

## **Chronic diseases based on cloud computing platform (hypertension) intelligent control system design and analysis**

**Youliang Huang<sup>1</sup>, Xing Zhai<sup>1</sup>, Fengying Guo<sup>1</sup>, Sajid Ali<sup>2</sup>, Renquan Liu<sup>1</sup>**

<sup>1</sup> Information Center, Beijing University of Chinese Medicine, Beijing, China,

<sup>2</sup> Department of Computer Science, University of Education, Lahore, Pakistan  
(corresponding author Xing Zhai)

### **Abstract:**

*Chronic diseases seriously affecting people's lives and health in China, as one of the major chronic diseases of hypertension, incidence is increasing constantly endangering people's health and life. Treatment of high blood pressure, prevent complications and complications to be an important task of the medical profession. With the development of information technology and medicine, change the passive role in diagnosis and treatment of patients in the traditional mode, making full use of advanced information technology to achieve real-time monitoring of the disease is possible. Cloud computing platforms of chronic diseases is discussed in this paper (high blood pressure) meaning of intelligent control system, analysis of chronic diseases (hypertension) construction of an intelligent control system demonstrates the feasibility of the system, chronic diseases (hypertension) new model of prevention and control information, realize full use of limited medical resources and maximizing the social benefit.*

**Keywords:** cloud computing; hypertension; internet of things; intelligent control; telemedicine

### **I. Introduction**

Associated with an aging society is accelerating, China's rapid increase in incidence of chronic diseases, currently diagnosed with 260 million people [1], is a major public health problem. Chronic disease duration, the popular broad, expensive and disability a higher rate of death, seriously affecting people's lives and health. Deaths from chronic diseases accounted for 85% of the total deaths in China, resulting in the burden of disease has accounted for 70% of the total burden of disease, is caused by diseases of poverty-returning of important reasons of mass, if we do not effectively control, will cause serious social and economic problems. As one of the major chronic diseases of hypertension, cardiovascular disease is common in China, and treatment of high blood pressure, prevent complications and complications to be an important task of the medical profession. In recent years, many scholars apply the effect, alone, a large number of clinical studies according to the prevention and treatment of hypertension, found hypertension treatment based on integrated management of patients by combination of TCM and Western medicine, working from life, comprehensive intervention can reduce the economic burden of disease. Combined TCM "rule not disease" of thought, especially TCM differentiation card in the attention love records, and environment, and life habits, factors in disease occurred, and development, and turned return aspects by up of role, treatment in the stressed from overall starting, spirit, and life nursed back to both of thinking mode, can for slow disease reserves of system integrated prevention provides advanced of theory Guide, conducive to slow disease reserves of health risk management theory system, and practice mode and core technology of development, can up to is good of promoted role.

With the development of information technology, with the help of digital visualization technologies, Internet, cloud computing, smart medical technology used in the medical field, such as the formation and effective solution to the shortcomings of traditional medical model. Health care from the hospital to the home, the community, enabling remote management of patients, improve clinical results, effectively delaying the development of chronic diseases, reduces patients' medical costs, enables limited medical resources to allow more people to share.

This paper intends to target the people's health, by means of information technology, according to the evidence-based medical research, integration of quality medical resources, life style, work style, personalized drug treatment for a full range of intelligent control to discuss chronic diseases (hypertension) new models of clinical research and development, and promotion and application.

## **II. Demand and feasibility analysis**

### **2.1. Market demand**

China's adult prevalence rate of hypertension of 18.8%, about 160 million hypertensive patients with long-term hypertension can cause serious complications in heart, brain, kidneys, and eventually leading to organ failure, and seriously endanger people's health and lives. In clinical practice, found that some medical personnel usually do not focus on blood pressure in hypertensive patients. Some patients with irregular, or stop taking medication, treatment and control rate is low. Patients, medical staff must be completed within a very short period of time for patient treatment. Due to the lack of necessary tools, referral on time, in patients with normal blood pressure are met, risk factors, such as how alone patient medication and medical staff in the clinic of health education for patients within a relatively short time, to achieve the desired effect is difficult. In addition, physicians on efficacy of antihypertensive therapy evaluation only 1-2 times according to a recent evaluation of blood pressure to make an impression, and difficult to track evaluation of long-term efficacy. Therefore, using information technology means of diagnosis and treatment guidelines for hypertension, supported by evidence-based medicine the results, from a combination of lifestyle, job, personalized medication full intelligent intervention an urgent demand. Chronic diseases based on cloud computing platform (hypertension) proposed intelligent control system, remote diagnosis, recommendations not only in patients with hypertension treatment, clinical assessment, classification management, reminder functions of follow-up and query statistics, and with low cost scientifically rational management of patients with hypertension, improve patient referral, treatment, management and control of rates.

### **2.2. Policy guidance**

General trends in the development of 21st century medicine are life and health law as a whole, disease control systems--4P (personalized, predictive, preventive, participatory) model, that is personalized, predictive, preventive and participatory. At present, the medical institution faces many challenges and problems, due to concentration of medical resources in large comprehensive hospitals, resulting in large number of hospitals increased, resulting in "difficult to see a doctor, see a doctor expensive" situation. Based on current situation, China population and health technology development strategy determine has "strategy Qian moved" and "gravity Xia moved" of approach strategy, former refers to of is on disease occurred of dangerous factors implemented effective of control and management, from to treatment for Center steering to prevention for Center; which is is refers to will health disease work of focus put in community and family [2], this for carried out slow disease intelligent control specified has policy direction. China Government also is concern technology in medical field of application, national real networking "Twelve-Five" planning proposed "intelligent medical" of concept, pointed out that to "to human physiological and medical parameter collection and the analysis for point oriented family carried out remote medical service" [3], promoted has real networking technology and remote home health management of cross combined; "Eleven-Five" national technology support plans focus project "Chinese personal health management information system of building and application" [4] was in the form of discipline construction supports research on health management information system, aimed at focusing on health information management, health assessment, health promotion, health management, realization of capture, storage, management, query, the use of personal health information, residents of building electronic health records.

### **2.3. Technical support**

#### **2.3.1. Medical Internet of things technologies.**

Internet of things technologies is an intelligent human life can change the world, are widely used in intelligent transportation, environmental protection, Government, public safety, safe home, intelligent fire, industrial monitoring, care, personal health and other fields. Is the Internet of things Internet of things technologies in medicine applies health science, health monitoring, health management and medical health fields and a new important interdisciplinary [5], which is based on modern Internet technologies to solve medical health problems. At this stage, the medicine through the use of the Internet of things technologies and intelligent devices for medical and health related things to perception and behavior recognition, are transmitted over the network interconnection, for calculating, processing and data mining for various medical objects and the interactions and seamless links to medical data, meet on the field of medical and health behavior and change control, precise management and scientific decision making purposes.

#### **2.3.2. Cloud computing platform.**

Cloud computing is a new way of Web services, traditional desktop as the core task of managing change for the network as the core, using the Internet to finish processing tasks, make network transmission of information, delivery service and delivering computing power of integrated media, truly on-demand collaboration services, [6]. With the development of cloud computing technology and applications, finding low-cost, high automation

of the medical field, is an ideal platform for cloud computing. In cloud computing, the patient's electronic health records or test information and related system software and information are stored on the cloud servers, rather than on the user or computer. Patients with access to medical information and information to the global resources group share can consist of one or several hospital, rather than in a hospital alone in HIS system. With cloud computing, hospital investment in hardware and software can be more effectively applied, resources to maximize the application, the hospital's yield was greatly enhanced. In May 2009, the National Ministry of Health issued a health record base set of schema and data standards (WS/T 2009) and its standards, also based on the concept of cloud computing and technology "standardised electronic health records" application.

### **2.3.3. Cloud computing platform.**

Data mining is a higher level of the application of intelligent technique, it in the application of intelligent provide an automated or semi automated data analysis methods, using data mining technology users will be able to more easily find the data model, and use those patterns to some conforms to the characteristics of the data to make predictions [7]. Through medical networking and cloud computing platform can collect user basic information, personal health behavior, hypertension prevalence and family health behavior, and so on all aspects of the data to extract information and to set up the data mining model. By using data mining methods, and from hypertension mining model that residents living in the family environment and personal health behavior and chronic disease incidence of hypertension between the potential relationship and find out the key factors to affect the prevalence. For medical staff effective control of the body of the patient predicted daily living environment and living habits change on chronic disease prevalence rate brought influence, take timely intervention measures, and earnestly do a good job in chronic disease tracking, disease prevention and control work has played a positive role.

## **III. System architecture and module design**

### **3.1. System architecture**

In order to solve the doctor's distress and the prospect of the technology to consider, this study reference a variety of medical architecture system [8-11], constructed based on Cloud Calculation Platform of chronic disease (hypertension) intelligent control system, proposed integrated traditional Chinese and Western medicine combined with chronic disease (hypertension) prevention and control of intelligent new model. Intelligent control system is divided into four layers: data collection layer is mainly responsible for the collection of basic information; layer will collect the data storage for cloud computing, and according to the characteristics of data classification; data mining layer according to the data collected to analyze and predict; intelligent control layer mainly based on data mining analysis results of potential incidence provide intelligent control scheme.

### **3.2. Module design**

#### **3.2.1. Cloud computing platform.**

Data acquisition module, you can monitor the patient's blood pressure, can in patients with blood pressure reaches a preset value when provides tips on information, and can further accidents immediately to provide patients with geographical location and the nearest medical units. Patients with data on blood pressure and other physiological information mainly through intelligent equipment acquisition, and can through the communication network, wireless network, and cloud computing platform for mutual communication data, and in disease or abnormal to the first time with the doctor and the patient's family members get in touch.

#### **3.2.2. Data management.**

Data management module, mainly collecting and storing data acquisition module transmits data and with personal information (such as living environment, occupation, medical records, medical history, allergies, etc.) storage in the cloud platform and for each patient established private cloud storage, personalized treatment services. When the patients, medical personnel can promptly from the mass data storage of patient data acquisition effective physiological data, also can with cloud platform will patient information with other hospitals, community hospitals and other medical institutions to share data, and provide convenience for the diagnosis and treatment of patients.

#### **3.2.3. Data mining.**

Data mining module, according to the data acquisition transmitter with personal physiological data and cloud computing storage platform of other personal information such as blood type, smoking, drinking, living environment, family history, combined with a variety of data mining analysis algorithm to establish a slow disease hypertension mining model. Through data mining analysis, speculated that a variety of different factors and whether the relationship between different levels of high blood pressure and the degree of dependence, and provide data support for the next step of intelligent prevention and control.

### 3.2.4. Intelligent control.

Prevention and control of intelligent module, mainly based on the analysis of data mining results and reference to the World Health Organization classification of hypertension risk, risk factors of stratification, the provisions of the treatment principle and treatment scheme and standard, of potential patients in hypertensive patients with high risk early warning. For potential patients, recommend prevention programs, adjust the living habits, recommend a reasonable diet, etc. Patients of high risk or disease, when patients. Before the ambulance arrived at the patient location, in patients with a history of on the current situation to make judgment to guide emergency personnel in patients in remission, after arriving at the hospital immediately gives the remedial plan.

## IV. Conclusion

With the development of information technology and the level of medical treatment and mature, intelligent control technology will play an important role in disease prevention and control, the design of the system is mainly used for chronic disease (hypertension) prevention and control center of the system of intelligent, attention is not sufficient for the care and treatment of chronic diseases, this system can make the patients was real to monitor the health status at home, to facilitate the timely detection of problems, and take reasonable treatment measures, ensure the normal life of chronic patients, at the same time to save the patient's treatment costs, can stay at home and their condition will transfer to the doctor's hands, the medical industry will improve the ability of scientific management of the system is put into use, the more smart, fast and safe medical service; accelerate the development of digital hospital, improve the quality and speed of service for patients, It can play a vital role in improving the level of medical and health service in our country..

## V. Acknowledgements

The authors are very grateful to the referees and anonymous reviewers for their helpful comments and suggestions. This work was supported, in part, by Beijing Youth Project (Grant No. YETP0821), in part by Beijing University of Chinese Medicine (Grand No. 2015-JYB-JSM052).

## VI. Conflicts of interest

The authors declare that there is no conflict of interest associated with this work. Corresponding author is Xing Zhai.

## References

- [1] Subarna, Chakravorty, and Thomas N Williams. 'Sickle Cell Disease: A Neglected Chronic Disease of Increasing Global Health Importance', *Archives of Disease in Childhood* Vol. 100, No. 1, 48-53, 2015.
- [2] Witten, Ian H., and Eibe Frank. 'Data Mining: Practical Machine Learning Tools and Techniques with Java Implementations', *Computer Science Working Papers* Vol. 4, No. 4, 76-77, 2000.
- [3] Peytremann-Bridevaux, Isabelle, Grégoire Gex, Pierre Olivier Bridevaux, and Bernard Burn. 'Chronic Disease Management Programs for Adults with Asthma', *Cochrane Database of Systematic Reviews* Vol. 5, No. 3, 2015.
- [4] Fernando, Niroshinie, W. Loke Seng, and Wenny Rahayu. 'Mobile Cloud Computing: A Survey', *Future Generation Computer Systems* Vol. 29, No. 1, 84-106, 2013.
- [5] Blomgren, Jenni, Nico Maunula, and Heikki Hiilamo. 'Over-Indebtedness and Chronic Disease: A Linked Register-Based Study of Finnish Men and Women During 1995-2010', *Journal of Cardiovascular Pharmacology* Vol. 2, No. 34, 1-10, 2016.
- [6] Stein, L. D. 'The Case for Cloud Computing in Genome Informatics', *Genome Biology* Vol. 11, No. 5, 79-82, 2010.
- [7] Alhidari, Abdullah, Pramod Iyer, and Audhesh Paswan. 'Personal Level Antecedents of Ewom and Purchase Intention, on Social Networking Sites', *Journal of Customer Behaviour* Vol. 14, No. 2, 107-125, 2015.
- [8] Buyya, Rajkumar, Chee Shin Yeo, Srikumar Venugopal, James Broberg, and Ivona Brandic. 'Cloud Computing and Emerging It Platforms: Vision, Hype, and Reality for Delivering Computing as the 5th Utility', *Future Generation Computer Systems* Vol. 25, No. 6, 599-616, 2009.
- [9] Ehret, Michael. 'The Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism', Palgrave, 2015.
- [10] Romero, Cristóbal, Sebastián Ventura, and Enrique García. 'Data Mining in Course Management Systems: Moodle Case Study and Tutorial', *Computers & Education* Vol. 51, No. 1, 368-384, 2008.
- [11] Han, Jiawei, and Micheline Kamber. 'Data Mining: Concepts and Techniques', *San Francisco* Vol. 5, No. 4, 1 - 18, 2000.