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Considerations on the Design Strategy of Professional Big Data Cloud Platform for Chest Pain Center

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Abstract: The establishment of a professional big data cloud platform with the chest pain center as the core can not only collect, process and analyze various types of rapidly changing mass data in the clinical work of the chest pain center in real time, but also provide personalized services to individuals and connect individuals, hospitals and health management institutions through the mobile Internet channel. This paper summarizes and proposes matters that should be noted in building this platform: The design should focus on the actual business operation and management requirements and meet the infrastructure requirements of the big data cloud platform. It should be considered as a whole from the regional level to the hospital level, and the architecture design and standards should be considered vertically and horizontally; It is recommended to unify patient identification numbers and to be compatible with existing data systems. At the initial stage of the construction of the cloud platform, a tertiary hospital should be the core, and all kinds of medical resources such as hospitals, nursing institutions, nursing homes and pharmacies at all levels should be gradually opened. The functional integration design strategy of the chest pain center workstation should be integrated with the electronic medical record system as the core, making full use of the original PACS system and equipment of the hospital to automatically collect time trajectory and examination data of the whole process of patient's medical treatment. Meet the hospital's quality control and management needs of the platform. The ultimate goal is to reduce the mortality of patients with chest pain.

Keywords: Chest Pain Center, Big Data, Cloud Platform, Design

1. Introduction

The "chest pain center" is a concept proposed to reduce the morbidity and mortality of acute myocardial infarction [1-3]. The construction of a chest pain center requires not only multidisciplinary collaboration, such as pre-hospital emergency medical system, emergency department, cardiology department, imaging department, but also the collaboration of various medical institutions and health management institutions in the region, such as pharmacies, nursing centers, elderly institutions, medical insurance companies, etc. [4] The data and information generated in the clinical process of the chest pain center are complicated. The personal health information that is scattered in each system,

each institution and even each medical device is extracted to form a complete personal treatment information and then a complete personal health record. This big data thinking is to collect, process, and analyze more types, faster changing, and larger orders of magnitude of data in real time, and to provide personalized services to individuals through mobile Internet channels, connecting individuals, hospitals, and health management organizations, such as pharmacies, care centers, elderly care institutions, and health insurance companies, to form a fully linked health cloud service platform [5]. Because of the properties of the specialized specialty of chest pain center, good top-level design is the basis for the orderly and rapid construction of the platform.

2. Design Strategy of Big Data Cloud Platform for Chest Pain Center

2.1. Overall Architecture Design Strategy

2.1.1. Basic Architecture Requirements

The construction of any information technology project in a hospital is not only to improve the efficiency and quality of actual clinical operations, but also to improve management and enhance the overall operational efficiency and effectiveness of the hospital, both of which are equally important. The construction design of the big data cloud

platform of chest pain center should focus on the actual clinical operation and management needs, without blindly following the trend or pursuing comprehensive platform functions, and should meet the basic architecture requirements of the big data cloud platform [6, 7] (Figure 1).

2.1.2. Focus on Emergency Process Data

The emergency process of the chest pain center can generate a large amount of data, and after statistical analysis a large amount of valuable information can be extracted, which can continuously improve the clinical work, especially for the improvement of the emergency medical process will play an important role. Therefore, the design should be considered as a whole from the regional level to the hospital level, and the architecture design and standards should be considered vertically and horizontally [8].

2.1.3. Uniform Patient Identification Number

Patients entering the chest pain center for consultation, whether pre-hospital emergency, hospitalization and post-discharge outpatient follow-up, can only be assigned a unique identification number. If there are two numbers, it is bound to bring trouble to the integration and access of clinical information (medical records, images, tests, medical orders, etc.). If a patient has multiple types of registration cards, the system must be able to associate these cards to a unique identification number.
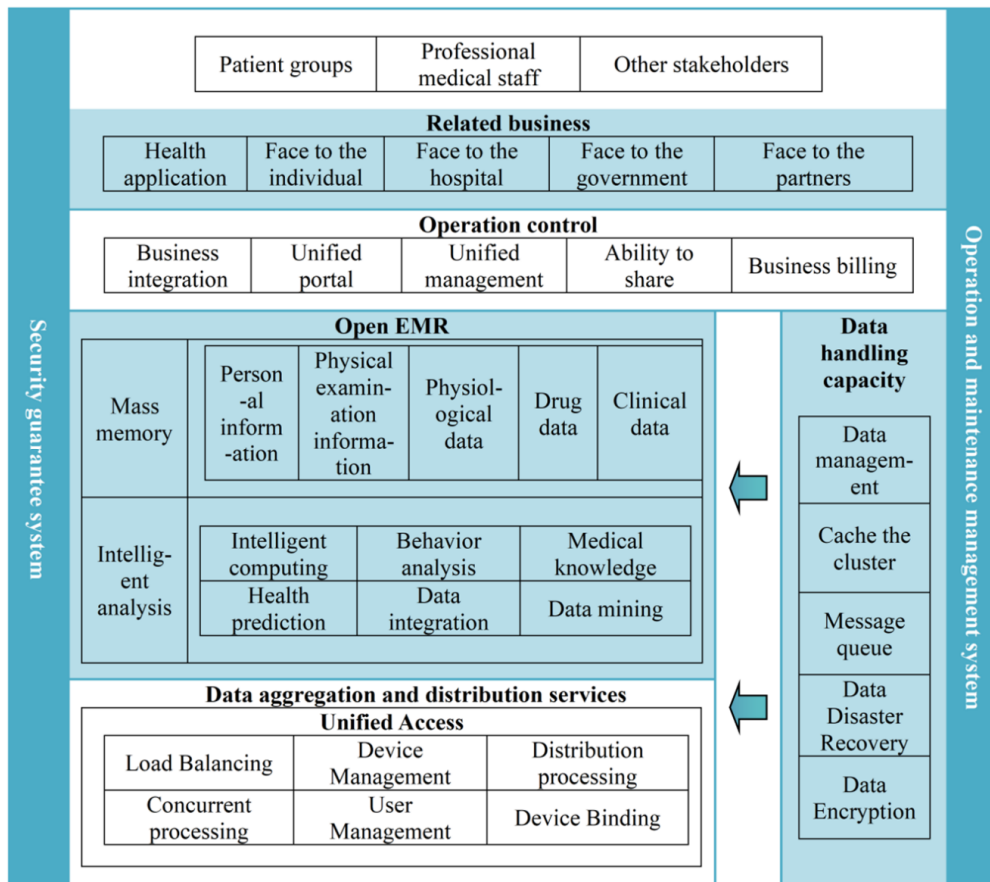
EMR: electrical medical record

Figure 1. *Health big data cloud platform system foundation architecture design [6].*

2.1.4. Compatible with Existing Data Systems

Although the construction of chest pain center requires the data scope of the patients to cover from pre-hospital to post-discharge, it should be clear that the platform is the development and extension of the original in-hospital information system, rather than an independent system formed separately.

2.2. Phased Building Strategy

2.2.1. Select High-Grade Hospitals as the Basis for Cloud Platform Construction

The initial stage of cloud platform construction should be centered on a tertiary hospital to increase infrastructure construction and grow independent operation and management experience. When the "emergency chain" of chest pain center is stable and the scale of the internet of things (IOT) breaks through the geographical limitation and reaches the provincial level or even cross-province, it is necessary to rely on telecommunication operators or even unified management by the government to establish a specialized cloud platform data center with the participation of institutions at all levels.

2.2.2. Priority for Emergency System Participants

The platform construction and operation is oriented to various medical resources such as hospitals, nursing institutions, nursing homes and pharmacies at all levels in the domain. The developed remote monitoring system, medical record system and smartphone terminal should meet both the automatic recording and automatic retrieval of information, as well as the multi-channel remote login and integration of various types of information, so as to minimize the burden of pre-hospital emergency personnel and in-hospital medical personnel and conform to their usage habits. Therefore, the platform system should give priority to the participants of the emergency system, and then gradually expand to the personnel of other institutions to complete the knowledge transfer.

2.3. Chest Pain Center Functional Integration Design Strategy

2.3.1. Meet the Timely Transmission of Collected Data

The platform needs to meet the collected data, including ECG, blood pressure, oxygen saturation, blood glucose, troponin, etc., and upload them to the cloud platform through wireless technology (Bluetooth, WIFI, 4G, 5G) transmission, moving some functions of the emergency department and intensive care unit to the pre-hospital [9], achieving clear pre-hospital diagnosis, pre-hospital activation of the catheterization laboratory, bypassing the emergency green channel, and direct access to the catheterization laboratory or operating room.

2.3.2. Case Templates and Risk Level Assessments Need to be Intelligent

The medical records of the chest pain center should start the corresponding templates according to different types of diseases, and the pre-hospital medical records should be based on the checkbox type; the in-hospital medical records should focus on condition analysis, resuscitation records, calculation of Grace score [10] and risk stratification, and bring the pre-hospital information into them automatically.

2.3.3. Integrated Design with Electronic Medical Record System as the Core

One of the recognized characteristics of big data is "low value density", which is caused by the relatively large volume of data and the relatively small amount of core data with real value. The integrated data with electronic medical records (EMR) as the core is also characterized by large volume and discrete nature. Therefore, in the process of platform construction, priority should be given to collecting those key and core information data, such as case information of key people or typical cases, and case information of diseases, etc., and focus on providing utilization, so as to maximize the value of the platform in the shortest possible time [11].

2.3.4. Need to Support Cross-Platform Data Retrieval

The original picture archiving and communication system (PACS) and equipment of the hospital are fully utilized and incorporated into the specialist IOT of the chest pain center to achieve massive image data sharing. Each medical institution in the domain is a storage point, and the shared image data can be called instantly during inter-hospital consultation. It supports cross-platform and mobile browsing, as well as ordinary Windows system computers, Android system cell phones and tablets, and also IOS system Apple phones and computers [12].

2.3.5. Time Track Is Automatically Captured

Automatic time track collection for the whole process of patient's medical visit. Time nodes can be recorded by scanning bar-code or quick response (QR) code and through Bluetooth and other transmission technologies. When pre-hospital emergency personnel first contact patients, they can place bar codes or QR codes at obvious locations to complete time point records from the emergency site, to the ambulance, to the emergency room, to various departments in the hospital, and to the catheterization laboratory.

2.4. Design Strategies for Quality Control and Management Requirements

2.4.1. Clinical Practice Quality Control

Clinical practice quality control generally includes medical record quality control, clinical pathway quality control, nursing quality control and rational drug use quality control. These technologies can use the functions of the hospital's original system modules and do not need to be built separately.

2.4.2. Aiding Hospital Management Decision Making

Aiding hospital management decisions is the core demand of managers for the platform. Real and accurate first-hand data is the basis for hospitals to make management decisions. By deeply mining and visualizing the big data, we can grasp the time distribution pattern of patients' consultation, the

inventory and circulation of drugs, the utilization rate of beds, the utilization rate of equipment and the input-output ratio. This information can help hospital management control the operation of the chest pain center in real time and make the right decision in time accordingly.

For example, according to the data of the patient's cell phone application, such as repeatedly doing ECG, query and other behavioral data analysis for many consecutive days, we can evaluate and judge the probability of coming to the hospital for consultation in the near future, and according to the data, we can make advance plans and preparations for the examination items, drugs, receiving medical staffing and other related services for this patient. To achieve this goal, the platform construction should be preceded by combing the existing rules and regulations and workflow, completing the setting of internal standardized sections and forming internal control mechanisms; then forming external policy specifications for various types of medical resources, and standardizing various types of data from the system, in order to facilitate the establishment of indexable data warehouse of the big data platform.

2.4.3. *Need to Be Compatible with Different EMR Systems*

Previous clinical practice has found that there are two approaches to achieve clinical decision support based on EMR. One is that knowledge concepts can be mapped directly to correspond to tables and fields in the EMR database during the process of knowledge acquisition or encoding, using the same terminology encoding system to express the same semantic concepts, and when decision support is applied to different EMR systems, the knowledge needs to be re-modeled each time to create a new mapping relationship [13]. The other is to investigate a representative simple and unified data model that reduces the coupling between the EMR database and the decision support module by implementing a mapping from the EMR to the data model, which is the clinical decision support applied to different EMR systems [14, 15]. Obviously, the latter approach of the established data model shields the variability among heterogeneous EMR systems, meets the innate characteristics of the variability of EMRs in different medical institutions in the region, and provides a basis for the integration of clinical decision support with different EHR systems.

3. Conclusion

To build a specialized big data cloud platform around the chest pain center, it is necessary to take into account the existing hospital systems and also be compatible with different systems. Therefore, on the basis of tertiary hospitals, it will be built in steps to gradually improve and refine various functions to meet the needs of each institution. The ultimate goal is to reduce the mortality rate of chest pain patients.

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