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Visual analysis of related hotspots affecting Diabetes based on CiteSpace research on Medical Insurance

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SUMMARY: *The purpose of this study is to use CiteSpace to visually analyze the literature related to diabetes and medical insurance in more than 30 years, and reveal the current situation, hot spots and trends of diabetes development in the process of medical insurance. Using the China National Knowledge Infrastructure (CNKI) database as the data source, relevant research literature from January 1996 to August 2024 was retrieved. CiteSpace software was used to visualize and analyze data on authors, institutional collaboration networks, keyword co-occurrence, clustering, emergence, timelines, and highly cited literature. A total of 1168 relevant literature were retrieved, and 617 were included after manual screening. The author's collaborative network shows that the distribution of research power is relatively even, and cooperation needs to be strengthened; In the institutional cooperation network, institutions in the same province have closer cooperation. Key words co-occurrence and cluster analysis show that research focuses on diabetes and its complications management, health literacy and influencing factors, medical insurance and cost control, data analysis and technological innovation. The analysis of highly cited literature shows that the research topics involve chronic disease management, medical expense burden, patient self-management, and other aspects. Future research should continue to strengthen interdisciplinary cooperation, use new technologies to focus on diabetes prevention and health management, and improve the effect of diabetes prevention and control.*

KEYWORDS: *Diabetes; Medical Insurance; CiteSpace; Bibliometrics*

1 Introduction

Diabetes mellitus is a chronic systemic disease characterized by metabolic disorders, and clinical data suggest that type 2 diabetes mellitus (T2DM) accounts for more than 90 percent of patients with diabetes [1], while type 1 diabetes mellitus (T1DM) and other types of diabetes mellitus are less common [2]. The core pathogenesis stems from a relative or absolute deficiency of insulin secretion in the body, resulting in persistent and abnormally high blood glucose levels [3]. Long-term exposure to this abnormal blood glucose state significantly increases the risk of complications such as retinopathy, cardiovascular dysfunction, liver damage, and diabetic foot [4], which can lead to exacerbation and even death. According to statistics from the International Diabetes Federation (IDF), the prevalence of diabetes among people aged 20 to 79 years was estimated to be 10.5% (approximately 536.6 million) globally in 2021 and is expected to rise to 12.2% (approximately 783.2 million) by 2045. China has the largest number of diabetic patients, with more than 140 million

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patients in 2021 and this number is expected to grow by more than 174 million by 2045 (Table.1).

Table 1: Top 10 countries or regions in terms of the number of adults (aged 20-79 years) with diabetes in 2021 and 2045 [5]

2021				2045		
Rank	Country	Number(millions)		Rank	Country	Number(millions)
1	China	140.9		1	China	174.4
2	India	74.2		2	India	124.9
3	Pakistan	33		3	Pakistan	62.2
4	USA	32.2		4	USA	36.3
5	Indonesia	19.5		5	Indonesia	28.6
6	Brazil	15.7		6	Brazil	23.2
7	Mexico	14.1		7	Bangladesh	22.3
8	Bangladesh	13.1		8	Mexico	21.2
9	Japan	11		9	Egypt	20
10	Egypt	10.9		10	Turkey	13.4

Since the establishment of the medical insurance system, the early stage has mainly focused on the reimbursement of expenses for acute diseases and major illnesses [6], and the protection of chronic diseases such as diabetes has lagged behind. However, with the rapid expansion of the diabetic patient population and the increasing medical burden, all sectors of society have paid great attention to it. In order to cope with this challenge, the government has gradually incorporated diabetes into the medical insurance system, and initially established a medical expense protection mechanism for diabetic patients. In recent years, this process has accelerated significantly, not only from hospitalization expenses to outpatient treatment, drugs, and examination costs, but also through policy adjustments, such as the release of the new version of the NRDL in 2017, to include more oral hypoglycemic drugs and complications in the reimbursement scope, and to optimize drug classification and reimbursement conditions [7]. In 2019, the state successively introduced important measures, first implementing a centralized drug procurement policy, and then including some key drugs such as insulin in the medical insurance catalogue [8], which further reduced the financial pressure on diabetic patients. As of 2023, there are 82 Western medicines for the treatment of diabetes in the new version of the medical drug list. Among them, since 2017, 41 drugs have been included in the NRDL, including 26 negotiated transfers, with an average decrease of 60.6%, and 15 drugs have been directly transferred [9]. In addition to reducing the cost burden, more innovative drugs have been incorporated into clinical trials in a timely manner, which has greatly improved the treatment level and treatment effect of diabetes. This series of policies and measures marks a new stage in the development of medical insurance in the field of diabetes.

The development of medical insurance in the field of diabetes reflects the continuous improvement and progress of the social security system. The positive impact brought by this measure is multidimensional. On the one hand, it effectively builds a solid economic support for patients and provides strong medical service support; On the other hand, this action has effectively promoted the all-round promotion of diabetes management and created a harmonious and stable situation for the society. In the future, as the medical insurance system continues to be optimized and innovated, the role of medical insurance in the field of diabetes will become even more significant.

As a comprehensive interdisciplinary discipline that integrates mathematics, statistics, and philology, the core of bibliometrics lies in the use of quantitative analysis methods to deeply analyze the internal laws and structures of knowledge carriers, which provides a powerful quantitative tool for academic research and policy formulation [10]. In this study, we focus on diabetes and medical insurance, an important social health issue, and make full use of the unique advantages of bibliometrics to systematically sort out and dig more than 600 Chinese literature with the help of CiteSpace visual analysis tool. The purpose of this paper is to construct a clear and intuitive knowledge map, in order to show the current structure, development context and evolution law of the research field of medical insurance and diabetes, and profoundly reveal the challenges, current research hotspots and future development trends of diabetes prevention and control with the continuous reform of the medical insurance system.

We hope to provide social scientists, policy makers and senior experts in the health care industry with a comprehensive and in-depth observation perspective, helping them more accurately understand the complex internal relationship between medical insurance and diabetes. When conducting theoretical discussions, formulating relevant policies, and implementing specific intervention measures, they are able to make more scientific and rational choices. This study also shoulders another important mission, which is to build a solid foundation for researchers who will enter this field in the future, thus promoting the continuous deepening and vigorous development of research in this field.

2 Information and Methodology

2.1 Data Sources

In the China Knowledge Infrastructure (CNKI) database, select ("diabetes" or "DM") and ("medical insurance" or "medical security" or "medical insurance") as keywords to launch literature query. Set the search time span from January 1, 1996 to August 31, 2024. After systematic search and screening, a total of 1169 Chinese literature materials were obtained.

2.2 Data Filtering

In database processing, manual filtering is used to remove duplicate documents, books, newspaper materials, conference papers, project reports, and irrelevant content to the research topic one by one. After screening, 617 documents that meet the requirements were finally obtained as the basic information for subsequent data visualization analysis.

2.3 Data Visualization

Export the relevant materials from the CNKI platform in Refwork format and text format, named 'download_01.txt'. Use CiteSpace software for data preprocessing, including removing duplicate data items and converting data formats. When setting CiteSpace parameters: (1) Time slice setting, set the time span to January 1, 1996 to August 31, 2024, and set the time slice value to 1; (2) Node type selection, select "Author", "Institution", and "Keyword" as the analysis nodes; (3) Select criteria based on the g-index (k=13), select the top N=50 data, and set the proportion of the top N% to 10.0%; (4) Trimming methods, targeting the analysis of "author", "institution", and "keywords", adopt two pruning methods: "Pathfinder" and "Trimming Slice Network". After completing the above data processing steps, the transformed data is visualized and analyzed in depth, aiming to explore its information in multiple dimensions such as publication quantity, author co-occurrence, institutional co-occurrence,

keyword co-occurrence, time pattern of keyword occurrence, keyword clustering characteristics, and research direction.

3 Results and Analysis

3.1 Publication Trends

Analyzing the trend of research hotspots plays an important role in grasping the current development status and future direction of a discipline. This research focuses on systematic statistical analysis, and conducts in-depth research on 617 Chinese literatures in the "CNKI database" (from January 1996 to December 2023) to explore the development trend of diabetes under the background of health insurance coverage. Through the analysis of the publishing trend (see Fig.1 for details), it can be found that in the past three decades, the annual number of documents related to diabetes in the health insurance field has experienced different stages of development, showing a steady growth trend. The change in the number of publications can be divided into three stages. The first stage was from 1996 to 2005, the initial development period, characterized by a slow but sustained growth trend in the number of relevant academic papers. From the trend line, it appears relatively flat, indicating that although the number of research activities in this field is gradually increasing, the growth rate is relatively slow. This situation is due to the fact that the field is still in its early stages of development, the number of relevant researchers is limited, and the available resources are also relatively limited. At the same time, the scientific issues and policy environment involved in this field are still gradually being clarified and constructed.

The second stage is from 2006 to 2015, a period of upward development. The number of published papers shows a rapid growth trend. The line representing the number of papers has significantly increased, indicating a significant expansion in the scale of research activities. The reason why rapid growth can be achieved in this stage is the result of multiple factors working together. On the one hand, the prevalence of diabetes has shown an upward trend, and the medical insurance system has also been continuously optimized and improved, which has greatly increased the social demand for research in this field. From another perspective, research activities have been continuously promoted and made progress, thanks to the continuous increase in research funding and the continuous enrichment of research resource reserves, which have provided solid support for research work. At the same time, the methods and technologies used in this research field are undergoing continuous innovation and optimization, which is driving research to expand in depth and achieve more comprehensive coverage in breadth.

Since 2016, this research field has entered its third phase, with a relatively stable and fluctuating number of publications. This may be because the field is still in its early stages of development, with a limited number of relevant researchers and a scarcity of research resources that can be allocated. At the same time, the scientific issues in this field are not yet fully understood, and the policy environment is also in the process of gradually being constructed and improved. In the second stage, from 2006 to 2015, it belongs to the development stage of this field. During this period, the number of published papers showed a rapid growth trend. From the relevant data curve, the upward trend is extremely obvious, which fully reflects the significant expansion of research activities and the continuous emergence of a large number of research results like mushrooms after rain. The rapid growth trend in the research field at this stage may be due to the combined effects of multiple factors. Among them, the incidence rate of diabetes continues to rise, and the medical insurance system is increasingly sound and perfect, making the society's attention and demand for

research in this field significantly increased. At the same time, the continuous increase in research funding and the continuous enrichment of research resource reserves provide solid and powerful guarantees for the vigorous development of research activities. Moreover, the field is constantly innovating and making breakthroughs in research methods and technologies, effectively promoting the expansion of research to deeper levels and wider scopes. Since 2016, the research has entered its third phase, and the number of related publications no longer shows a significant increase or decrease, but has entered a relatively stable period with slight fluctuations.

The line remains stable after reaching a certain height. Notably, there was a relatively rapid growth around 2017, which might be associated with the inclusion of more oral hypoglycemic drugs and complication medications in the reimbursement range of the updated health insurance drug list. This phase's curve reflects the maturity and stability of research activities in the field. As research deepens and expands, the field has accumulated a certain body of research results and knowledge system, with research activities now focusing more on quality and depth. At the same time, the field also faces new challenges and issues, such as how to further enhance the efficiency of research outcome translation, and how to better respond to the trends of diabetes prevalence.

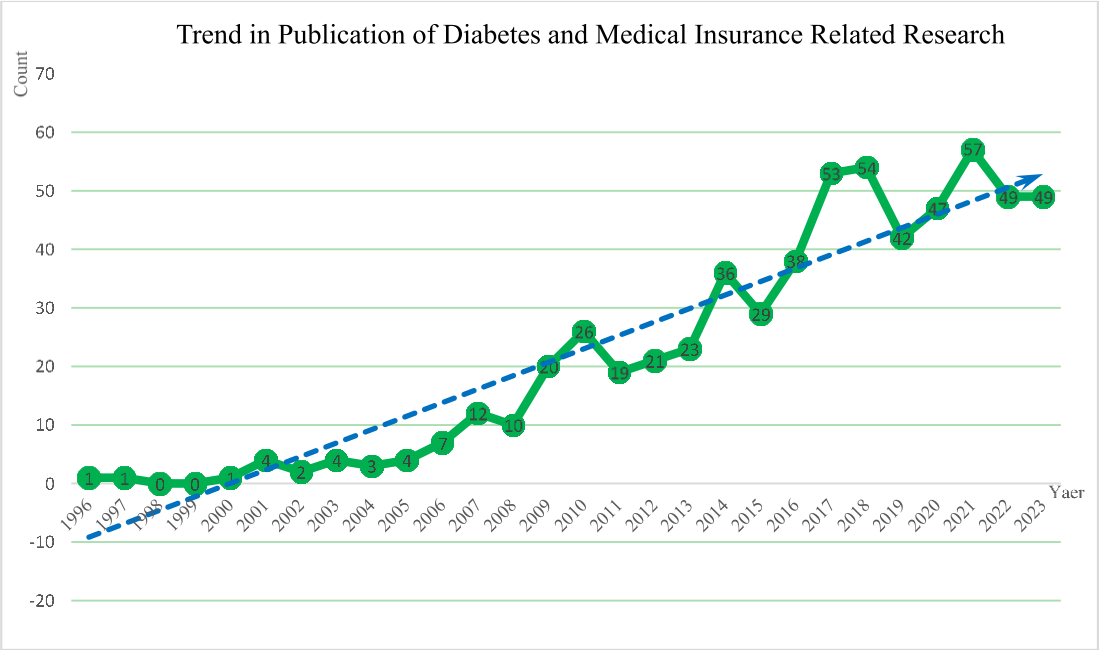

Figure 1: Trend in Publication of Diabetes and Medical Insurance Related Research (1996-2023)

3.2 Authorship and Institutional Analysis

3.2.1 Author Collaboration Network

A total of 617 articles covered 291 authors, and the maximum number of published papers was 4. According to Price's law [11], N=1.50 is calculated, and the core authors with more than 2 papers are rounded off (Fig.2), and 59 core authors are counted, with a total of 131 papers, accounting for 21.2% of the total number of papers published by all authors. From the perspective of cooperative network, although 291 author nodes and 197 cooperative connections have been identified, the network density is only 0.0047, indicating that the current cooperation between authors is not close, and a large-scale and systematic cooperation

group has not yet been formed. This situation suggests that it is of great significance to strengthen cross-author and cross-group collaborative research to promote knowledge exchange and integration in this field and accelerate the output of research results.

According to the analysis of node size in Figure 2, the larger the node, the more authors will publish [12]. Among them, the authors with the largest number of articles are Qiao Jing, Zou Sasa, and He Miao. It is particularly noteworthy that the core cooperation team composed of Qiao Jing, Zou Safeng and Tang Wei focused on the epidemiological characteristics of diabetes and its related diseases hypertension in the medical insurance population (such as enterprise medical insurance personnel and medical insurance subsidy applicants), discussed in depth the impact of medical insurance policies on patient treatment and management, and put forward a series of optimization suggestions, aiming to improve the efficiency of medical insurance funds, alleviate the economic pressure of patients, and effectively promote the prevention and control of diabetes.

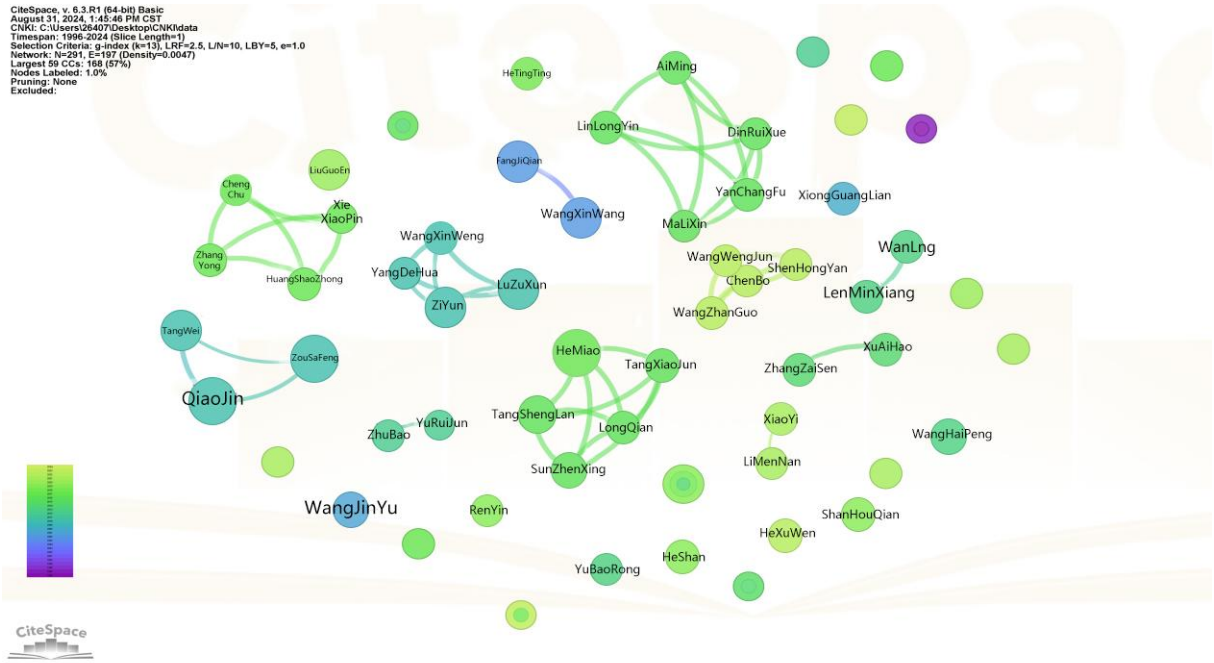

Figure 2: Co-occurrence of authors (number of papers≥2)

At the same time, the table “Author-published volume-first published year” (Table.2) is drawn. Judging from its data, research in this field has shown an active and continuous trend since 1996. It is worth noting that He Miao, Qiao Jing, and Zou Safeng have all published four high-quality papers in recent years, showing their in-depth exploration and contribution in this field. As early as 2009, Qiao Jing devoted herself to relevant research work, which clearly showed that in the initial stage of discipline development, diabetes and medical insurance related issues had entered the scope of academic research. Looking back on the past decade, scholars such as Liu Guoen, Feng Xinglin, and He Miao have conducted more in-depth and extensive explorations in this field. This phenomenon clearly reflects that with the continuous rise of the incidence rate of diabetes and the gradual optimization and improvement of the medical insurance system, the value and importance of research in this field has become increasingly prominent, and has become a core topic of academic focus. Not only that, early scholars such as Fang Jiqian and Wang Xinwang who devoted themselves to research in this field, through active exploration and practice, have built a solid theoretical framework for subsequent research, as if laying a solid foundation for the long-term

development of this field, effectively promoting its continuous progress.

Scholars such as Tang Wei, Lu Zuxun and Chai Yun have also joined the research ranks in different years, further enriching the research results in this field. With the deepening of research, we have found that the research on the association between diabetes and medical insurance is not only a long-term and evolving topic, but also an indispensable part of social health issues. With the continuous increase in the incidence of diabetes and the continuous improvement of the medical insurance system, the value of research in this field is becoming more and more prominent. In the future, we look forward to more scholars joining this line of work. Through strengthening cooperation and deepening research, we will jointly promote the optimization and upgrading of the diabetes prevention and control and medical insurance system, and contribute more wisdom and strength to the cause of human health.

Table 2: Top 10 authors by the largest number of publications (Number of publications≥3)

Rank	Author	Number of publications	First publication year
1	Miao He	4	2016
2	Jing Qiao	4	2009
3	Safeng Zou	4	2010
4	Wei Tang	3	2009
5	Guoen Liu	3	2014
6	Xinglin Feng	3	2014
7	Jiqian Fang	3	2004
8	Zuxun Lu	3	2009
9	Xinwang Wang	3	2004
10	Yun Chai	3	2010

3.2.2 Institutional Collaboration Network

Analysis by CiteSpace of Chinese literature reveals that from 1996 to 2024, 214 institutions have studied the impact of diabetes on health insurance, with the highest output being 16 papers. As shown in Fig.3, there are 214 nodes and 112 lines in the collaboration spectrum of these institutions, with a network density of 0.0049, indicating loose collaboration among institutions. However, institutions in the same province have a close relationship, such as the Fujian Provincial Social Security Insurance Association, the Fujian Provincial Health Insurance Management Center, and the School of Pharmacy at Fujian Medical University. Institutions like Huazhong University of Science and Technology, Shandong University, Jilin University, and Fudan University have been continuously researching diabetes and health insurance in recent years, with expectations of a large number of research outcomes in the future. Moreover, this research field involves many economic institutions, such as the School of International Medicine Business and Management at China Pharmaceutical University, Southwest University of Finance and Economics, and Central South University of Finance and Law, facilitating interdisciplinary collaboration across disciplines.

The implementation of this series of strategies and actions has sparked new sparks of thinking in the theoretical dimension, giving rise to numerous innovative achievements; In terms of application scope, it has greatly expanded its coverage breadth and deepened the depth of exploration. Such achievements highlight the huge development potential and prospect of the cooperation between diabetes research and health insurance. From the distribution of institutions, it can be seen that groups are the main characteristics, indicating that in order to promote the development of this field, it is urgent to strengthen the collaboration among various research institutions. The close cooperation among research

subjects within the region highlights the urgency of strengthening the integration and sharing of regional resources. The active participation of economic institutions further stimulates the vitality of interdisciplinary cooperation, laying a solid foundation for closer and more efficient collaborative research in the future.

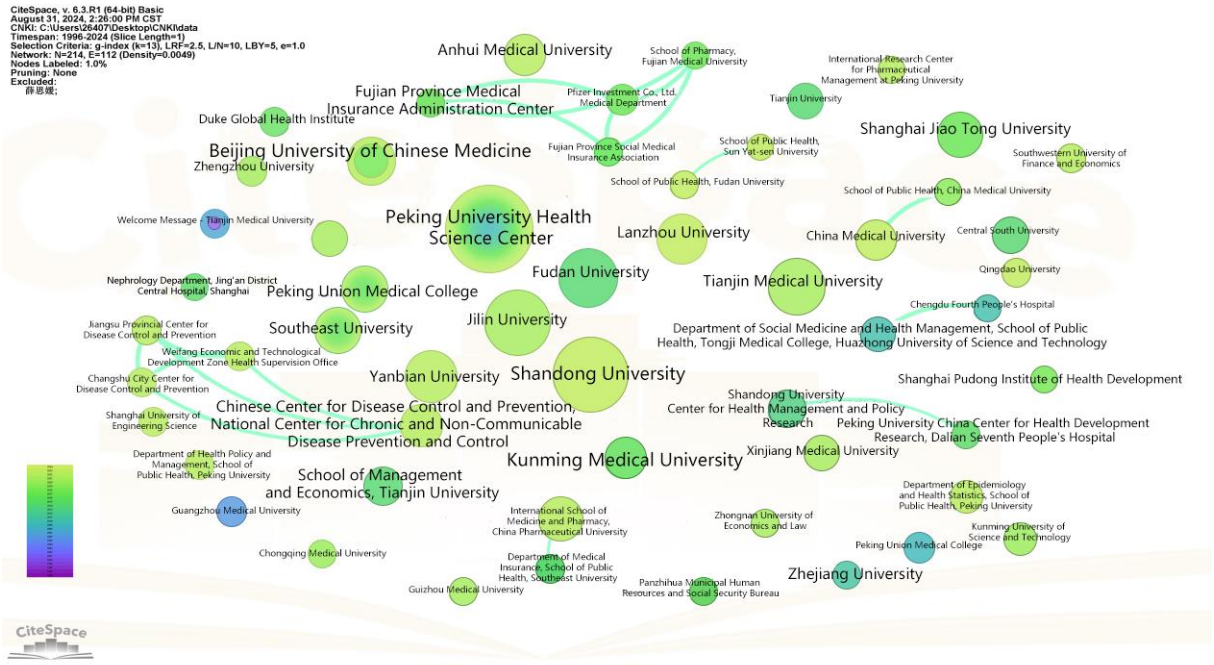

Figure 3: Co-occurrence of the issuing institutions (number of papers published≥2)

Through in-depth analysis of Table.3, it is found that the association between diabetes and health insurance research is multidimensional and neutral. Since 2008, Huazhong University of Science and Technology has published a total of 16 papers in this field, demonstrating that the university not only has a profound professional knowledge accumulation in this field, but also has received a large amount of resource investment. Shandong University also maintains a focus on this field, with 15 related publications. As early as 2006, the school had already devoted itself to related research work, reflecting its long-term attention to this research topic. Jilin University and Fudan University have published 11 and 10 papers respectively, adding diverse perspectives and enriching the connotation of research in this field. In recent years, institutions such as Beijing University of Traditional Chinese Medicine, Tianjin Medical University, and Shanghai Jiao Tong University have also actively participated in research in this field, injecting new vitality into its development. Particularly from 2011 to 2012, these institutions began to significantly increase their publication volumes, with the issue of diabetes and health insurance gaining more attention from academic institutions, thereby enhancing the overall level of research in this field.

In particular, the participation of economic institutions such as the School of International Pharmaceutical Business, China Pharmaceutical University not only broadens the research horizon, but also promotes the cross-integration of disciplines, and provides new ideas and methods for the policy formulation and economic analysis of diabetes and medical insurance. This interdisciplinary cooperation model is expected to promote the development of research in this field to a deeper and wider scope in the future. So far, the research on diabetes and medical insurance has formed a research network involving medical and economic institutions, and although the connection between various institutions needs to be strengthened, it can also be found that their cooperation and exchanges are becoming more

and more frequent, in order to lay a solid foundation for the continuous development and innovation in this field.

Table 3: Top 12 Institutions by Number of Publications (Number of Publications ≥ 5)

Rank	Institution	Count	Year
1	Huazhong University of Science and Technology	16	2008
2	Shandong University	15	2006
3	Jilin University	11	2011
4	Fudan University	10	2006
5	Tianjin Medical University	9	2011
6	Yanbian University	8	2012
7	Lanzhou University	7	2012
8	Shanghai Jiao Tong University	6	2014
9	Beijing University of Chinese Medicine	5	2011
10	School of International Pharmaceutical Business, China Pharmaceutical University	5	2015
11	Peking Union Medical College	5	2011
12	Southeastern University	5	2015

3.3 Keyword Analysis

3.3.1 Keyword Co-occurrence

The keyword co-occurrence analysis of the 617 screened articles was carried out to draw the keyword co-occurrence map (Fig.4), which contained 249 nodes and 474 connections, and the top 11 high-frequency keywords are shown in Table 4. The research in this field focuses on diabetes, and focuses on its influencing factors, chronic disease associations, medical insurance, and cost control. Future research may further explore the prevention, health management, hierarchical diagnosis and treatment, and optimization and improvement of medical insurance policies. Table.4 shows the top 11 keywords with the highest frequency of occurrence.

Through the analysis of the co-occurrence map and high-frequency keywords, it can be seen that the research hotspots and core keywords focus on "diabetes", "influencing factors" and "chronic diseases", indicating that researchers are very concerned about the influencing factors of diabetes and believe that it may be an important factor connecting diabetes with other chronic diseases, such as "hypertension". Secondly, terms such as "stroke" and "coronary heart disease" enrich the relevant research on diabetic complications and provide a reference for studying the relationship between diseases. "Medical insurance" has appeared in the early stage of research in this field, and the closely related "medical expenses" and "hospitalization expenses" have gradually attracted attention, and it is predicted that the financial burden of diabetic patients will be alleviated by expanding the scope of reimbursement, increasing the reimbursement ratio, and reducing the price of drugs and hospitalization. "Elderly" and "hierarchical diagnosis and treatment" summarize the needs of medical system reform and optimal allocation of medical resources in recent years, and also indicate the innovation and transformation of diabetes management mode. People's attention to "risk factors" and "health management" reminds us that we need to focus not only on the mysteries of diabetes treatment, but also on its prevention and health management, and reduce the incidence and complications of diabetes by identifying and managing risk factors. With the continuous enrichment of relevant research results, keywords such as "data mining" and

"decision tree" have also emerged as data research, and it is believed that the perfect combination of clinical and data can be used in the future to study more effective treatment methods.

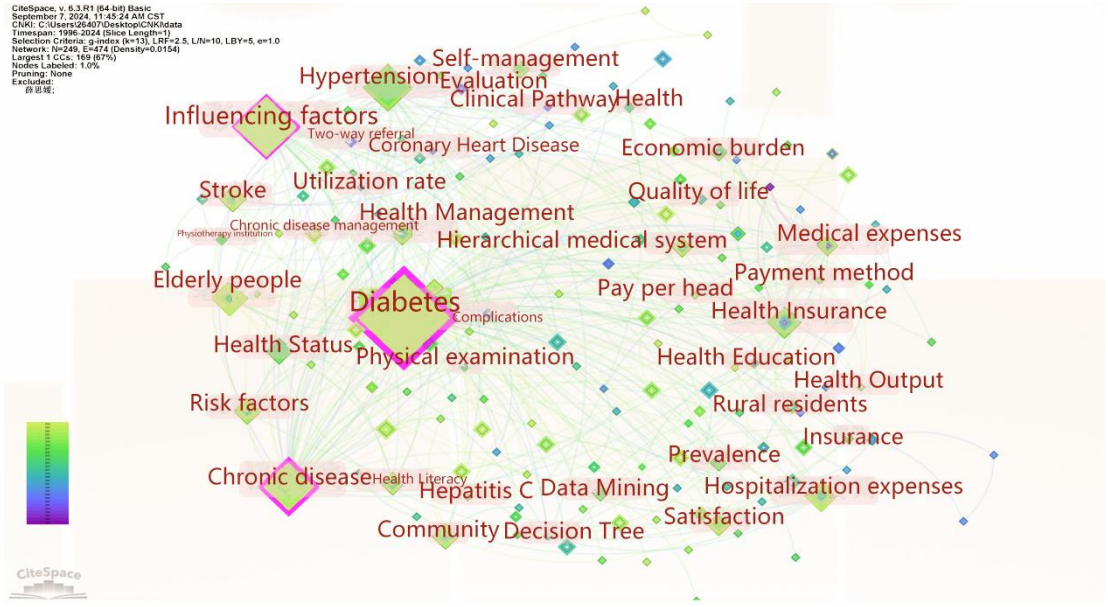

Figure 4: Keyword Co-occurrence Map

Table 4: The Top 11 keywords with the highest frequency of occurrence

Rank	Keywords	Count	Centrality	Year
1	diabetes	157	0.49	2001
2	influencing factors	88	0.18	2005
3	chronic diseases	59	0.23	2003
4	medical insurance	38	0.09	1997
5	hypertension	35	0.04	2003
6	hospitalization expenses	31	0.03	2006
7	elderly	27	0.05	2013
8	medical expenses	19	0.05	1997
9	risk factors	17	0.01	2010
10	health management	16	0.06	2008
11	hierarchical diagnosis and treatment	12	0.01	2016

3.3.2 Keyword hotspot cluster analysis

Through keyword cluster analysis of the selected literature, the research hotspots and structures in the field of "diabetes and medical insurance" can be visually displayed (Fig.5, Table.5). The resulting clustering modules are all focused on specific research topics. The size of the number after the cluster number reflects the number of references in the cluster, and the smaller the number, the larger the scale of research in the field [13].

In this study, the module value Q=0.565 and the average profile value S=0.8441 of the clustering results reached the significance level (Q>0.5, S>0.7) [14], indicating that the clustering results were reasonable and valid. The following is a specific analysis based on the cluster results:

(1) Diabetes and its complications management dimension. Cluster # 0 research emphasizes the economic pressure caused by diabetes and the psychosocial impact caused by various factors such as depression, and pays attention to the comprehensive management model of chronic diseases. Cluster # 1 highlighted the core effectiveness of the community in chronic disease management, especially focusing on rural residents' satisfaction with measures related to chronic disease management, as well as the prevention and control strategies for diabetes. Based on these research results, it can be found that the management of diabetes and its complications in the public health field is not only of great practical significance, but also faces an extremely complex situation. (2) Exploration of Health Literacy and Its Influencing Factors. Cluster # 2 focused on analyzing the multiple factors that affect the management of diabetes. These factors cover the health literacy of the public, the physical health of the elderly and the compliance of patients in the treatment process. Through this series of cluster analysis, it can be clearly seen that various factors possessed by patients themselves occupy a pivotal core position in the process of diabetes management. This also means that future research directions should focus on exploring effective ways and means to effectively improve patients' health literacy and self-management abilities. (3) Research on Medical Insurance and Cost Control Mechanism. Cluster # 3 focuses on in-depth analysis of the key role played by medical insurance in cost control and the construction of community health service systems. The fifth group of studies focuses on specific factors such as hospitalization costs, patient comorbidities, and specific types of medical insurance, to conduct in-depth exploration of the impact mechanism of medical expenses, providing rich and detailed data basis for further improving and optimizing medical insurance policies. (4) Hypertension and stroke prevention and control. Cluster #4 focuses on the prevention and control of hypertension and its complications (such as Stroke), emphasizing the role of corporate health management and two-way referral system in hypertension management. This clustering reflects the research status of hypertension as an important comorbidity of diabetes mellitus and the correlation between the two in prevention and control strategies. (5) Data analysis and technological innovation: Cluster #7 uses advanced technologies such as data mining and support vector machine to analyze insurance data to explore the gap between urban and rural areas and the difference in health care costs. Cluster #8 focuses more on healthcare system reform measures such as hierarchical diagnosis and treatment, primary diagnosis, and the role of medical associations in the management of chronic diseases. The two clusters demonstrate the potential of technological innovation to improve the efficiency and quality of diabetes management.

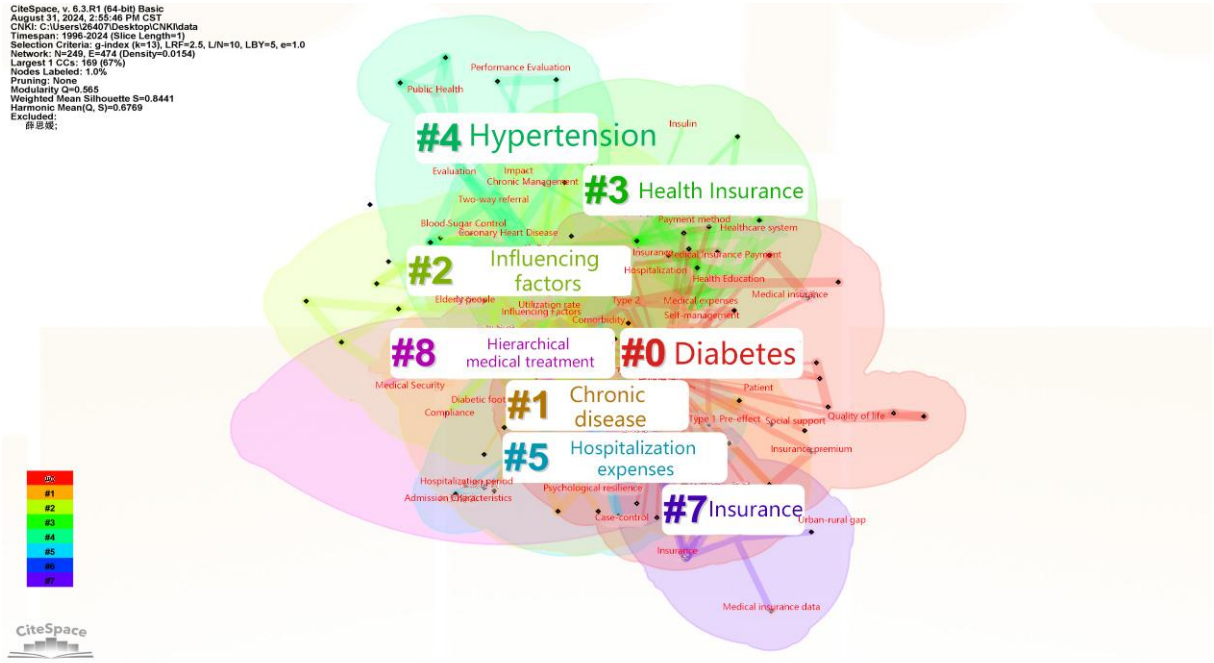

Figure 5: Visualization of Keyword Hotspot Clustering

Table 5: Keyword Hotspot Clustering Related Information

Rank	Count	Similarity	Keywords
0	42	0.84	Diabetes; Type 2; Chronic disease; Depression; Financial burden
1	32	0.8	Chronic disease; Community; satisfaction; Diabetes; Rural dwellers
2	32	0.836	Influencing factors; health literacy; Senior citizen; health status; Compliance
3	20	0.912	Health insurance; medical expenses; Analyse; Hospitalization; Construction of community health service system
4	19	0.836	Hypertension; Enterprise; stroke; control rate; Two-way referrals
5	11	0.806	Hospitalization expenses; comorbidities; type of medical insurance; ischemic stroke; Case-control
7	8	0.905	Insurance; Data mining; support vector machines; urban-rural disparities; Health care costs
8	5	0.959	hierarchical diagnosis and treatment; Primary primary diagnosis; countermeasure analysis; outpatient chronic diseases; Medical complexes

3.3.3 Clustering Hotspot Time Analysis

To better illustrate the popular research directions at different time periods, the Chinese keyword clustering diagram in Figure 5 is transformed into a keyword clustering timeline (Fig.6). This allows for a more pronounced focus on the distribution of different clusters over time, facilitating the discovery of research hotspots at different periods [15].

The Chinese keyword clustering, specifically #0 and #3, has the longest time span, indicating that diabetes and medical insurance have always been major research hotspots. #1 and #4 maintained high research interest after 2003, showing that chronic diseases associated with diabetes, such as hypertension, have received sustained social attention and are still challenges that need to be addressed. Meanwhile, #2 and #5 ended around 2020, suggesting

that research interest in factors affecting diabetes and hospital costs has decreased. This implies that as the field continues to develop, theories related to the factors affecting diabetes are becoming more mature, and with strong support from the medical insurance system, the burden of hospital costs and related issues are being addressed. Although #7 and #8, which gained attention around 2015, have a shorter time span, they still focus on reflecting the societal needs of that period. They began to utilize modern data analysis to understand urban and rural development as well as healthcare reforms, paying attention to their positive effects on citizens, aiming to deepen reforms and bring about a healthier, more beautiful, and more convenient life for many.

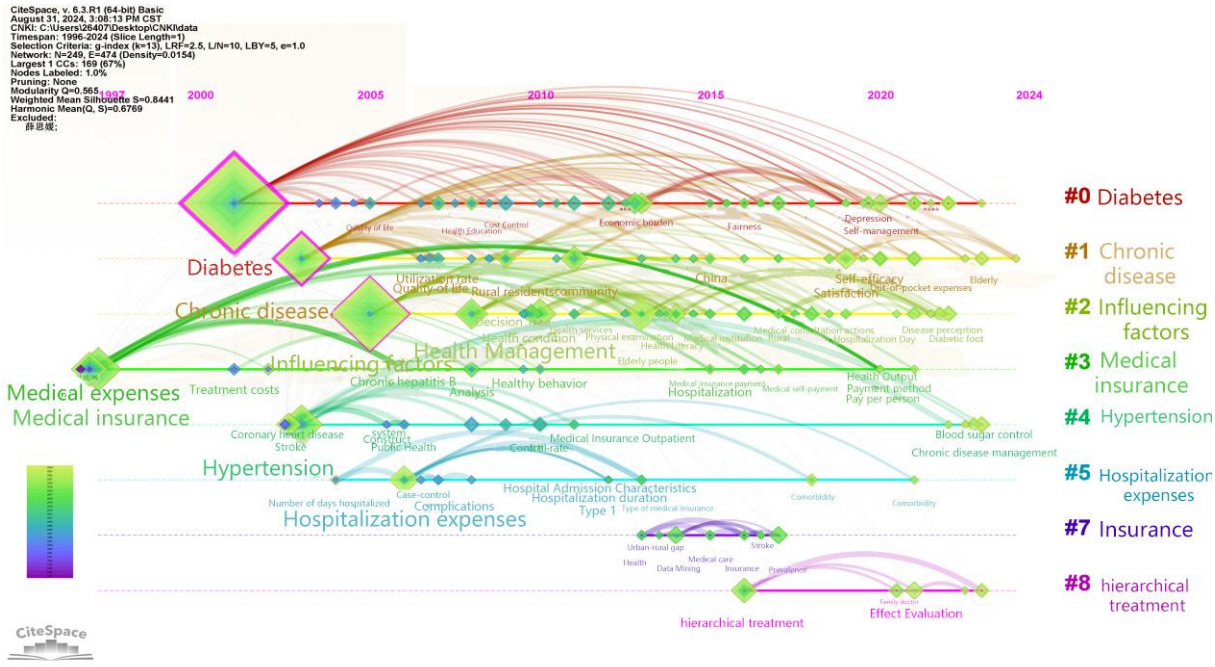

Figure 6: Timeline Map of Keyword Hotspot Clustering

3.3.4 Keyword emergence

Keyword burst analysis can capture high-frequency changes in keywords over a certain period of time [16], reveal the beginning, evolution trajectory and mutation intensity of diabetes research in the medical insurance field, and provide intuitive data for predicting future development trends in this field. As shown in Fig.7, the keywords “medical expenses” and “medical insurance” began to appear around 1997 and continue to this day, which shows that since then, medical expenses and medical insurance issues have been the focus of research in diabetes or the broader medical field. The emerging keyword "hypertension” appeared in 2003 and was frequently mentioned in the literature from 2009 to 2011, indicating that the relationship or treatment of hypertension and diabetes has become a hot topic in research, and researchers have begun to pay attention to the association of the “two diseases” and the harm to society. At the same time, “health status” continued to receive attention from 2010 to 2018, reflecting the importance people attach to the assessment and improvement of the health status of diabetics. “Hierarchical diagnosis and treatment” suddenly emerged from 2016 to 2018. This may be related to the hierarchical diagnosis and treatment policy implemented by the state [17], which aims to optimize the allocation of medical resources and improve the efficiency and quality of medical services. The brief appearance of the keyword ”prevalence" (2017) may be due to the fact that the policies issued by medical insurance for diabetes during

this year made more people pay attention to the huge base of diabetics, and statistics released new prevalence data and enriched its related research. The keyword ”influencing factors" began to appear in 2005 and continued until 2019, showing that researchers have been exploring the influencing factors of diabetes for a long time. As a relatively new keyword (2019-2020), “Satisfaction” may reflect that in today's society, patients' satisfaction with medical services or medical insurance has increased, and medical insurance has also paid more attention to the patient's satisfaction experience, which is conducive to the positive development of medical insurance. “Elderly" as the key word began to appear in 2013 and will continue until 2024, and the intensity is high, which shows that the problem of elderly diabetics is getting more and more attention. On the one hand, it is due to the aging of China's population and the increase in the elderly population base. On the other hand, it is also due to the increase in the prevalence of diabetes among the elderly, reminding us that we need to pay more and more attention to the problem of elderly diabetics. Special groups of the elderly are given caring care. Finally, the brief appearance of the “indicator system” in 2021 may point to the establishment of a new evaluation system or standard for evaluating the quality and effectiveness of diabetes or related medical services.

Figure 7: Keyword Emergence

3.4 Analysis of Highly Cited Documents

The number of citations is an important indicator to reflect the current research situation and future development direction [18, 19]. Table.6 shows the top 10 most cited literature on "diabetes and medical insurance" in CNKI database. From the analysis of research fields and topic distribution, the top two literatures "China Stroke Report 2020 (Chinese Edition)" (1) and "Epidemic Status of End-Stage Renal Disease in China and the World" are interpreted from the perspective of broader health management and medical insurance policies, reflecting the global trend of chronic disease management, and enlightening the formulation of medical insurance policies for chronic diseases such as diabetes. The third-ranked article "The Economic Burden and Economic Risk of Five Chronic Diseases for Urban Residents in China" directly explores the economic burden and economic risk of chronic diseases (including diabetes) before medical insurance covers diabetes, which poses a challenge to the affordability and coverage of medical insurance. Subsequently, the "Reliability and Validity Evaluation and Application of the Morisky Medication Adherence Scale in Patients with Type 2 Diabetes Mellitus in the Chinese Edition 8 Items" was cited 114 times, and the "Survey on Self-care Behavior and Disease Control Status of Elderly Patients with Type 2 Diabetes

Mellitus" was cited 106 times, respectively, to explore the effects of medication adherence and self-care behavior on diabetes control, and to emphasize the importance of patient self-management in the effect of medical insurance. The sixth and seventh papers discuss the linkage reform between family doctor contracted services and medical insurance payment, as well as the medical expenses of diabetes treatment populations, which are directly related to the implementation and effect evaluation of medical insurance policies. Finally, three papers from Chinese Journal of General Practice and Modern Preventive Medicine studied the quality of life, utilization of health management services, and utilization of health services in different patient groups (such as ischemic stroke patients, chronic disease patients, and elderly migrant populations), and provided data support for how medical insurance policies can better serve these special groups [20].

This study comprehensively utilized diverse research methods to conduct in-depth exploration of source documents, covering epidemiological survey methods, economic analysis, quantitative assessment methods using scales, and questionnaire survey forms. By conducting research from multiple perspectives and levels, the scientific and rigorous nature of the research process has been effectively ensured, thereby enhancing the credibility and reliability of the research results. In the data collection process, the data sources on which the source files are based are rich, diverse, and highly representative. On the one hand, utilizing large-scale epidemiological investigations to obtain fundamental data provides extensive data support for research; On the other hand, fully mining the information in hospital records to obtain first-hand medical data. At the same time, by combining the patient's self-report content, one can comprehensively and deeply grasp various situations related to research. Such rich and accurate data collection has laid a solid foundation for drawing scientifically reasonable research conclusions and presenting research results clearly and intuitively.

Related predictions show that the relationships between multiple research fields such as medicine, economics, and sociology will continue to strengthen, and interdisciplinary collaboration will be further promoted. This multi-disciplinary integration and cooperation model will focus on the analysis of the complex internal relationship between chronic diseases such as diabetes and medical insurance. We will continue to conduct long-term follow-up studies to deeply observe the profound impact of medical insurance policies on patients' health status and economic affordability over a longer period of time. In the era of reform, there will be more research utilizing new technologies such as big data and artificial intelligence to enhance the precision and efficiency of health insurance policies.

Table 6: Top 10 highly cited articles from CNKI

Rank	Title	Source	Year	Citation
1	China Stroke Report 2020 (Chinese Edition)	Chinese Journal of Stroke	2022	272
2	Epidemic Status of End-Stage Renal Disease in China and the World	Chinese blood purification	2014	255
3	The Economic Burden and Economic Risk of Five Chronic Diseases for Urban Residents in China	Journal of Peking University (Health Sciences)	2014	142
4	Reliability and Validity Evaluation and Application of the Morisky Medication Adherence Scale in Patients with Type 2 Diabetes Mellitus in the Chinese Edition 8 Items	Chinese Journal of Clinical Physicians	2018	114
5	Survey on Self-care Behavior and Disease Control Status of Elderly Patients with Type 2 Diabetes Mellitus	Journal of Nursing	2006	106
6	Analysis of the theoretical basis and policy value of the linkage reform of family doctor contract service and medical insurance payment	Health Policy Research in China	2016	86
7	A study of the total cost of care in the population treated for diabetes	Chinese Health Economics	2016	72
8	Research on the Influencing Factors of the Quality of Life of Ischemic Stroke Patients at Different Stages after Onset	Chinese General Practice	2021	54
9	Research on the Utilization of Community Health Management Services for Chronic Disease Patients and Influencing Factors	Chinese General Medicine	2021	53
10	An analysis of the health status and health service utilization of the elderly migrant population in China	Modern preventive medicine	2017	49

4 Discussion

4.1 Diversification of research hotspots

4.1.1 Management of diabetes and its complications

As a core topic in the management of chronic diseases, the economic burden, psychosocial impact and comprehensive management strategies of diabetes mellitus have always been the focus of his research. As a common complication of diabetes, hypertension is closely related to diabetes management. The emergence of keywords such as corporate health management and two-way referral system reflects the interconnection and synergy between diabetes and its complications in the prevention and control management, and may become the key to achieving breakthroughs in diabetes and its complications in the future.

4.1.2 Health Literacy and Influencing Factors

The level of health literacy of patients directly affects their self-management ability and treatment effectiveness. Especially in the context of an aging population and an increasing number of elderly diabetic patients, research should pay more attention to improving patients' health literacy and self-management ability. More high-quality research results on the influencing factors of diabetes are needed to provide more effective references for better control of diabetes and its complications in the future.

4.1.3 Health Insurance and Cost Control

The role of health insurance in diabetes management is becoming increasingly prominent. With the continuous improvement of the medical insurance system, researchers have begun to pay attention to the role of medical insurance in cost control and the construction of community health service system. At the same time, the impact of specific factors such as hospitalization costs, comorbidities, and medical insurance types on medical expenses has also become a hot topic of research.

4.2 Evolution of Trends and Predictions

4.2.1 Continuous Optimization of Medical Insurance Policies and Systems

From the trend of research, the role of health insurance policies in diabetes management will become increasingly important. With the continuous improvement of the health insurance system, it is expected that more policies and benefits will be introduced for diabetes patients, further alleviating their financial burden.

4.2.2 Interdisciplinary collaboration and the continuous strengthening of technology

The research on diabetes and health insurance has deeply crossed many disciplines such as medicine and economics. At present, interdisciplinary collaboration has become a key development trend in this research field. With the organic integration and systematic integration of knowledge in different disciplines, we can have a more comprehensive and in-depth view of the complex relationship between diabetes and health insurance, thus providing a solid and powerful support for formulating more scientific and reasonable policies. At the same time, emerging technologies in the field of data mining have brought new opportunities for development. These technologies clearly convey a signal that in this research field, fully utilizing data analysis and decision support methods can effectively improve the quality and depth of research. If we can organically integrate the massive information accumulated in clinical practice with various data elements and conduct precise analysis, then we can evaluate the implementation effectiveness of medical insurance policies in reality with higher accuracy. It can provide highly scientific and reliable reference for the formulation of medical insurance policies and flexible adjustments based on actual situations.

4.2.3 High Emphasis on Health Management and Prevention

With the continuous deepening of the research process, the society has a clearer and deeper understanding of the core efficacy of health management measures and prevention measures in the prevention and control of diabetes. At present, more and more researchers focus on the optimization and upgrading of diabetes prevention strategies and the bold innovation of health management models. If we can accurately identify various risk factors and implement effective management strategies, we can significantly reduce the incidence of diabetes and its related complications.

5 Outlook

In the current era of vigorous economic and social development and rapid changes in China, the research in the field of diabetes and health insurance seems to be standing on a new historical coordinate point, which is about to start a new journey of great momentum. Looking ahead, research in this field is highly likely to achieve significant breakthroughs and breakthroughs.

With the continuous innovation and iterative upgrading of cutting-edge technologies such as big data and artificial intelligence, novel and creative research methods will emerge and be cleverly applied to promote the field to a new level of development in a more efficient and rapid way. Among them, data integration, as a key core driving force, can greatly expand the depth and breadth of interdisciplinary cooperation, promote the deep integration and complementarity of traditional and modern disciplines, and thus generate more extensive, in-depth, and influential scientific research achievements in this field.

At the same time, the importance of vertical research focusing on health insurance and diabetes management has become increasingly prominent. By long-term and systematic tracking and observation of the sustained impact of medical insurance policies on patients' health status and economic burden, we can provide more scientific and accurate basis for policy formulation, making policies more in line with actual needs.

This series of continuously advancing research results profoundly demonstrates the country's high concern and importance for people's health and well-being, and reflects our firm collective determination to pursue high-quality medical services in a prosperous and stable social environment. All parties work together to create a magnificent blueprint for building a healthy China and outline a clear vision for a bright and healthy future.

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