Characteristics and Situation Analysis of Physician Competency Based on Big Data

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Abstract. Through the research and analysis of domestic journal literature in the field from 2011 to 2020, it hopes to provide a reference for advancing the competence of doctors in my country. Methods: By searching the full-text database of academic journals of China HowNet, we can obtain relevant literatures on physician competency research from 2011 to 2020, and use statistical analysis tools such as Bicomb, SPSS19.0, geluta 2.0, Excel and Ucinet for co-word analysis. Results: There are 435 effective literatures, 16 high-frequency journals and 34 core keywords. The number of papers related to doctor's job competency is on the rise, and the journals with high citation frequency are of high quality. The top three in terms of the number of papers published are the first hospital of Peking University, the First Affiliated Hospital of Zhejiang University and Peking Union Medical College Hospital Affiliated to Chinese Academy of Medical Sciences. Through the two-way cluster analysis, the research on the competency of doctors in China can be summarized into four clustering hotspots: the research on the competency of general practitioners, the research on the competency of clinical trainees, the research on the competency evaluation of doctors and the research on the competency based training system of doctors. Conclusion: The research reveals the hot spots in the field of research on the competence of doctors in my country, and provides some references for the development direction of this field in my country.

Keywords: Physician Competency, Bibliometrics, CO Word Clustering, Hotspot

1. Introduction
Since the introduction of "competency" by psychologist McClelland of Harvard University in the 1970s, experts and scholars from all over the world continue to expand and promote the competency theory [1]. At present, competency theory is widely used in various disciplines, and competency research has gradually become a research hotspot in the field of medical education and medical management at home and abroad [2]. The fundamental symbol of the quality of medical talent training is to adapt to the needs of my country's medical and health development, to meet the needs of my country's medical and health services, and to meet the needs of doctors' ability [3-4]. Clinical medicine is a highly practical subject. Clinicians need not only solid professional knowledge, but also superb clinical skills and professional ethics to be able to meet the needs of doctors. This study intends to use
the co-word analysis method and cluster analysis method to explore the research hotspots and cutting-edge trends of domestic doctors' job competence in recent years, in order to provide references for advancing the work of doctors' job competence in my country.

2. Information and Methods

2.1. Source
The research data was collected from CNKI academic journal full-text database. The search conditions were: (topic% = ‘physician’ OR title% = ‘physician’) OR (topic% = ‘doctor’ OR title% = ‘doctor’) AND (topic% = ‘competence’ OR title% = ‘competence’) AND (year Between (‘2011’ , ‘2020’); Search Scope: Journal. A total of 559 papers, excluding conferences, biographies, corrections and editorials, and other non-relevant literature, the final effective 435 papers as the study object.

2.2. Research Methods and Tools
In this study, co-word analysis and cluster analysis were used to analyze the data. Co-word analysis is based on the frequency of co-occurrence of subject words or key words in relevant literature to judge the hot topics or key words in the study, or the correlation between them. At the same time, this paper uses cluster analysis to identify and classify the subject words or key words, and then reveals the status quo, characteristics and hot spots of the subject. The study used statistical tools such as Bicomb, SPSS19.0, Ghauta 2.0, Excel and Ucinet for co-word analysis.

3. Results

3.1. Journal Distribution
Using Bicobb 2.0 software to extract periodical information, the literatures about physician’s post competence were distributed in 157 periodicals of CNKI periodical database. Among them, there were 16 periodicals with more than 6 articles, and the cumulative number of articles was 44.419%. The journal that published the most research on the post competence of doctors was “Chinese higher medical education” (47 pieces).

| Serial number | Periodicals | Frequency of occurrence | Percent | Cumulative percentage | Serial number | Periodicals | Frequency of occurrence | Percent | Cumulative percentage |
|---------------|-------------|-------------------------|---------|-----------------------|---------------|-------------|-------------------------|---------|-----------------------|
| 1             | Higher medical education in China Post-graduate medical education | 31        | 7.062  | 7.062                 | 9             | Chinese hospital | 8          | 1.822                | 33.941  |
| 2             | Post-graduate medical education | 27        | 6.150  | 13.212                | 10            | Health Vocational Education | 8          | 1.822                | 35.763  |
| 3             | General Practice in China Continuuing medical | 26        | 5.923  | 19.134                | 11            | Chongqing medicine Clinical and education | 7          | 1.595                | 37.358  |
| 4             | Continuuing medical | 20        | 4.556  | 23.690                | 12            |              | 7          | 1.595                | 38.952  |
3.2. Distribution of Core Keywords

There are 777 Thesaurus, and 34 core thesaurus (frequency $\geq 6$), accounting for 42.898%.

| Serial number | Key words | Frequency of occurrence | Percentage | Cumulative percentage | Serial number | Core subject headings | Frequency of occurrence | Percentage | Cumulative percentage |
|---------------|-----------|-------------------------|------------|-----------------------|---------------|----------------------|-------------------------|------------|----------------------|
| 1             | Competency of post | 151 | 8.718 | 8.718 | 18 | General Practice | 10 | 0.577 | 36.432 |
| 2             | Competence | 109 | 6.293 | 15.012 | 19 | Core competency | 10 | 0.577 | 37.009 |
| 3             | Standardized resident training | 58 | 3.349 | 18.360 | 20 | Medical Student | 9 | 0.520 | 37.529 |
| 4             | residency | 53 | 3.060 | 21.420 | 21 | Clinical competency | 9 | 0.520 | 38.049 |
| 5             | Standardized training | 40 | 2.310 | 23.730 | 22 | Model | 9 | 0.520 | 38.568 |
| 6             | General Practitioner | 38 | 2.194 | 25.924 | 23 | Phased target | 7 | 0.404 | 38.972 |
3.3. Frequency Distribution of Citations

The results show that most of the top 10 most frequently cited articles are from the core journals of Peking University, and “China higher medical education”, “medicine and philosophy (a)” and “continuing medical education” are also more prestigious core journals of China’s science and Technology. It can be seen that the journals with higher frequency of citations have higher quality.

Table 3. Distribution of top 10 citation frequencies

| Serial number | Title | Author | Source |
|---------------|-------|--------|--------|
| 1             | Some thoughts on the cultivation of post competence of medical students | Xie Xianghui | Continuing medical education | 75 |
|   | Title                                                                                     | Author(s)                     | Journal                                      | Page |
|---|--------------------------------------------------------------------------------------------|-------------------------------|----------------------------------------------|------|
| 2 | Construction of competency-oriented standardized training and assessment system for residents | Zhang Bo et al.               | Hospital management in China General Practice in China | 67   |
| 3 | Construction of competency model for general practitioners based on exploratory factor analysis | Jin Lijiao et al.            | General Practice Medicine and philosophy (a) | 65   |
| 4 | Training objectives of medical students and teaching of humanistic medicine                | Du Zhi-zheng                  | Journal of Shanghai Jiao Tong University (Medical Edition) | 61   |
| 5 | An empirical study on the competency of General Practitioners in community health service institutions | Ma Zhiqiang et al.          | China Medicine and philosophy (a) | 60   |
| 6 | Study on the construction of the evaluation index system of the post competence of general practitioners | Han Ying et al.              | General Practice in China Higher medical education in China | 54   |
| 7 | Exploration and practice of training excellent doctors in the view of internationalization | Yang Mianhua et al.         | Journal of the Southern Medical University General Practice in China | 47   |
| 8 | Theoretical construction and empirical study on competency model of rural general practitioners | Yeung sau muk, etc.         | Journal of the Southern Medical University General Practice in China | 44   |
| 9 | Experience of general practice postgraduate training based on the post competency of the Royal College of General Practitioners | Zhu Ling, equality          | Chinese Journal of Medical Education Exploration | 44   |
| 10| Milestone resident competency evaluation system in USA and its enlightenment                | Lee Man Wai, et al.          | Chinese Journal of Medical Education Exploration | 40   |

### 3.4. Analysis of Fund Support
The various funds set up by the government are an important source of funding for scientific research, and papers are one of the manifestations of scientific research achievements, therefore, the fund level and the fund source indicated in the paper reflect the importance and the policy direction of the government or the relevant funding unit to a certain extent. The results show that there are a maximum of 17 NSFC grants, followed by 6 NSFC grants and 4 NSFC grants respectively.

### 3.5. Distribution of Research Institutes
In terms of the number of articles published, the Peking University First Hospital ranked first with 22 articles, indicating that the hospital has focused and sustained research in the field of post competency, the First Affiliated Hospital of Zhejiang University ranked second with 17 articles, and the Peking Union Medical College Hospital ranked third with 15 articles.

### 3.6. Clustering Results and Analysis
The software GCLUTTA2.0 is used to generate a visual map of the peaks formed by fitting the Gauss Curve. In the visual cluster map, each cluster is described as a peak of 3D terrain. The location,
volume, height and color of the peak describe the information of the related cluster. The bigger the peak in the cluster map is, the more the subject literature is, and the higher the peak height is, the better the cluster consistency is. The peak color is used to represent the standard deviation between clusters, the redder the peak color, the smaller the document standard deviation, and the bluer the higher the standard deviation. The clustering effect of 0, 1 and 2 groups is good in the 4 mountain maps obtained in this study, 3 groups of clustering effect is poor (0-3 groups of clustering corresponding topics are: general practitioner’s post competency research, clinical post competency research, Doctor’s Post Competency Evaluation Research and competency-based training system research).

Figure 1. Mountain map of hot spots in the study of physician post competency

3.7. Hot Spot Analysis of the Post Competence of Doctors
As the backbone of basic health services, general practitioners play the role of "gatekeeper" for residents' health. Enhancing the evaluation and improvement of general practitioners' comprehensive capabilities is the key to strengthening the construction of the grassroots medical and health personnel team and promoting the development of grassroots medical and health services [5-6]. To do a good job in the research on the current practice situation and post competency of general practitioners can provide reference for the reform of medical education and the training, selection and assessment of general practitioners in primary medical and health institutions, so as to comprehensively improve the service level of primary medical and health care.

Research on Competency for Clinical Posts of Gui Pei sheng (Cluster 1): Standardized training of resident physicians is a continuation and supplement of university education, a pre-study before becoming a doctor, and practical education that ultimately transforms basic knowledge into clinical work ability [7-8]. Standardized training for residents with clinical competence as the core, through continuous updating of training concepts, summarizing training experience, and improving training measures, making them the backbone of my country's clinical medical services. Its purpose is to train doctors with good medical competence for medical institutions at all levels.

Research on post competence evaluation of doctors (Cluster 2): Evaluation is an important value judgment activity in hospital management. Without scientific evaluation, there would be no scientific management [9]. Since the 21st century, many domestic and foreign experts, scholars and institutions have carried out useful exploration and practice in the evaluation of doctors' competence. For example, the Royal Society of Physicians and Surgeons of Canada issued the "2005 Competency Framework of Canadian Doctors" report in 2005, which pointed out the technology, core knowledge and ability index system that specialists need to have, and evaluated the population [10]. Domestic Liu Zhuang, Xia Yun and others also made relevant analysis on the construction and evaluation of the index system of clinicians' job competence [11-12].
Research on competency-based physician training system (Cluster 3): With the changing spectrum of diseases and the widespread application of new technologies, it is essential to provide clinicians with continuous and effective training in general. The training of clinicians in medical institutions at all levels attaches great importance, and various forms of training have been carried out in practice. Competency-based training is training on the key competencies required by clinicians for specific positions, which can effectively and continuously improve the medical technology and service capabilities of clinicians and the entire hospital.

4. Summary

Based on bibliometric methods and using statistical analysis tools such as BICOMB, spss19.0, geluta 2.0, Excel and UCINET, this study conducts big data text mining on the research of domestic doctors' post competency. This paper summarizes the hot topics in the field of physician competency research since 2011. It includes the analysis of high-frequency journals, high-frequency keywords, fund support and the distribution of key research institutions, in order to provide reference for promoting the work of physician competency in China. However, this paper does not include the competency of foreign doctors into the study, and there are subjective impressions such as standardized data processing and threshold setting, which still have some impact on some specific results. The improvement of these problems needs to be explored in the future research.

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