

Exploring the Practice of TCM Health Management in the Context of Big Data

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Received: 3 September 2025; Accepted: 16 October 2025; Published: 14 November 2025

Abstract:

TCM health management is a distinctive direction of health services unique to China. In the era of big data, grasping the future development trend and accurately applying relevant factors such as policies, technologies, and talents to the practice of TCM health management will promote the sustainable development of the TCM health management cause and make the future promising.

Keywords:

Big Data, Artificial Intelligence, TCM Health Management, Practical Application

1. Introduction

The introduction of your article is organized as a funnel that begins with a definition of why the experiment is being performed and ends with a specific statement of your research approach. And it highlights controversial and diverging hypotheses when necessary. [1]

2. Background of Health Management Big Data

2.1. Background of Modern Medical Health Management Big Data

Health management originated in the United States in the 1980s. Later, developed countries such as the United Kingdom, Germany, France, and Japan also actively implemented health management, forming a large-scale industry. Statistics show that currently, 77 million Americans receive medical services from approximately 650 health management institutions, and more than 90 million Americans have participated in health management programs [1]. In Japan, driven by the government's national health plan and the promulgation and implementation of the Health Promotion Act, there are over 600,000 dietitians providing professional health management services for a total population of less than 200 million [1]. The Helsinki Declaration of the 8th Global Conference on Health Promotion in 2013 proposed the all-round perspective of health: "Health-In-All Policies" [3], while the Shanghai Declaration of the 9th Global Conference on Health Promotion in 2016 put forward the whole-cycle perspective of health: "Only by carrying out health promotion in the process of achieving all sustainable development goals and engaging the whole

society in the process of health development can we realize healthy lives for people of all age groups and enhance health well-being” [1]. As a dynamic process of social progress, China must attach importance to health in its future sustainable development to ensure that every Chinese citizen can enjoy good health.

In September 2008, the British journal *Nature* published a special issue on “discussing technical issues and future challenges of big data processing”, and the concept of “big data” was proposed for the first time [2], marking the arrival of the big data era. Currently, the definition of big data includes the “attribute definition” given by the International Data Center (IDC) and the “comparative definition” given by McKinsey & Company [1]. Big data has four core characteristics: massive data volume, high data velocity (fast data flow), diverse data variety, and low data value density. On this basis, some experts have further proposed the veracity (authenticity) of big data, which are collectively summarized as the “5V characteristics” of big data. In addition, some scholars use “4V+1C” to summarize the characteristics of big data, where “4V+1C” respectively represent variety (diversity), volume (massiveness), velocity (speed), vitality (flexibility), and complexity [3]. In short, the characteristics of big data can be summarized as “massive”, “diverse”, “fast”, “flexible”, “authentic”, and “complex”.

Highly intelligent medical technologies supported by big data and cloud computing conduct health monitoring through the Internet of Things (IoT) with digital and visualized models, realizing the sharing of medical resources. Especially in the two aspects of disease prevention and personalized medical care, the application of these technologies will promote social development. By sharing data, in the field of medical and health care, big data can be used to avoid and reduce excessive medical treatment and repeated medical treatment, and improve medical quality. In the field of healthcare, through the analysis of clinical data and behavioral data, personalized preventive health care services can be provided to each individual [4]. Therefore, the true value of big data lies in the huge added value brought by the processing and analysis of big data.

2.2. Current TCM Comprehensive Health Management and Big Data

In response to the national and international situation, China has issued the Healthy China 2030 Plan Outline, which points out that health should be placed in a strategic position of priority development. It also proposes to give full play to the unique advantages of TCM, develop TCM health preservation and “preventive treatment of disease” services, implement the TCM “preventive treatment of disease” health project, integrate TCM advantages with health management, and explore a TCM health security model that combines health culture, health management, and health insurance [4]. TCM health management is a method that combines TCM diagnosis and examination technologies with Western medical testing. Through state identification, it evaluates the state of individuals or groups from multiple dimensions such as physiology, psychology, and society, and provides corresponding health preservation, regulation, health maintenance, and education plans according to different health states of individuals, thereby realizing the goal of “preventive treatment of disease” [5]. The practical application of TCM health management will maximize the conservation of China’s medical resources and improve the overall health level of the people.

China's health management industry started relatively late. As early as more than 2,000 years ago, Huangdi Neijing (Inner Canon of the Yellow Emperor) put forward the idea that "a wise man treats disease before it occurs rather than after it has developed", and there were many ideological sparks of health management in China at that time. China's modern health management is an emerging industry that has only emerged in the past 10 years and is still in the exploration and initial stage. The first health management company was registered and established in 2001, but the industry has developed rapidly: the number of health management institutions has grown at an annual rate of 25%, with more than 2,000 institutions in 2005, nearly 7,000 in 2009, and over 8,000 by October 2011 [6]. Currently, most health management institutions in China mainly focus on health check-up services, and the professionalism of health management services is relatively low. From 2007 to 2008, a survey jointly organized by six major mainstream medical groups (including the Chinese Medical Association, Chinese Preventive Medicine Association, Chinese Medical Doctor Association, Chinese Health Education Association, Chinese Women Physicians Association, and Chinese Hospital Association) showed that among the 5,744 collected health management-related service institutions, the most commonly used name was "physical examination center" (accounting for 64.5%), followed by "health consulting company" (14.0%), and "health management company" ranked third (6.1%) [5].

However, with the arrival of the big data era, TCM health management has also ushered in new opportunities and challenges. The development of IoT, cloud platforms, cloud computing, and intelligent devices will continuously promote the progress of TCM health management in health information collection, health data mining and analysis, and feedback and communication of health adjustment information [7]. Therefore, exploring the current needs of TCM health management and integrating big data technology into it is an important step to break through the development bottleneck.

At present, the big data of TCM health management mainly comes from four sources [4]: ① Literature data: including journal articles, conference proceedings, doctoral dissertations, master's dissertations, newspapers, patents, standards, and book literature (ancient TCM books, modern medical works). ② Clinical medical data: In recent years, TCM clinical information systems that can record TCM diagnosis and treatment information have been put into use in various TCM hospitals. ③ Health management and public health data: With the application of "preventive treatment of disease" centers, health management institutions, and physical examination centers in various regions, a large amount of health management data related to the general population, community population, functional community population, and sub-healthy population will be generated. ④ Other data: such as online information data, and data generated in non-medical fields such as the health management industry and commercial data.

The processing and analysis of big data in TCM health science should focus on the origin of the formation of TCM basic theories, and use data technology to build mathematical technology models based on massive information data. The establishment of TCM health management big data requires the support of data flexibility and comprehensiveness, and personalized data has become a top priority—but this is also one of the current difficulties in health management data, as the required data is too large and complex. The full-sample and heterogeneity of the required data are difficult to be compatible with data accuracy: accurate data can

answer “why” through the analysis of causal relationships, while multi-source, heterogeneous, and full-sample data can better answer “what” through correlation analysis. The theoretical system of TCM emphasizes the consistency, interaction, and mutual influence between the subject and the object, which is also an analysis of “what” [9]. Personalization is the ultimate application of big data, and personalized technology and big data technology are the two major technical directions in the future.

At present, in the big data era, the main challenges faced by the development of TCM include: realizing the digitalization of diagnosis and treatment practice collection and management; the management and utilization of massive data mining and data centers; the immature sharing and common use of data; and the serious shortage of interdisciplinary talent teams. Digitizing clinical practice and using data to solve key issues in TCM is one of our current key tasks.

3. Current Practice Level of TCM Health Management

Based on different health levels, TCM health management classifies health states into three categories: “disease-free state”, “predisease state”, and “disease state”. Disease, syndrome, constitution, and physiological and pathological characteristics are a comprehensive summary of different states in the human life process [3]. Health state is a dynamic process, and the internal state is reflected through objective external signs. State identification is based on TCM theory: “identifying state elements according to sign parameters and forming state names” [6].

The application of artificial intelligence (AI) and big data is conducive to improving the objectivity, standardization, and accuracy of TCM diagnosis and syndrome differentiation, and also has positive practical significance for reducing the misdiagnosis rate. The use of a Bayesian network TCM syndrome differentiation system for data quantitative analysis and reasoning verification of the relationships between syndromes, syndrome elements, and syndrome names shows a high consistency with the experience of TCM experts [8]. Therefore, constructing a multi-scale health state cognitive framework from the perspectives of symptoms, syndrome elements of disease location, syndrome elements of disease nature, and syndrome types is the core step to realize the application of AI in TCM diagnosis and treatment under the guidance of the “syndrome differentiation and treatment” theory [8].

TCM health management uses the TCM concept of “preventive treatment of disease” to identify the human body’s state and conduct subsequent management. The grasp of health state is achieved by observing and analyzing state signs [9], including macro, meso, and micro state parameters. Macro parameters mainly refer to heaven, earth, and time—namely, celestial phenomena, climate, geographical environment, solar terms, and other factors related to health; meso parameters refer to four diagnostic data and constitution identification data related to health state, such as biological and psychological data; micro parameters usually refer to the material world at the particle level such as molecules and atoms, so here micro parameters refer to parameters collected with modern technical means, such as biochemical indicators and genes in physical and chemical examinations [9]. When informatizing TCM health management, attention should be paid to dynamism and comprehensiveness.

The process of TCM health management includes health state parameter collection, health record establishment, health state assessment, risk early warning and

intervention adjustment, effect evaluation, and recycling [10]. The collection and monitoring of health-related information are carried out through new technical means such as wearable devices, four diagnostic instruments, and TCM space capsules, as well as data network computing. Then, each healthy individual forms their own unique and continuous health record. For health risk factors, long-term, comprehensive, and dynamic monitoring and information processing methods such as cloud computing are required for massive data modeling to assess the health risks of individuals and groups. Then, based on the assessment results, a personalized intervention plan is formulated and implemented. After a period of intervention, the intervention effect is evaluated and fed back, and real-time suggestions on lifestyle or medication adjustment are put forward for the health state of the managed objects, thus entering the health management cycle [11]. In this process, the storage, exchange, analysis, calculation, and feedback of health information are its most basic needs. With the increasingly developed cloud storage technology, scattered electronic health record information resources obtained through community medical stations, hospitals, disease control centers, health management centers, IoT, and intelligent terminals are organized through cloud service platforms to form various “clouds” for health record information resource services [10].

In the self-management link of TCM health management, the use of AI devices allows us to continuously collect simple physiological indicators of individuals in a home environment—such as heart rate, electrocardiogram, blood pressure, and blood glucose index—as well as TCM signs, dietary conditions, exercise volume, and psychological status. These technologies store information in “cloud” services, enabling long-term, uninterrupted, and accurate tracking of the human body’s state, timely adjustment, and the realization of ideal health management. When an individual’s vital signs are abnormal: if the symptoms are mild, they can understand their state through an online platform or intelligent device and receive medical consultation services; if the discomfort is severe, an automatic alarm device will be triggered, and the individual or their family members will be notified through the intelligent device terminal to accompany them to seek medical treatment.

4. Challenges Faced in the Practice of TCM Health Management Big Data

In TCM health management, massive data can be generated through state identification, and how to effectively process this data is a key scientific issue that needs to be solved urgently. In addition, although policies have been introduced to support the construction of health management service systems by hospital health management institutions, there is no unified standard; moreover, public recognition is the most important factor, and differences in patient compliance lead to deviations in health management data (i.e., clinical effects). All these factors make TCM health management face numerous challenges in big data practice. Specific examples are as follows:

In 2017, the proportion of the population aged 65 and above in China was 11.4%, and the birth rate was 12.43% (compared with 12.95% in 2016), showing an aging population structure. Medical expenditure is expected to grow rapidly, and there will be a waste of medical resources. The incidence of chronic diseases is increasing—especially cancer, heart disease, and diabetes, which have become fatal diseases for Chinese residents. Currently, there are approximately 114 million diabetes patients in

China, and the global number of patients is expected to increase from the current 415 million to 642 million by 2040 [11].

There is an imbalance in the supply and demand structure of talents with Chinese characteristics: in 2016, there were 2.31 licensed (assistant) physicians per 1,000 people in China. In addition, the poor practice environment for doctors in China has led to a gradual decrease in the number of outstanding talents entering the medical system. There is an imbalance in the development of medical resources: from 2010 to 2016, the compound annual growth rates of the number of outpatient visits and institutions of tertiary hospitals were 10.7% and 8.3% respectively, while those of primary hospitals were only 1.5% and 0.4%. The traditional medical treatment model has led to overcrowding in tertiary hospitals, resulting in a poor medical experience and serious waste of high-quality medical resources. Therefore, China still regards the promotion of hierarchical medical system as its current top priority [11]. However, the TCM health management provided by primary hospitals is limited, and even many primary hospitals have not yet established health management centers. Therefore, it is imperative to improve the existing medical treatment model, promote the hierarchical medical system, and advance the construction of TCM health management centers.

The resource allocation of the health management industry is unbalanced, mainly concentrated in first-tier cities such as Beijing, Shanghai, Guangzhou, and Shenzhen. This phenomenon is affected by three factors: medical resources, government attitude, and doctors' acceptance.

5. Development Strategies for TCM Health Management in China in the Big Data Era

5.1. Policy Support

Due to the strong supervision of China's medical system, if big data is to realize its value in the industry, the state needs to establish a top-down strategic policy to guide hospitals, pharmaceutical companies, private capital, insurance institutions, and other enterprises to build projects and cooperate with each other. Ultimately, this will change the medical habit from "treatment" to "prevention" and reduce medical expenses from the individual to the national level. China's health care big data has entered the initial stage of favorable development, and the state, as the policy guide, has issued more than 50 "outlines" or "opinions" [13].

5.2. Co-construction and Sharing

Establish an ABC community [27] (where A = Alliance, B = Business, C = Client), give play to the hub and flagship role of hospitals in the health service supply system, fully stimulate the vitality of high-quality resources, and develop a health service supply system based on three dimensions: individual (Client), institution (Business), and alliance (Alliance). Conduct multi-disciplinary team (MDT) diagnosis and treatment [12]: avoid the limitations of single-discipline and single-system diagnosis and treatment of difficult and complex diseases. For patients' conditions, multiple experts from different departments conduct consultations simultaneously, and on the basis of integrating the opinions of various disciplines, tailor the most scientific, standardized, and reasonable treatment plan. Real-time follow-up is also carried out to ensure that patients receive the best diagnosis and treatment services.

5.3. Technical Support

The development of technologies such as wearable devices and AI has laid a foundation for product research and development, and leading capital has entered the market [13]. In the next step, it is necessary to wait for the integration of products with market demand and jointly explore big data products with commercial or clinical value.

5.4. Data Changes

In the process of health management services, the objects of management are individual people. Human health is affected by various factors such as genetics, environment, and lifestyle, and changes at every moment. Therefore, human health status can be regarded as a constantly updated database, and data-driven health management is also the development direction of the future health management industry [13]. During the health management service process, the collection of health data is not limited to the initial stage of the service but runs through the entire process of health management services. Secondly, personalized health management strategies should be formulated based on the analysis of health data of different individuals and groups—especially the analysis of data changes across different times and environments—combined with professional health management knowledge. Finally, the evaluation of changes in health status and intervention effects must also be derived from the analysis of health data changes, which in turn provides a basis for adjusting intervention strategies. At the same time, changes in health status reflected in health data allow customers to more intuitively perceive the value and effectiveness of health management services.

5.5. Data Sharing

More importantly, it is necessary to solve the current problem of inability to share data. Due to inconsistent formats, non-unified content, and incomplete records of health data collected by different regions and departments, health data sharing has become difficult. To address this, a unified health database standard should be established to avoid duplicate collection of health data among different departments and fully explore the application value of health data. For example, a nationwide unified electronic health record system should be built. An electronic health record information system based on shared health data is the foundation for comprehensively and effectively providing health management services, as well as an important guarantee for the development of the health service industry. Integrating big data and advancing TCM health management requires continuous innovation in technologies and skills to help health management institutions integrate and analyze health data.

5.6. Strengthening Talent Cultivation

It is essential to cultivate interdisciplinary talents who possess both health management knowledge and data analysis capabilities. Investment in talent cultivation in the field of health management should be increased, and the disciplinary system of health management, the talent training system, and the vocational training system for health managers should be continuously improved. This will provide sustained impetus for the development of the health management industry.

6. Conclusions

In the near future, the maturity and application of artificial intelligence technology will usher in the “big data era” of TCM health management. It is believed that through

unremitting efforts, big data technology will be applied more widely in TCM health management, and related technologies will become more mature and sophisticated. This will make greater contributions to improving the health level of the Chinese people.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

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