

Development and Trend of Big Data Sharing Research on Health Care during 2014-2020-Based on the Citespace Visualization Analysis

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Abstract: Select the relevant literature on health care big data sharing in CIKI database from 2014 to 2020, use Citespace visual analysis software to show the changing characteristics of health care big data sharing by means of knowledge map from the aspects of research hotspots and trends and academic community, and sort out and analyze this topic. The results show that the topic heat and research trend of health care big data have maintained a stable rise in recent seven years, but no academic community has been formed. It mainly includes the application of health care big data sharing and the problems and countermeasures in the application process. It expounds the application connotation and scope of data sharing, finds that there are problems in information privacy security, legislative guarantee and ethics in the sharing process of health care big data, and puts forward personal suggestions to provide reference for the sharing research of health care big data.

Keywords: Health and medical big data, Sharing, Citespace

1. Introduction

Health care big data refers to the collection of medical-related data generated in various health care activities, including personal health, medical services, disease prevention and control, and health care. How to conduct health care big data sharing, especially in the clinical diagnosis and treatment, public health information decision, healthcare industry, and scientific research, and other typical scenarios to promote the regional institutions between horizontal and vertical data sharing, to give full play to the potential of data resources, activate data resources value is becoming a new focus of medical treatment from all walks of life. This paper analyzes the research literature of CNKI sharing healthcare big data in the past seven years (2014-2020), discusses the development and trend of this direction of research, summarizes the problems and related countermeasures raised in the research of healthcare big data sharing, and provides a reference for further research of sharing health care big data.

2. Research Methods and Data Collection

2.1. Research Technique

This paper uses a method of literature measurement, which is based on the Citespace software to implement a visual analysis of the literature sample results. In the previous research on health care big data sharing, mainly using the traditional literature review and quantitative analysis method to analyze the content of the literature, mainly describes the characteristics of the text, involves the possibility of artificial interpretation, each scholar each has each knowledge explanation, but to explain the causes behind the phenomenon often presents the results of dazzling. Citespace software, supplemented by visual analysis of text analysis, analyzes the development and trend of healthcare big data sharing, interprets and deepens the understanding of it, to provide a reference for future relevant research.

2.2. Data Collection

The four keywords "Healthcare big data", "Healthcare big data sharing", "Healthcare big data

development" and "Healthcare big data sharing problem" were searched in the CIKI database of CNKI. By selecting the date range of publication from 2014-2020 and the secondary screening of the source type of journals, 1033 articles were searched, and the press release reports, meetings, recommended related books and overlapping documents that could no longer be used for analysis were excluded. A total of 486 literature samples containing the author, abstract, keywords, and other complete information were obtained after using Citespace software for removal and reprocessing, and 485 sample data were obtained after conversion and used as the data source for this study. Finally, the Citespace visualization analysis was used to perform a deeper analysis of the literature from the collected CIKI database.

3. Overall Description

3.1. Topic Heat

Regarding the theme of "Development and trends of healthcare big data sharing", through searching for the keyword "Healthcare big data", the selected literature type is journals, in the time range of 2014-2020, as shown in the figure below.

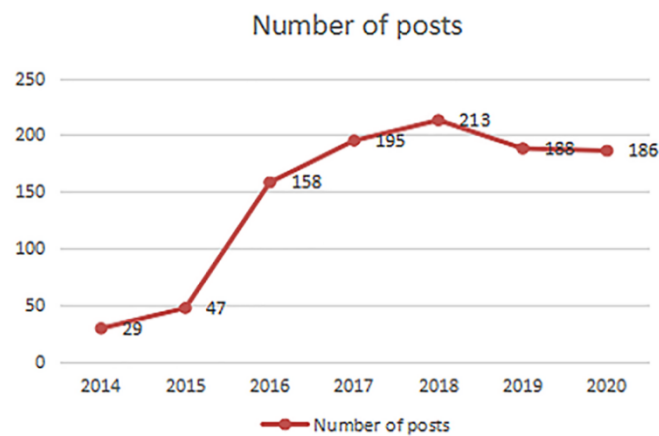


Figure 1: Quantity chart from 2014-2020.

In the Chinese database, from 2014-2020 on health big data sharing research literature is on the rising trend, the domestic academia in nearly seven years on the development of health big data sharing and trend of the theme research has generally high attention also shows the development of domestic health big data sharing and trend of the topic heat. Big data sharing in health care belongs to the micro-level aspect of big data sharing. On the increase of the development and trend of big data sharing in health and medicine, there may be three possible reasons for this reason, first, big data is constantly evolving in different fields, for example, the development of the health care field, the development of big data and its related technologies have provided a good technical foundation for the application of big data in the health care field; secondly, the rapid growth of the national economy and the enhancement of the national comprehensive strength provide strong background support for the health and medical big data sharing. In recent years, the country has paid more attention to the health of its people, relevant policies, including the Healthy China 2030 Plan, have been formulated, the continuous introduction of national policies has also provided strong policy support for the application of health care big data sharing in the national health and health care industry. In a word, big data sharing in health care has burst out with great potential in the common development of all fields of society.

3.2. Academic Community

Academic community refers to a group composed of people with the same or similar value orientation, cultural life, internal spirit and special professional skills, for common values or interest goals, and to follow a certain code of conduct. The analysis of the partnerships between authors and authors revealed no significant pooling of authors in areas related to medical and health big data, with most of the authors writing alone. In addition, from the dispersion between the nodes, the cooperation between the authors is scattered, and no effective cooperation relationship is formed. Therefore, the academic cooperation community is not formed at present (see Figure 2).

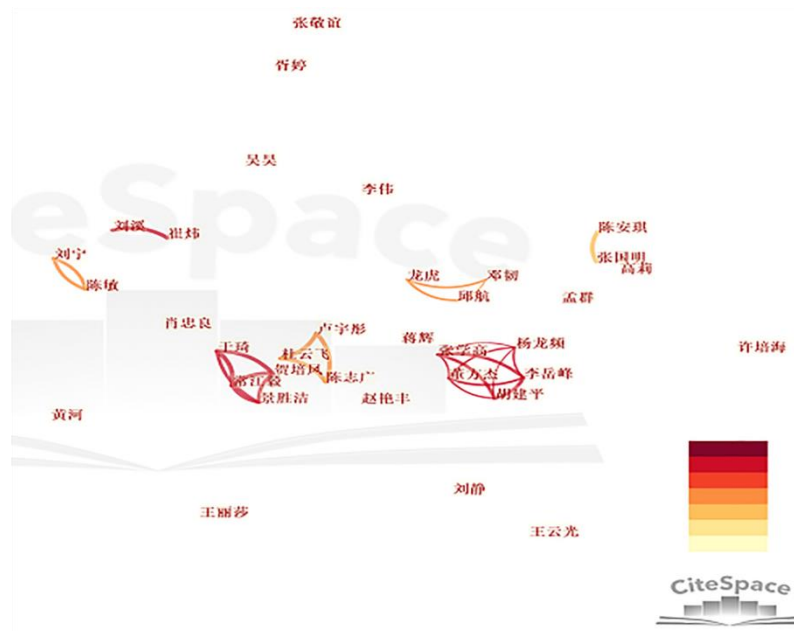


Figure 2: Map of healthcare big data sharing academic community formation.

At the same time, judging from the analysis of the number of research authors and publishing institutions, many topics about health care big data are concentrated in the field of health management and information technology (see Table 1 and 2). Through the comparison of the two forms, it is also found that the main publishing institutions and the author's unit overlap so that there is a trend of head effect within the important publishing institutions.

Table 1: Important author of Health Care Big Data Research in 2014-2020.

Ranking	Author	Number of published articles	Author's unit
1	Min Chen	12	School of Medicine and Health Management, Tongji Medical College, Huazhong University of Science and Technology
2	Yu Liu	7	School of Medicine and Health Management, Tongji Medical College, Huazhong University of Science and Technology
3	Xuegao Zhang	6	The Statistical Information Center of the National Health Commission
4	Yuefeng Li	6	The Statistical Information Center of the National Health Commission
5	Guoming zhang	5	Jiangsu Provincial Health Statistics and Information Center
6	Jianping Hu	5	The Statistical Information Center of the National Health Commission
7	Wei Li	5	The Nuclear and Radiation Injury Laboratory, the Rocket Force General Hospital
8	Shenghao Jing	4	School of Humanities and Social Sciences, Shanxi Medical University
9	Wei Cui	3	The Second Hospital of Hebei Medical University
10	Jiangyi Chang	3	School of Humanities and Social Sciences, Shanxi Medical University

Table 2: Number of major institutions in 2014 to 2020.

Ranking	The organization name	Number of posts
1	School of Medicine and Health Management, Tongji Medical College, Huazhong University of Science and Technology	7
2	Institute of Medical Information, Chinese Academy of Medical Sciences	4
3	Editorial Department of "Only Reality" of the Party School of the CPC Jiangsu Provincial Committee	3
4	Wanda Information Co., Ltd	3
5	The Statistical Information Center of the National Health Commission	3
6	Research and Publicity Department of the Social Welfare Center of the Ministry of Civil Affairs	3
7	The National Super-computing Guangzhou Center of Zhongshan University	3
8	School of Humanities, Beijing University of Traditional Chinese Medicine	2
9	School of Medicine and Health Management, Tongji Medical College, Huazhong University of Science and Technology	2
10	Northwestern School of Public Administration, Northwestern University	2

4. Interpretation of Result

4.1. Co-occurrence Analysis of High-frequency Keywords

Through the clustering analysis of the frequency of keywords in Chinese literature, we found that the three most prominent clusters in the network are found: big data, healthcare big data and health care (see Figure 3).



Figure 3: Network plot of health and medical big data research.

Combined with word frequency, the keyword frequency statistics table of healthcare big data sharing research (see Table 3), which further reveals the research topics and content characteristics in this field.

Keywords are an important feature of an article, and the more cited indicates the more research in the field. As shown in Table 3, the three keywords at the highest level are "Big data", "Healthcare big data" and "Healthcare", indicating that the domestic research hotspots are mainly concentrated in the medical and health field, and the emergence of big data has played an important role in the sharing research of healthcare big data. Is cited frequency of the second-highest level of keywords for "Health management", "Application", "Data", "Data mining", "Big data platform", "Privacy protection", "Cloud computing", etc., shows that health big data development in multiple fields and application, and

scholars began to share the related problems in the process of the application, at the same time the creation of all kinds of platform sharing provides a wide range of media. The above analysis shows that the scope of domestic research hotspots is constantly expanding, especially at the application and technical levels. They complement each other, and the research is more comprehensive, providing strong theoretical and technical support for the sharing and development of health care big data, and is conducive to the gradual realization of data sharing within the whole social scope.

Table 3: Keyword classification and word frequency in Chinese literature from 2014-2020.

Order number	Keyword	The frequency of being cited	Order number	Keyword	The frequency of being cited
1	Big data	156	15	Medical data	10
2	Health care big data	109	16	Health	8
3	Health care	55	17	Big data analysis	8
4	Medical and health	44	18	Block chain	7
5	Medical big data	32	19	Healthcare big date	7
6	Health big data	21	20	Healthcare	7
7	Health control	17	21	Precision medicine	7
8	Application	16	22	Internet+	7
9	Data mining	16	23	Data sharing	6
10	Big data platform	12	24	Medical treatment and Public health	6
11	Privacy protection	12	25	Cloud computing	6
12	Artificial intelligence	12	26	Medical treatment	6
13	Big date	10	27	Challenge	5
14	WIT120	10	28	Internet	5

4.2. Analysis of Theme Evolution

The time slice was selected for one year in the Citespace analysis to obtain the following keyword time zone map (see Figure 4), which shows the year when the keyword first appeared and the frequency when it was mentioned. The earlier the year, the bigger the wheel, and the importance of the keywords and the occurrence time and the time background can be found.

In the past seven years, five main new words have appeared more intensively. 2014 is the initial stage of the development of the health big data industry, "Health big data" also belongs to the new concept, technology also faces a lot of problems, domestic scholars research focus is mainly on the definition of health big data concept, nature, technology, so "Health and medical", "Big data technology", "Data nature" and other main keywords. In 2015, the application and sharing of health care big data in the construction of smart medical treatment began to pay attention. "Dig data platform", "Smart medical treatment", "Big data analysis and application" and other related aspects have become hot research topics. After 2016, the application of Internet plus health care and health care big data are shared among regions. The problems in the process of healthcare big data sharing have become the focus of research by domestic scholars, including "Information security", "Regional sharing", "Legal regulation" and other issues. In 2017, health care big data played a role in multiple fields, and "Data sharing" became the entry point for research. In 2018, with the deepening of the application of health care big data, keywords such as "Clinical specialty" and "Integrated health file" appeared. From 2016 to 2018, in conjunction with several national policies to promote the development of health care big data, the number of documents has increased significantly, especially highlighting the keywords such as "Precision medicine", "Interconnection" and "Data application". From 2019 to 2020, with the

emergence of COVID-19, health big data was widely used in national epidemic prevention and control work, and the application of health big data in "Epidemic prevention and control" and protecting "Data security" of epidemic residents has become hot research.

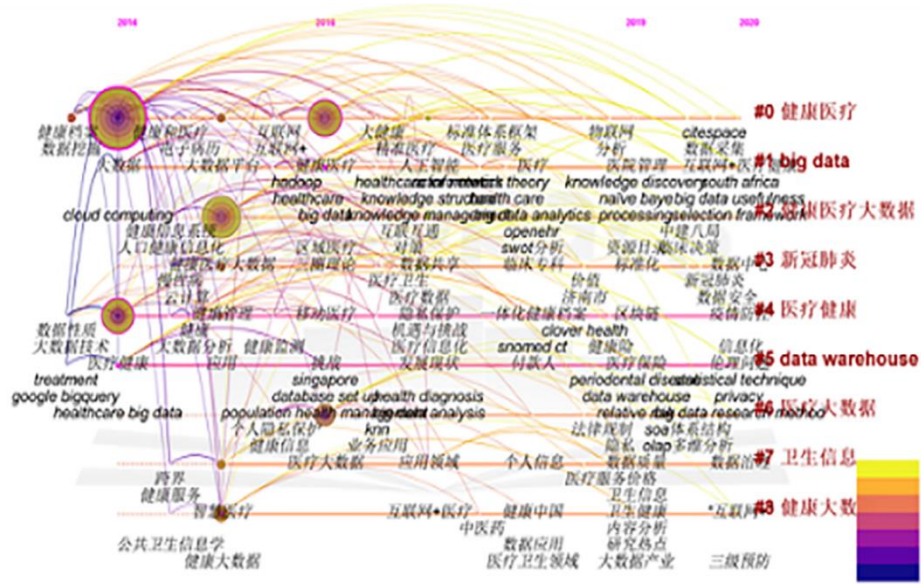


Figure 4: Keyword time zone map of the literature from 2014-2020.

From the above analysis, it can be seen that in the past seven years, the development of health care big data research mainly focuses on the analysis, application and sharing of data, which is in line with the national health care development strategy. With the continuous improvement of health big data technology, health big data has been applied in the medical field and many fields with no direct relationship to medical treatment. The continuous development of the health data industry also shows that health big data has received more attention and attention from the country.

4.3. Research Hotspots Analysis

According to the results of high-frequency keyword analysis, the research hotspots can be divided into two main themes: one is the application research of health medical big data sharing, the other is the existing problems in health medical big data sharing and its countermeasures research.

4.3.1. Application Research of Big Data Sharing in Health Care

The above analysis shows that new keywords about big data sharing in health and medicine constantly appear and expand because its application research has been expanded and innovated in the innovation of network technology.

4.3.1.1. The Application Connotation Extends to Multi-dimensions

The application connotation of healthcare big data sharing has been developed from a simple broad concept to a multi-dimensional concept. Health care big data at first only applied in a single level, the first development of big data in western countries did not determine the specific concept, so produced the earliest "Big data", "Healthy big data" simple concept, the big data of the medical industry into China big data "Medical big data", "Health big data", on the overall connotation is broad and not unified. It was not until 2018 that the relevant documents issued by the National Health Commission noted that "Health care big data" means "Healthcare-related data generated in the process of people's disease prevention and health management", leading to a formal concept. Now with the development of sharing information technology and health promotion of big data sharing application, its connotation combined with the era development needs and multi-dimensional development, from the field of the original application development radiation to the development of information technology of medical payment system, medical association and other related fields, the future will be close to the medical industry continue to lead to multiple levels.

4.3.1.2. The Scope of Application Has Developed to Multiple Fields

The application scope of health care big data sharing is layer-recurrent and extensible. Most foreign

countries are applied in business, products and services by many enterprises, while the main domestic applications are promoted in the medical industry. From the beginning, it was applied to medical services, patient health services, health decision-making and other basic fields close to the medical industry. Later, the technology was further developed into clinical diagnosis, drug research and scientific research innovation. In recent years, the application has continued to expand to various emerging medical industry fields. Such as the shared application of smart medical data, it includes the application of electronic medical records, remote medicine and disease research, dedicated to combining the diagnosis and treatment of serious diseases, establish a disease diagnosis and treatment plan and prevention mechanism with a multi-dimensional sharing mechanism, it has a huge role in laying the transformation of China's medical and health undertakings; sharing and application of public health emergency management data, judging from the COVID-19 outbreak, in the face of the traditional artificial service mode has been unable to integrate with The Times, instead, big statistical ability to actively handle and serve it in the face of public health emergencies, the sharing of public health emergency management data partly helps public health monitoring to quickly obtain effective data information in a short period of time, establish an emergency defense system in the first place, improve work efficiency.

In addition, the application of the healthcare big data sharing mechanism extends to areas such as the medical and health care industry and the technological innovation related to the medical and health undertakings, and even to other areas involving medical care in the future. In addition to helping to build high-tech industries and improve the industrial chain, it also provides a broader possibility for the future transformation and upgrading of the medical industry.

4.3.2. Problems and Countermeasures Existing in Healthcare Big Data Sharing

The research on the problems and countermeasures of sharing healthcare big data mainly focuses on the following four aspects, mainly on the information security protection, inter-regional sharing, ethical and legal issues in the process of healthcare big data sharing.

4.3.2.1. Research on Domestic Information Security Protection and Its Countermeasures

Data security issues are a major obstacle to the data sharing process. Related survey shows that there are about 657 smart medical cloud platforms, most of them do not do platform security management and prevention, spot check results show that nearly 90% of medical institutions have serious security risks, such as insufficient data management constraints, lack of information security management standards and information security protection technology (such as poor anonymity technology) may lead to data security and data leakage problems. In multiple links of big data sharing, related subjects of data and wearable devices and other aspects may cause privacy leakage.

How to strengthen the protection of information security, it can be summarized into three aspects, first of all, improve the corresponding hardware function of strengthening information security technology in information protection, to improve the means of breaking the secret and the firewall and other technical functions as the foundation, we will continue to improve systems and research and develop new technologies, such as "Transparent encryption" technologies developed in recent years, enhance the shell protection capability of data information; secondly, in the transmission process of data and information, especially in the data collection and use, need for an anonymous protection approach to the data^[7], limit the further extraction and analysis of protected data by specific institutional departments, to reduce the ease of data acquisition and use; finally, in the storage stage of the data repository, in addition to using some regular encryption programs, virtualization replication technologies such as CPD protection technology or SRM can also be added. From the institutional level, first, a sound system can play a boundary and supporting role in the application and sharing of big data, therefore, a clear information security management standard should be formulated, including data collection, openness and other boundary instructions, as well as citizen privacy and data and information use security and other basic protection issues; secondly, the specific supervision of all parties in the process of data operation, strengthen the management of full-time personnel by the establishment of horizontal and vertical supervision system, in addition, an easily overlooked link is that most systems are a code of behavior for data processors, regulation of smart devices is often unasked, this can easily lead to the device being illegally manipulated in the background, all kinds of data are transported and sold, therefore, the two-way supervision of personnel and equipment should be paid attention to. In general, if big data sharing wants to apply in health care to further steady development in many fields, relevant network technology departments and system construction departments have to strengthen their hard skills and soft power.

4.3.2.2. Research on Regional Data Sharing and Its Countermeasures

The main problems restricting the regional shared development are the standardization of information management system, policies, capital and human resources. Although some scholars have proposed that an information service management system (Linlin Gu) suitable for our hospital and a unified standard for regional information system (Zhixiang Xu), there is still no unified opinion on how to establish a national standardized information management system.

How to break the industry barriers and break through the barriers to realize regional sharing as soon as possible ultimately needs to rely on the strong guarantee of national government departments. First of all, the differences between regional data sharing systems should be broken and establish a "One national data center" standard, that is, integrate multiple regional standards to create a unified, standardized and standardized information management system. Secondly, the inter-regional data sharing is inseparable from policy, capital and talent support, first, on the basis of the interests, the policy and stronger support and guarantee, the other is capital, the construction of government financial allocation and social jointly raise funds, increase the comprehensive construction of regional data sharing system, talent resources, management and other related disciplines. In short, from the information management system of grassroots hospitals with different characteristics to the establishment of unified data sharing platforms in many places, and then gradually moving forward to a unified national standardization, the state needs to provide multi-directional support for health and medical big data sharing between the area.

4.3.2.3. Ethical Problems and Their Countermeasures in the Age of Big Data

With the continuous development of technology, data is more convenient and scientific, so it is easy to produce data dictatorship in diagnosis and treatment activities, that is, the relevant medical departments rely too much on data in the process of using data while ignoring the development of human subjectivity, which eventually leads to the emergence of a series of ethical problems. One is the problem of unknown autonomy of data subjects, due to data openness, no legal definition of autonomy; the other is the problem of social equity, because it pays more attention to data analysis results, the difference may lead to the discriminatory consequences of gender and occupation, and the lack of humanistic care, due to data and ignoring the moral and psychological changes.

Data, as a tool to assist diagnosis and treatment activities, people can use it to provide better services, rather than being controlled by data and ignoring ethical problems. First, put people first, medical institutions should be patient-centered, focus on the subjective feelings of the patient itself; secondly, the collaborative restriction of system and ethics, standardize medical and health activities by formulating relevant laws and regulations and regulations, rewards and punishment systems, clarifying the relationship between the rights and obligations of the data-related subjects; thirdly, management and ethics are the collaborative restriction, real-time supervision and management of relevant subjects and equipment, establish management specifications or standards, improve the autonomy of data subjects; finally, the relevant principles and ethical collaborative constraints, some scholars have put forward the establishment of five principles: the human-oriented principle--to increase humanistic care and assistance; principle of data subject autonomy--strengthening people's subject consciousness; principles of openness and transparency--maintaining social equity; principles of responsibility--raise the awareness of responsibility; safety protection principles--strengthen the dual protection of system and technology.

4.3.2.4. Research on Legal Problems and Its Countermeasures in Data Sharing

As for the sharing of healthcare big data, China lacks special legislation. Although there are laws and regulations involving the sharing of healthcare big data, the content is relatively scattered and not comprehensive enough. First, the legal content related to health care big data sharing is more scattered¹, as this is shown in Table 4, the *Criminal Law* and other laws propose to clearly protect the right to information of natural persons, the *Mental Health Law* and other acts include the supervision and management of medical departments in accordance with the law, this means that if some enterprises and institutions seize the legal loopholes to rub the ball to infringe on residents' medical information, when citing laws, it is necessary to judge the laws and regulations involved in such incidents, time-consuming and laborious, it is difficult to fully protect the interests of the rights and interests parties; secondly, the existing laws and regulations for data sharing are not comprehensive enough, for example, the "National Health and Medical Big Data Standards, Safety and Service Management Measures (trial)" (hereinafter referred to as the "Measures (trial)"), it only stipulates the rights and obligations of relevant subjects such as administrative departments in the process of health and medical big data sharing, the rights of the data-related subjects are not vested, regional sharing and other aspects

to make specific provisions.

Table 4: Legal content related to health care big data sharing.

Legal name	Primary coverage
<i>Criminal Law, General Provisions of Civil Law, Administrative Penalties Law</i>	Defend privacy rights of different legal nature involved and protect personal privacy from infringement.
<i>Tort Liability Law</i>	The right of privacy as a basic citizen right, the right of privacy is no longer a second-class right attached to the right of reputation.
<i>Network security law</i>	To the point where it's impossible to identify or recover, the application of big data needs to desensitize citizens' information.
<i>Mental health law, Measures for the management of nurses, Regulations on AIDS prevention and control</i>	It stipulates that medical and health departments shall not disclose relevant information about patients' personal privacy.
<i>National Health and Medical Big Data Standards and Administrative Measures for Safety and Service (for Trial Implementation)</i>	To stipulate, supervise and administer the rights and obligations of relevant administrative departments and responsible units.

In terms of information security protection, foreign relevant legislation on healthcare big data can be borrowed. The *General Data Protection Regulations* formulated by the EU in 2016 clarify the rights of various legal subjects formed in data protection and refine the rights protection of data subjects^[错误:未定义书签.]. In addition, also need to clear the concept of health big data, how to supervise and management and technical protection, promote health big data special legislation and legislation refinement, in 2018 national health commission issued the (trial) method, the method for our health big data special legislation provides a good start, but from the long-term development of data sharing or lack of some authority. Under the background of comprehensive rule of law, it is an important problem to create a special law in line with China's national conditions on health and medical big data sharing and provide legal support for healthcare big data sharing activities.

5. Conclusions

From combing relevant literature, health care big data sharing in nearly seven years relying on the development of network technology has become a hot topic for research, the development trend is rising year by year, such as in the field of health services, health decisions and other industry development of application and development, has considerable development potential, but also brings information security and data specification challenges, for personal privacy and information protection, regional sharing, ethics and legal refinement, is still a stumbling block in sharing health care big data application. In the future, more improvements in the big data era: protect privacy and information security in the system and technology of big data sharing, standardize data standards, establish government-led, regional cooperation, multi-sharing mode; improve data quality, information security and specific management system; promote people-oriented, legislative refinement, step by step, and promote data value in sharing in other areas in the future.

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