Research Hotspots and Trend Analysis in DRG Field Based on Bibliometric Method

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Abstract. Diagnosis Related Groups (DRG) is currently the most widely used hospital inpatient service payment system in the world. It is helpful to encourage hospitals to improve medical quality management, avoid excessive drug use, expensive consumables, and over examination. In recent years, China has gradually shifted from a "project-based-payment" post payment system to a "disease-based-payment" packaged prepayment system. In this paper we explore the undergoing tracks of DRG research and the development of research hotspots by bibliometric analysis. By analyzing the number and distribution of publications, cooperation of research institutions, keyword clustering and keyword burst, we have obtained some conclusions. Research in DRG field has experienced exactly 40 years, and it has a blowout growth in the past five years in China. Chinese research institutions are lack of communication and cooperation, while worldwide research institutions have shown obvious cooperative relationships. In view of research hotspots, Chinese researchers focus on the impact of DRG implementation on hospital operation. In contrast, the global research is mainly on the development of DRG grouping tools. Finally, we give some suggestions for DRG reform in China.

Keywords: DRG · Diagnosis Related Groups · bibliometric analysis

1 Introduction

Diagnosis Related Groups (DRG) is currently the most widely used hospital inpatient service payment system in the world. In the United States, the Medicare system began a phased transition to a new payment method for hospitals based on uniform payments by diagnosis-related group (DRG) on 1 October 1983 [1]. DRG is considered as one of the effective reform measures for medical insurance payment. Currently, DRG prepaid payment system has been widely used in US, Denmark, France, Germany, Hungary, Italy, Netherlands, Poland, Spain, UK and other countries and regions [2]. DRG standardizes the use of medical resources through a unified disease diagnosis classification quota payment standard. It is helpful to encourage hospitals to improve medical quality management, avoid excessive drug use, expensive consumables, and over examination.

In May 2019, DRG Launched in China. The National Medical Security Bureau of China published the list of 30 DRG pilot cities. In the next few years, DRG is going

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to implement gradually. In 2020, a diversified and composite medical insurance payment method is promoted. It is based on payment by disease diagnosis related groups. Long-term hospitalization such as medical rehabilitation and chronic mental illness are implemented based on payment by length of stay, while special chronic diseases in outpatient clinics implemented payment per capita.

Our data sources are from the following databases. We search English publications from Web of Science (covering SCI-EXPANDED, SSCI, ESI), and Chinese publications from CNKI database respectively with the search terms "Diagnosis Related Groups". The article type was limited to English-language/Chinese-language respectively. Our bibliometric analysis and network visualization were performed with VOSviewer (Version 1.6.18; https://www.vosviewer.com/download) and CiteSpace (Version 6.1.R6; https://sourceforge.net/projects/citespace/files/latest/download). The retrieval strategy is as follows. In advanced retrieval of CNKI, the "subject" field is accurately retrieved using "DRG", "DRGs", "disease diagnosis related groups", and "diagnosis related groups", with a logical relationship of "OR". The time limit is 1981/01/01–2022/12/31. The search strategy for Web of Science as: "Topic" = "disease related group" or "diagnosis related group" or "prospective payment system" or "diagnosis related groups" or "disease related groups", "Language = English". We chose articles and reviews for inclusion. The exclusion of repeated articles was performed manually.

2 Bibliometric Analysis on Publications

2.1 Number of Publications

The number of publications is the simplest and intuitive indicator to measure the development of a research topic and hotspot in a specific period. We conducted a statistical analysis of the annual quantity of Chinese and global publications in DRG field from 1981 to 2022, as shown in Fig. 1.

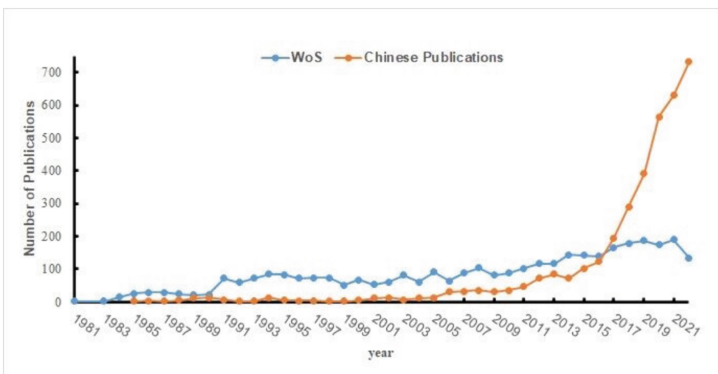

Fig. 1. Number of publications in DRG field from 1981 to 2022.

As shown in Fig. 1, research in DRG field began in 1983 in US. It had pioneered in implementing disease grouping according to disease diagnosis in New Jersey, and

number of publications in DRG field increased slightly during this period. After the 1990s, countries such as UK, France and Australia followed to US to implement DRG. DRG research had gradually become a worldwide research hotspot.

Chinese scholars also began to pay attention to DRG payment in the 1980s, but there has been no large-scale research for a long time. Until 2009, the promulgation of relevant policies in China led a favorable turn. Since then, research in DRG field has developed rapidly in China. Till 2022, number of publications on DRG research progress in China has reached a prehistoric high of 731.

2.2 Distribution of Publications

DRG is a universal and global topic according to its spatial distribution. A total of 3,309 publications involves 62 countries or regions. We rank the top 10 countries by number of publications. They are US, Germany, Australia, Italy, UK, France, Switzerland, Canada, China and Spain. According to the statistical analysis, US has obvious advantages in DRG research. On one hand, US implement DRG firstly, so the accumulation of publications is the most competitive. On the other side, the remarkable data shows that US has strong research power in DRG field. As a country with high welfare and social security, Germany's investment in DRG research is second to that of US.

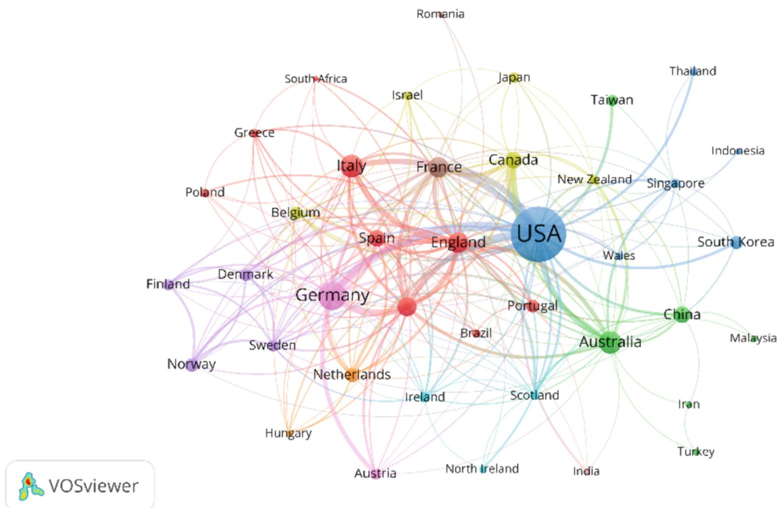

Fig. 2. Cooperation network among countries and regions.

In order to deeply understand the communication between these countries and country influence in DRG field, we adopt VOSviewer software to generate a network graph of cooperation between countries with high number of publications. Illustrated in Fig. 2. Node size represents the influence of countries, and distance between nodes and the thickness of connections represent the communication intensity between countries.

The graph center is mainly located in US, that has established cooperative relationships with 28 countries. The Germany's cooperation is mainly limited to US and other European countries.

2.3 Analysis of Institution Cooperation

We generate the Chinese institution cooperation graph by CiteSpace, illustrated in Fig. 3. There are a total of 270 nodes and 50 connections. It is shown that the institutions with the highest number of publications in China are Peking University Third Hospital, Wuhan University People's Hospital, Fujian Medical University Affiliated Union Hospital, National Health Commission Hospital Management Research Institute, Peking University First Hospital, Peking University School of Public Health, and Anhui Medical University First Affiliated Hospital. They show obvious cooperative group connections. From 2006, these institutions began to give a detailed introduction to the impact of DRG policy on average length of stay and clinical pathway, gradually expanding from theory to hospital payment system, medical insurance management, hospital performance management, etc.

Fig. 3. Cooperation Network of Research Institutions in Chinese DRG Field.

From a global perspective, there has been more wide communication in the DRG field among institutions. Global research institutions include Univ Michigan, Harvard Univ, UCLA, Duke Univ, and other institutions, shown in Fig. 4.

Univ Michigan mainly studies the future development prospects of DRG and the importance of case combination classification in advance payment systems, and adjusts the level based on the severity of the disease to promote the effective use of hospital medical resources. Harvard Univ mainly studies the impact of grouping by disease diagnosis on medical cost, as well as the relationship between disease severity and treatment outcomes, and conducts research on disease complications. UCLA and Duke Univ mainly study the impact of medical insurance and hospital payment models on nursing quality, as well as the risk of diseases.

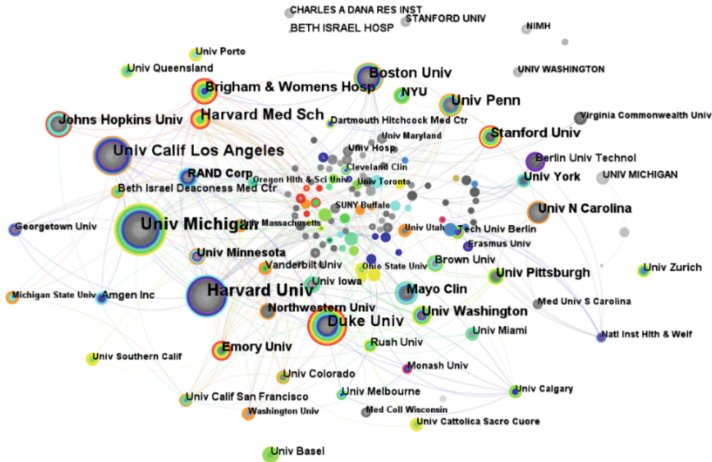

Fig. 4. Cooperation Network of Research Institutions in global DRG Field.

3 Bibliometric Analysis on Keywords

3.1 Keyword Clustering Analysis of Publications

We attempted to cluster keywords in DRG-related publications. Considering Chinese publications first, we have obtained a total of 50 clustering results. Some clusters being too small and not significant for the research. Thus the top 12 were selected as clustering results. The network contains 12 clusters, 305 nodes, 334 lines between nodes, and 253 nodes in 12 connection components, accounting for 82% of the whole network. The keyword clustering network of Chinese DRG-related publications is shown in Fig. 5.

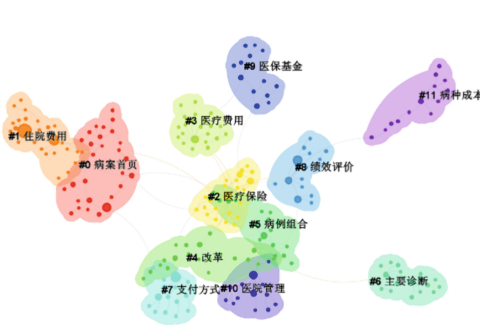

Fig. 5. Keyword clustering network of Chinese DRG-related publications

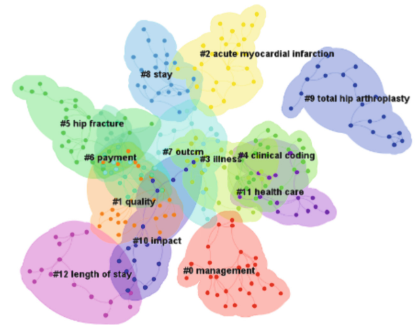

Fig. 6. Keyword clustering network of global DRG-related publications.

In Fig. 5, Modularity Q = 0.8516. Q value are generally between 0 and 1. It is considered that when Q > 0.3, the clustering is good divided, that means the correlation between keyword nodes within the same cluster is relatively close. In Fig. 5, Silhouette

S = 0.9411. S-value is an indicator that measures the similarity between a network node and its cluster compared to other clusters, with values ranging from -1 to 1. When the S-value is above 0.7, clustering is efficient and convincing. If the S-value is above 0.5, clustering is considered reasonable.

Considering global publications now. We selected the top 13 clusters. The network contains 13 clusters, 283 nodes, 401 lines between nodes, and 282 nodes in 13 connection components, accounting for 99% of the whole network. It is illustrated in Fig. 6. In this figure, Modularity Q = 0.7468, Silhouette S = 0.9129. The clustering results are reliable.

3.2 Keyword Burst Analysis of Publications

Keyword burst analysis could explore keywords' temporal distribution with large fluctuations and obvious booming, so as to analyze the research frontiers and trends in a certain topic. With the implementation of DRG payment method reform in stages, trends of research hotspots can be reflected in publications.

We firstly analyze keyword burst on Chinese publications in DRG-related field and found "medical cost" is the largest burst keyword. It is the longest lasting keyword for a total of 27 years from 1989 to 2016, indicating it is the critical hotspot for Chinese scholars, running through the DRG-related field.

Wang Z. [3] explored medical cost research on single disease inpatient and discussed it on DRGs scheme in Jilin Provence in 1990. Xu L. [4] discussed the control measures such as the combination of clinical pathways and DRG in 2002. It referred to it as CP-DRG. This method not only overcome the disadvantage of paying by disease, but also improved the process control of medical services and improved service quality. In 2010, Zhou X. [5] compared the impact of four payment methods, i.e. payment based on service items, payment based on capitation, total budget payment based on disease type, and payment based on service medical cost unit. In 2021, Zhang C. [6] analyzed the impact of prepayment models for disease diagnosis related groups on medical cost control, and provided new ways to improve hospital management efficiency.

As to global publications, the burst keywords such as "elderly patient", "discharge", "managed care" appeared in large numbers between 1992 and 2002, which can be considered as the research hotspot of this period. In the past five years, "prevalence", "bundled payment", "hospital readmission", "guidelines" and "cost analysis" reflected the trends and hotspots in DRG research.

"Implementation effect" is the largest burst keyword, indicating that worldwide researchers mainly focus on the effect of DRG implementation. For example, after comparing the implementation of DRGs between public and non-public hospitals, Buczak-Stec Elbieta found that the effect of introducing DRGs in public hospitals is not as significant as in non-public hospitals [9]. Daniel Schwarzkopf conducted a controlled time series analysis to analyze changes from the baseline to the intervention period comparing GQNS hospitals with the population of all German hospitals assessed via the national DRGs statistics [10].

The second burst keyword was "severity", indicating the severity of disease played an important role in the reform of the healthcare system. Yogesh Moradiya compared demographic and hospital characteristics between patients treated with IVT and those managed

with ventriculostomy, but without IVT. Results showed that IVT resulted in lower inpatient mortality and a trend toward favorable discharge outcome [7]. JT Schousboe verified DRG-based cost estimates of hospital stays differ significantly from Medicare payments, which are adjusted by Medicare for facility and local geographic characteristics [8].

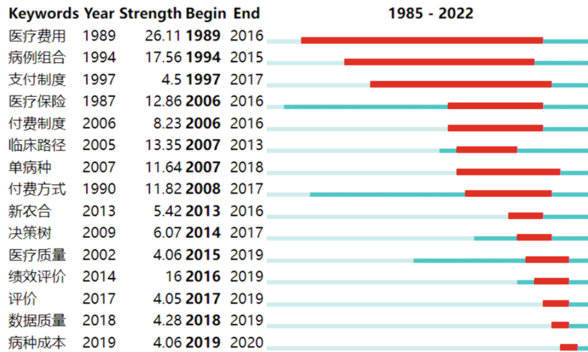

Fig. 7. Keyword burst on Chinese publications in DRG-related field.

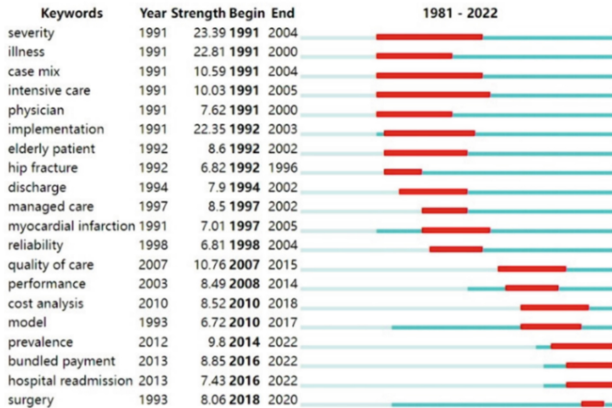

Fig. 8. Keyword burst on global publications in DRG-related field.

4 Conclusion and Suggestion

In China and in worldwide, research in DRG field continues to be promoted. Analysis on publications shows that Chinese DRG research has experienced a blowout growth in the past five years, that's benefit from the impetus of relevant national policies. While worldwide DRG research are continuously thriving, never been interrupted.

Analysis on research institutions indicates Chinese and global research institutions are mainly universities or university affiliated hospitals. Global research institutions have shown obvious cooperative relationships. However, Chinese research institutions lack communication and cooperation. This reflects that Chinese DRG research is still in its early stages and is not mature enough.

Analysis on keywords shows that most Chinese researchers focus on how to establish diagnostic grouping and payment mechanisms, evaluating hospital costs, improving medical quality and performance management. A few authors conduct deeply research on DRG from the perspective of game theory. In contrast, the global research is mainly on the development of DRG grouping tools. These indicate that Chinese DRG research is still in the exploratory stage. Therefore, we propose the following suggestions:

Improving data quality of medical record homepage. As the only data source for DRG, medical record homepage is crucial for the quality of DRG grouping. Chinese hospitals should pay attention to coder training to carry out DRG reformation.

Highlight the role of DRG in controlling medical cost. Medical cost run through the entire process of DRG research, so hospitals should focus on DRG payment to control the cost based on disease types, so as to reduce medical project costs, medicine costs, etc.

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References

1. Wennberg, J.: Will payment based on diagnosis-related groups control hospital costs? N. Engl. J. Med. **311**(5), 295–300 (1984)
2. Schreyoegg, J., Stargardt, T., Tiemann, O., et al.: Methods to reimbursement rates for diagnosis related groups (DRG): a comparison of nine European countries. Social Sci. Electr. Publ. **9**(3), 215–223 (2006)
3. Wang, Z., Yang, B., Cao, Y.: Research on hospitalization medical cost for single disease and discussion it on DRG scheme. Chin. Hospital Manag. **10**(9), 13–16 (1990)
4. Xu, L., Zhang, K.: Judging the viability of adopting CP-DRG in China by evolution of methods of payment. Chinese Hospit. Manag. **18**(8), 501–503 (2002)
5. Zhou, X., Wu, Z.: Discussion on payment methods for medical cost. Health Res. **30**(1), 46–48 (2010)
6. Zhang, C., Tian, X., Wang, K., et al.: Research progress on DRGs for medical cost control. China Health Ind. **18**(5), 195–198 (2021)
7. Moradiya, Y., Murthy, S.B., Newman-Toker, D.E., et al.: Intraventricular thrombolysis in intracerebral hemorrhage requiring ventriculostomy: a decade-long real-world experience. Stroke **45**(9), 2629–2639 (2014)
8. Schousboe, J.T., Paudel, M.L., Taylor, B.C., et al.: Estimation of standardized hospital costs from medicare claims that reflect resource requirements for care: impact for cohort studies linked to medicare claims. Health Serv. Res. **49**(3), 929–949 (2014)
9. Buczak-Stec, E., Goryński, P., Nitsch-Osuch, A., et al.: The impact of introducing a new hospital financing system (DRGs) in Poland on hospitalisations for atherosclerosis: an interrupted time series analysis. Health Policy **121**(11), 2004–2012 (2017)
10. Schwarzkopf, D., Rueddel, H., Brinkmann, A., et al.: The German quality network sepsis: evaluation of a quality collaborative on decreasing sepsis-related mortality in a quasi-experimental difference-in-differences design. Front. Med. **9**(1), 1–13 (2021)