



Application Research and Practice of Family Doctor Service Platform

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Abstract. By building family doctor service platform in, it helps family doctor to provide thorough and consecutive hearth service for resident. By adopting micro-services Architecture, and structuring standard heterogeneous data interface, it realizes interconnection between the family doctor service platform and other hearth application system, including Hospital Information System (HIS), Clinical Data Repository (CDR), wearable devices etc. the hearth data is applied in many scenes. By Internet and Internet of things, it realizes health records, follow-up management, medication management, Health self-examination, Risk screening etc. in Family Doctor Service Platform, it helps family doctor to provide thorough and consecutive hearth service for resident. Family Doctor Service Platform is profit to cooperation between family doctor and hospital doctor, and they will provide hearth together for resident, it is beneficial to Graded diagnosis and treatment, and it can optimize Medical resources.

Keywords: family doctor, online health services, personalized service

1 Introduction

Patients, rehabilitation groups, high-risk populations, and others with healthcare needs are flooding into hospitals, causing strain on medical resources and leading to difficulties in accessing care, high medical costs, and underutilization of primary healthcare services.

Research on outpatient services in foreign countries shows their healthcare systems differ from China's, facing distinct challenges.

In the United States, to control rising personal and societal medical expenses, the healthcare system primarily relies on Health Maintenance Organizations (HMO), a type of health insurance-driven healthcare model responsible for policyholders' health maintenance during the contract period. An HMO assigns each member a primary care physician, who holds referral authority; members must obtain approval from this physician before accessing specialist care or hospitalization.

In the UK, residents or households must register with a general practitioner (GP); regardless of illness, they must first be treated by their community GP, who must sign off before they can be referred to a designated hospital [1].

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C. F. Peng et al. (eds.), *Proceedings of the 2026 5th International Conference on Humanities, Wisdom Education and Service Management (HWESM 2026)*, Advances in Social Science, Education and Humanities Research 1024,

https://doi.org/10.2991/978-2-38476-593-5_46

This shows both the UK and US adopt a tiered healthcare system featuring a "gate-keeper" role, GPs or primary care physicians—who control referrals to specialist hospitals, effectively preventing hospital overcrowding.

Drawing on international healthcare models, China has recently advanced healthcare reforms to promote high-quality development of primary care, rolling out family doctor services to build a bridge between residents and primary care teams. This fosters a contractual service relationship, enhances public reliance on primary healthcare institutions, increases the rate of initial diagnosis at the grassroots level, promotes vertical integration of medical resources, and provides comprehensive, continuous, and all-around basic medical care, public health services, and health management for contracted residents [2].

2 Necessity of Building a Family Doctor Service Platform

2.1 Problems Existing in Family Doctor Services

In some regions of China, the family doctor system has been gradually established, but several challenges have emerged in practice:

- There are too few healthcare staff in primary medical institutions relative to a large resident population, creating a severe imbalance. This heavy workload discourages doctors from taking on family doctor roles, while residents receive poor service quality and are less inclined to seek help from family doctors.
- Elderly residents often have stronger healthcare needs in community services, yet they face significant barriers in using smart health technologies developed through the internet, IoT, and mobile communications.
- Many family doctors can only rely on patients' verbal descriptions to understand their conditions, making it difficult to access patients' medical histories and disease progression, which hampers effective diagnosis and treatment.

2.2 Platform Construction Objectives

With rapid advancements in technologies such as the internet, IoT, wearable devices, and artificial intelligence, their successful applications have expanded across various fields, particularly in healthcare. The Zhenjiang Family Doctor Service Platform discussed in this article leverages relevant information technology, internet tools, and wearable solutions to achieve the following goals:

- Empower residents to take initiative in managing their health by encouraging them to actively upload personal health data to the platform, enabling family doctors to work more efficiently and monitor residents' health status in real time.
- Establish a standardized heterogeneous data interface platform to ensure seamless interoperability between the family doctor platform and hospital systems (HIS, CDR), public health systems, and wearable devices, thereby improving service quality.

- Based on the family doctor service platform, provide accessible face-to-face support, helping elderly residents interpret medical reports and use online health services, promoting integrated online-offline healthcare delivery.

3 Platform Architecture

3.1 Adopting an Advanced Microservices Technology Framework

When community residents seek health services from family doctors through online and offline channels, these services are essentially organized around “business functions.” When an application is split into multiple services, the communication between them and the consistency of data storage across different databases are ensured through a microservices architecture. Maintaining data associations and tracing exceptions during service failures all rely on an advanced microservices application architecture [3].

When residents need to apply for family doctor enrollment, the application service must locate the corresponding enrollment service and identify the interface addresses of the relevant services via addresses. This gives rise to service registration and discovery services, whereby all microservices register their information with a specific service, allowing other services to find the relevant service information through this registration service and invoke their interfaces over the network.

Through the microservices architecture, issues are isolated within a specific module without affecting the overall application services. The relevant main business chain data is stored in databases across different services. By properly managing data, defining relationships between data applications, handling the performance impacts of high concurrency in data access, ensuring the sharing of foundational data, and maintaining data management, analysis, usage, and quality assurance, the microservices architecture can meet the data governance requirements of a family doctor online service platform [4].

Based on the context of regional healthcare services, when business volume is large and data across different medical institutions and management organizations is heterogeneous, constructing microservices enables the decoupling of data services from different institutions, thereby forming standardized and shared data microservices. The microservices technical architecture is illustrated in Figure 1.

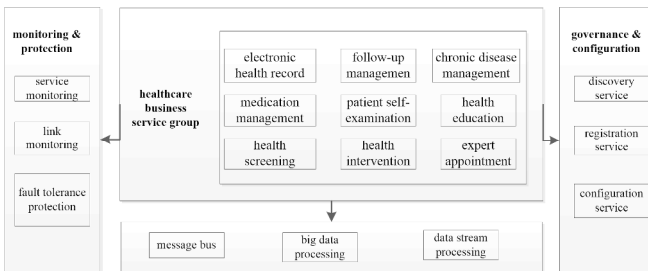


Fig. 1. Microservice technical architecture of family doctor service platform

3.2 Integration of Heterogeneous Data

To ensure comprehensive data coverage, the family doctor service platform involves the entire regional healthcare system and requires business collaboration and data exchange across different institutions and departments. Such collaboration and exchange must be supported by a fundamental network platform, which will ultimately cover the entire regional public health system and related entities, connecting various levels and types of healthcare institutions, health administrative departments, and other relevant organizations within the region. Therefore, a standardized heterogeneous data interface platform is established to ensure interoperability between the family doctor service platform and hospital HIS, CDR, public health systems, wearable devices, and other systems, thereby enabling data to play a role across multiple scenarios [5], see Figure 2.

By developing a heterogeneous data structure platform, a dynamic acquisition and massive storage model for multi-source heterogeneous health service big data is constructed, and standardized definitions and representation methods for health service data that are independent of specific application contexts are established. Through analysis, interpretation, understanding, and synthesis of raw data, information related to users' health status is obtained from various information systems such as HIS, CDR, and public health systems. Metadata specifications are established to further provide detailed descriptions of data elements, their contexts, and the interrelationships among data elements. The collected big data on residents' health is preliminarily processed through a preprocessing module to obtain primary data with application value, facilitating further data processing at the application layer.

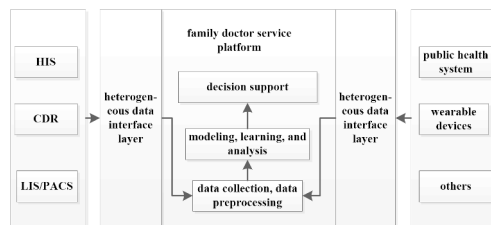


Fig. 2. Interconnection and interoperability between the platform and other systems

This enables collaborative exchange among heterogeneous information systems of various medical and health service institutions, effectively addressing the issue of data silos and achieving heterogeneous data integration across networks, platforms, and applications [6].

4 Main functions of the platform

4.1 Electronic Health Record

A patient's health record documents the patient's long-term health status information and serves as the foundation for family doctors to conduct follow-up work. This in-

formation is stored on the platform, making it convenient for family doctors to access online.

Health records include static health information and dynamic health information. Static health information comprises a patient's basic information, lifestyle habits, and health history. Dynamic health information includes various vital sign indicators that patients frequently monitor in their daily lives, as well as descriptions of changes in their condition, enabling family doctors to understand the recovery process of patients with chronic diseases. This allows them to implement personalized health interventions and education, which is beneficial to the patient's recovery [7]. The information structure is shown in Figure 3.

4.2 Online Follow-up Management

For outpatients, especially those with chronic diseases such as hypertension and diabetes, it is not only necessary to receive treatment in the hospital according to the doctor's instructions, but also essential for patients to continuously and consistently follow the doctor's orders at home—adjusting their lifestyle habits, dietary habits, etc., and taking medication and conducting self-monitoring as prescribed. At the same time, physical health indicator data can be collected through wearable health devices and uploaded to the platform, or measured health indicator data can be entered into the platform for storage.

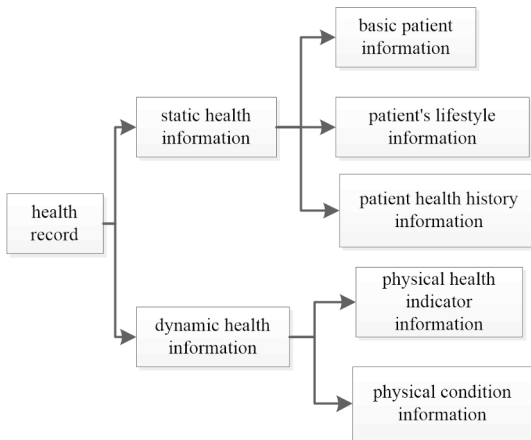


Fig. 3. Information structure of health records

During the period when patients are at home, doctors can check the patients' physical indicator data on the platform online to provide personalized health education, precise intervention, and health consultations. This approach effectively controls the condition and achieves significant therapeutic outcomes. Therefore, for patients with chronic diseases, online post-diagnosis follow-up management achieves goals that are difficult to accomplish through offline follow-up visits, making it a crucial component in improving treatment effectiveness [8].

4.3 Medication Management

The platform reminds patients to fill in medication records at scheduled times based on the doctor's medication orders. Patients fill in daily medication time, dosage, medication status, etc., as required, allowing doctors to monitor patients' medication adherence at home at any time, see Figure 4.

Since patients' medication records are stored on the platform, doctors can access and analyze them at any time, enabling early identification of issues and timely intervention, thereby preventing adverse conditions from persisting over extended periods.

4.4 Patient Self-examination

With technological advancements, the integration of the internet, mobile internet, the Internet of Things, and smart wearable devices with hospital management and physician services has become increasingly deep, playing an increasingly important role in post-diagnosis follow-up management [9], enabling online follow-up, see Figure 5.

For patients with chronic diseases such as diabetes and hypertension, measuring their physical indicators as required is a crucial part of follow-up and an important factor for doctors to assess the patient's condition [10].

Patients use different measurement devices, and accordingly, the methods of uploading measurement data vary:

- Wearable device measurements. For devices such as wristbands, which can measure a patient's blood pressure and heart rate, the measured data is automatically uploaded to the platform using IoT technology [11].
- Measurement devices. For devices such as the measuring body temperature, height, and weight, patients need to manually enter the measured data into the follow-up application on their mobile phones, which is then uploaded to the platform via the communication network.

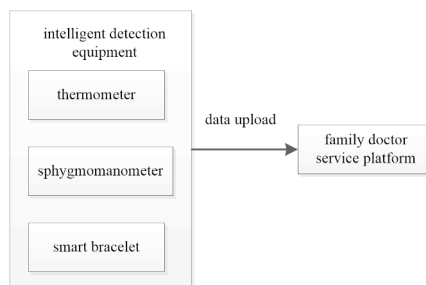


Fig. 4. Medication management process

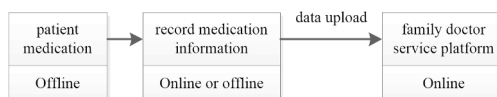


Fig. 5. Data source of online follow-up

4.5 Health Risk Screening

For physiological indicator data stored on the platform, if the values deviate from the normal range for several consecutive days, the system can detect such abnormalities in real time through a risk screening algorithm and promptly issue an alert to the follow-up doctor via the network [12], see Figure 6.

4.6 Health Intervention

In the past, after patients returned home, follow-up doctors could not easily access various indicator parameters and lifestyle habits of the patients and could only rely on telephone inquiries, making it difficult to cover the patient’s full situation and meet timeliness requirements. Meanwhile, patients were unable to proactively contact their doctors and were uncertain about what to do when problems arose.

With the application of technologies such as mobile internet and the Internet of Things, the above issues have been effectively resolved:

- Health Education: Diversity, Family doctors leverage the mobile internet to push health education materials directly to patients’ mobile phones, greatly enriching the presentation formats of health resources. Not only is the content more comprehensive, but the forms are also more diverse, which enhances patients’ interest in learning [13]. Personalization, as family doctors are aware of their patients’ medical conditions, they can deliver targeted and personalized health education content based on each patient’s individual characteristics, thereby improving the patient experience.

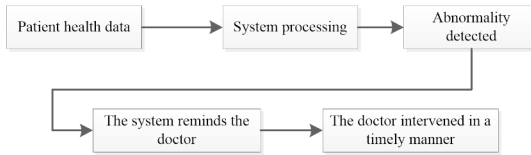


Fig. 6. Risk Warning

- Health Intervention: Because family doctors can stay informed about patients' recent conditions at any time, their interventions become more precise and targeted.
- Health Consultation: Through the mobile internet, patients can send messages to their doctors via their mobile phones to seek advice from family doctors whenever they have questions about their condition. Family doctors can respond during their free time, which enhances patient satisfaction and encourages more active cooperation with the doctor's treatment.

5 Application Status

Taking Hangzhou as an example, data shows that by the end of 2025, through the Hangzhou Family Doctor Service Platform, the number of residents signed up for

family doctor contracting services in Hangzhou exceeded 4.9 million, among which the signing coverage rate for ten key population groups, including the elderly and patients with chronic diseases, reached 90.79%. A total of 206 primary healthcare institutions and over 9,200 medical professionals from municipal and county-level hospitals had joined the platform. Building on routine health services, the platform promptly follows up with services such as internet-based diagnosis, cloud-based referral, cloud-based hospitalization, and cloud-based home care based on residents' needs. To date, these services have been provided to 165,000 residents, reducing the need for residents to make frequent trips back and forth.

6 Conclusion

With the advancement of healthcare reform, family doctors have become key to shifting the focus of disease prevention and control upstream. Through the family doctor service platform, family doctors can leverage the advantages of the internet to provide community residents with timely, continuous, and personalized health services. Together with hospitals, they also offer rehabilitation services to patients, enhancing patient adherence and providing strong support for the tiered diagnosis and treatment system, thereby optimizing the rational allocation of regional medical resources.

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