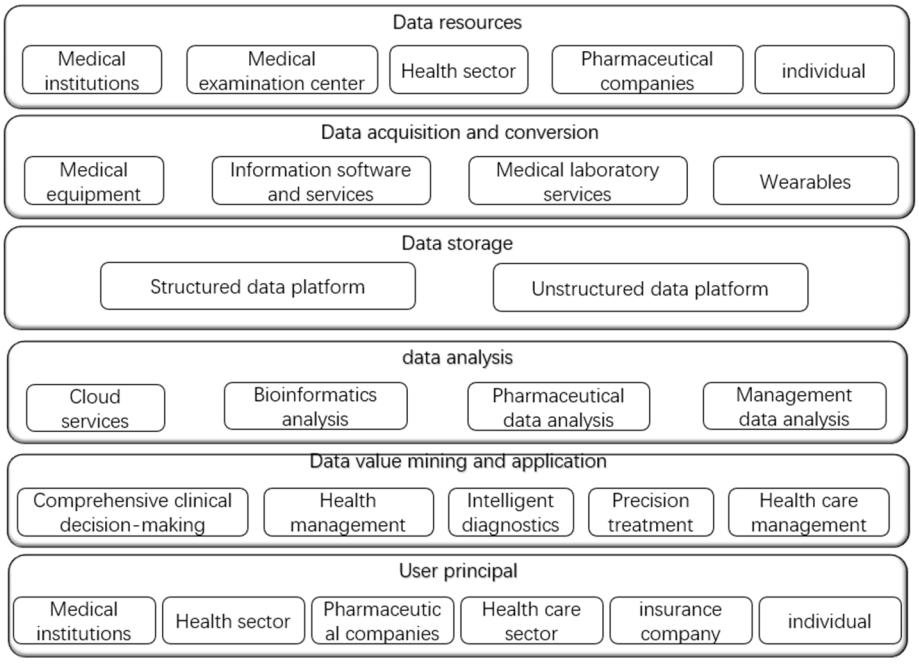

Figure 2. Framework of medical Big data center

4.2. Family Doctor Service Management System

The county-level medical community model proposes the signing service for family doctors. The family doctor service management system designed in this project focuses on the daily work of family doctors, and revolves around the signing management and establishment of health records for residents by family doctors, conducting a series of public health work such as health assessment, diagnosis and treatment intervention, disease tracking, follow-up, and basic medical services, By using mobile internet and intelligent mobile terminals to provide data feedback to specialized doctors, doctors can provide timely remote diagnosis and treatment of patients, thereby further optimizing personal body testing and health management services [11]. The architecture of the family doctor service management system is shown in Figure 3.

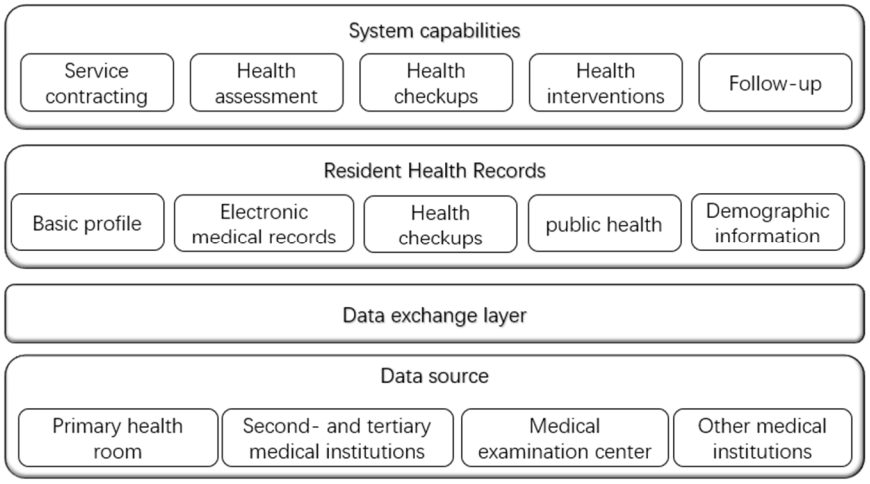

Figure 3. Architecture diagram of family doctor service management system

4.3. Diagnosis and Treatment Auxiliary Decision-making System

The diagnosis and treatment assistant decision-making system based on deep learning takes the intelligent decision-making engine and medical knowledge base as the core, follows the essential principle of disease occurrence and development, and uses the ontology based Semantic network, artificial intelligence, deep learning neural network algorithm and other cutting-edge technologies to "learn" the guidelines, literature, relevant medical records and other data related to disease diagnosis and treatment, self-improve the knowledge base, rule base and decision-making engine model to achieve accuracy Efficient and intelligent comprehensive analysis and judgment, providing precise solution push for basic examinations, diagnosis, and treatment services involved in the diagnosis and treatment process of doctors.

The service process of the diagnosis and treatment assistance decision-making system based on deep learning is mainly used by grassroots doctors, and is oriented towards the diagnosis and treatment process, achieving applications in different scenarios such as initial diagnosis and follow-up diagnosis. Its auxiliary functions mainly include: assisting in the standard collection of diagnosis and treatment information (patient symptoms, signs, and auxiliary examinations); Provide standardized diagnostic assistance to avoid misdiagnosis and missed diagnosis; Assist grassroots medical personnel and patients to have a comprehensive understanding of disease knowledge; Recommend personalized diagnosis and treatment plans for grassroots doctors to facilitate disease diagnosis and treatment; At the same time, when encountering difficult cases, corresponding specialized doctors can also be recommended to assist grassroots medical personnel in providing professional treatment for patients. The service process of the diagnosis and treatment assistance decision-making system is shown in Figure 4.

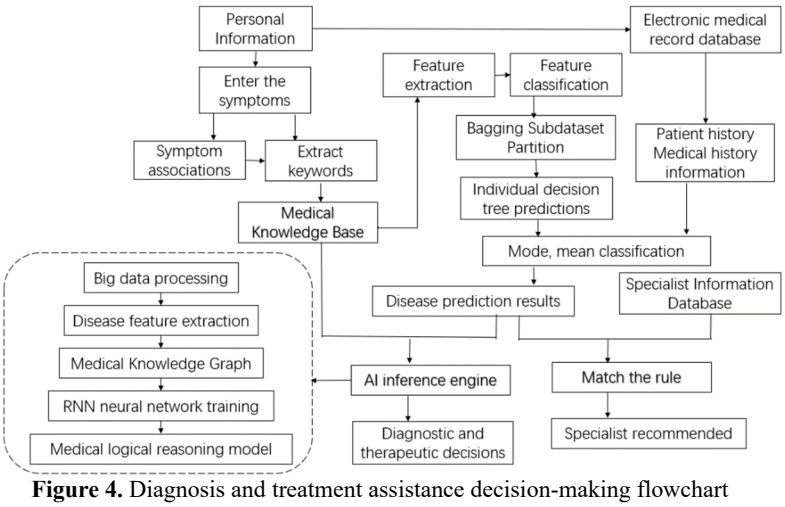

Figure 4. Diagnosis and treatment assistance decision-making flowchart

4.3.1. Medical Knowledge Base

The medical knowledge base is mainly to informationize the medical data issued by authoritative departments such as the constantly updated clinical diagnosis and treatment guidelines for diseases, Clinical pathway, medical textbooks, and the historical medical record data of the hospital, and then to organize the contents of the medical knowledge base structurally and elementarily through the combination of machine learning, data mining, and manual sorting and review.

4.3.2. AI Inference Engine

AI reasoning engine is mainly used to collect the data in the guide literature, clinical medical records and other original texts, use Big data processing, medical terminology annotation and other technologies to extract the key feature information related to diagnosis and treatment, form a Knowledge graph, and generate multiple medical logic reasoning models of different applications through neural network training, for auxiliary diagnosis and treatment,

intelligent guidance/triage Intelligent push for scenarios such as interpreting anomaly detection indicators.

4.3.3. Matching Rules

The system needs to design matching rules from multiple aspects, such as accuracy and utility, to ensure that patients can effectively seek medical treatment while also fully utilizing medical resources at different levels. Design corresponding symptom weighting rules, with doctors being skilled in prioritizing, pre-condition principles (such as pregnant women, young children, and other special populations), and rules for symptom severity, to provide patients with specialized doctors while ensuring efficient use of medical resources.

4.4. Information Security Guarantee

4.4.1. Data Privacy Security

Data privacy refers to information that individuals, organizations, and other entities are unwilling to disclose or do not want to be known to the outside world. The unique nature of medical data requires greater attention to privacy protection. In the process of data collection, transmission, data open sharing, data analysis and other processes, privacy security protection strategies need to be adopted for data, such as fuzzification, Data anonymization and encryption of medical data.

4.4.2. Data Trusted Control

Data credibility control refers to the control of data authenticity and accuracy. The source of medical Big data is complex and diverse, and there are high requirements for data accuracy and authenticity. Data credibility control is particularly important. The reasons for the credibility problem of medical Big data can be understood from the following two perspectives: first, the original error, that is, when the data is generated, it is the wrong data; The second is process error, which refers to errors generated during the data dissemination process [12]. Therefore, in the process of data collection and processing, attention should be paid to the authenticity of data collection and the accuracy of data processing.

4.4.3. Data Access Control

Data access is a prerequisite for healthcare data applications, and the services provided by medical service platforms are based on data communication. The process of data access is inevitable. To ensure the security of data access, appropriate control measures need to be taken for data access and communication processes. In addition to privacy processing of data at the source, different permission controls need to be implemented according to different user roles to ensure the security of medical data while sharing.

5. Conclusion

Respond to the call of national policies and use Big data technology to effectively solve the imbalance of domestic medical resources. The development of a medical community information platform is beneficial for individuals to manage their own health. With the help of the medical community information platform, comprehensive tracking of personal electronic medical records can be achieved, and medical treatment is no longer limited by geographical location. Rural residents can also enjoy professional assistance from county-level medical experts. On the other hand, it is conducive to assisting grassroots medical staff in making diagnosis and treatment decisions. Medical staff can use Big data technology to conduct scenario analysis on medical data associated with medical staff, so as to specify or select personalized diagnosis, treatment and care programs based on Big data analysis results. In addition, when encountering difficult and miscellaneous diseases, grassroots medical staff can timely seek help from county and city level medical experts, which can reduce the difficulty of patients' treatment to a certain extent.

Through the study of the county medical community model and Big data technology, this paper has made a preliminary exploration of the construction of the medical community information platform, which provides a theoretical basis for the future medical business needs of grass-roots medical personnel, the implementation, development and application of the medical Big data platform, and also provides some theoretical reference for the development of related industries.

Acknowledgments

Supported by The Innovation Fund of Postgraduate, Sichuan University of Science & Engineering.

References

[1] Dai Zhiyong. Practice and Experience of Implementing Gradual Referral within the Medical Community [J]. Jiangsu Health Management, 2022,33 (08): 1004-1007.

[2] Wang Wei Discussion on the Importance of Hospital Culture Construction for the Development of Medical Community Construction. Proceedings of the 28th Zhejiang Provincial Grassroots Health Reform and Development Conference and 2020 Academic Conference. Ed., 2020, 85-86.

[3] Gong Songbai, Chen Lan. Exploration of the Construction of China's Tight County Medical Community from the Perspective of Rural Revitalization [J]. Journal of Chengdu University of Administration, 2022 (06): 56-65+118.

[4] Shi Jiao Research on the optimization and construction of compact county medical community in X County [D]. Guangxi University for Nationalities, 2022. DOI: 10.27035/ d. cnki. ggxmc.2022.000669.

[5] Chen Xiangyu Research on the management of medical insurance payment mode in the context of medical community [D]. Shanghai Normal University, 2020. DOI: 10.27312/d.cnki. gshsu. 2020.002445.

[6] Zhang Libin, Ma Fuyu, Liu Zheng, et al. Exploration and Practice of Four Models of Medical Alliance Construction [J]. Chinese Hospital, 2019,23 (04): 21-24. DOI: 10.19660/ j.issn. 1671-0592.2019.04.07.

[7] Li Xin Comprehensive Medical Reform: Starting Again towards National Health [N] Qinghai Daily, 2018-01-03 (001)

[8] Xiong Jian National Health Commission: 4028 county-level medical communities have been established nationwide [N] People's Daily Overseas Edition, 2021-12-03 (009). DOI: 10. 28656/ n.cnki.nrmrh.2021.003659.

[9] Yuan Qiansheng. Discussion on the Design Scheme of a County Medical Community Information System [J]. Guangdong Communication Technology, 2022, 42 (05): 55-58+79.

[10] Meng Xiao Research and implementation of the whole process management system of intelligent auxiliary diagnosis and treatment based on Big data [D]. Nanjing University of Posts and Telecommunications, 2019. DOI: 10.27251/ d. cnki. gnjdc. 2019.001402.

[11] Liu Xiaobing, Wu Yingrui. Internet plus based family doctor health management function [J]. Intelligent Computer and Application, 2020,10 (04): 243-245.

[12] Liu Yawei Application of Big data technology in personalized medical services and platform design [D]. Dalian Jiaotong University, 2020. DOI: 10.26990/d.cnki.gsltc.2020.000385.

[13] Lv Pengpeng, Liang Yuxin, Yang Jing, et al. Identification and analysis of problems in the construction of county-level medical communities under the ROCCIPI framework [J]. Modern Chinese Medicine, 2023,61 (09): 82-84+112.

[14] Cai Haiqing. The total payment for the medical community cannot be included in one package [J]. Dean of Chinese Hospitals, 2023,19 (07): 79-81.

[15] Shen Shaotie, Xu Jing, Dou Hanyang People in the county cannot benefit from medical treatment People's Daily, June 4, 2021 (019). DOI: 10.28655/n.cnki.nrmrb.2021.005900.