Hospital Employee Performance Evaluation Based on Knowledge Map

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ABSTRACT

With the deepening of theoretical research and social practice, hospital employee performance management has developed into a mature knowledge system. Therefore, systematic review of the research results in this field is conducive to fully understand its research history, grasp the research hotspots and frontier issues, which is of great significance to theoretical innovation in the field of hospital employee performance evaluation. iteSpace 5.3.R4 was used as the visualization tool to draw a knowledge map to systematically sort out the distribution of relevant literature of hospital employee performance evaluation, including time distribution, journal distribution, author distribution, etc. and conduct a systematic research on the research hotspots and research frontiers in the field of hospital employee performance evaluation, which provides a beneficial reference for the theoretical research and practical innovation of domestic hospital employee performance evaluation.

KEYWORDS

Hospital Employee, Knowledge Map, Performance Evaluation, Research Review

INTRODUCTION

As an important part of deepening the reform of the medical and health system in China, building a fair and reasonable performance evaluation system is an important guarantee for the healthy development of public hospitals in the new era, which is of great significance in enhancing the enthusiasm of medical staff, improving the quality of medical services and the efficiency of hospital management. In 2017, the General Office of the State Council of China issued Guidelines on Establishing a Modern Hospital Management System, proposing to "establish and improve the internal performance appraisal system of public hospitals, by focusing on the direction of running the hospital, social benefits, medical service, economic management, talent training, sustainable development, etc., and emphasizing the performance of post responsibilities, workload, service quality, behavioral norms, medical quality and safety, control of medical expenses, medical ethics, and patient satisfaction". A detailed evaluation of an industry's individual parts, both real and conceptual, including personnel, properties, and procedures, is known as an internal analysis. Internal analysis aids firm judgement in precisely identifying the location for expansion or adjustment in order to develop a feasible strategic plan or financial model. Supervisors can use assessment to honor workers who excelled throughout the reviewed year. Acknowledging workers' accomplishments boosts their happiness, and happy

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people are more efficient. In 2018, the Notice on Pilot Establishment and Improvement of Modern Hospital Management System issued by six ministries and commissions, such as the National Health Commission of the People's Republic of China, clearly defined the key tasks of reform and development of pilot hospitals, and proposed that "the method of performance distribution within hospitals should be formulated scientifically, and various distribution methods such as annual salary system, agreement salary system and project salary system should be explored." For every individual, productivity averages are created that depict the records of results attained for every chosen profession over a stated amount of time. Management Problem Solving, Strategic Planning, Feedback Loop, Break-Even Analysis, Management by Objectives, Time Series Analysis, Quality Circle, Value Analysis, Statistical Quality Control, Forecasting, Operations Research, and other strategies are accessible for excellent medical administration.

The traditional performance evaluation system of public hospitals in China originated from the stage of transition from planned economy to market economy, with many outstanding problems such as high proportion of economic indicators, incomplete feedback mechanism and backward evaluation methods, so it is urgent to promote the innovative development of performance management of public hospitals in China through systematic and scientific research. At present, many scholars have carried out relevant research on the hospital employee performance evaluation and achieved phased research results. For example, Yin (2015), Luo (2017), Zhong (2018), Bao (2019) and other scholars optimized the hospital performance evaluation system in different degrees by sorting out the performance evaluation problems of public hospital personnel from different angles. (Yang et al. 2016), (Xie 2017), (Deng & Liu 2017), (Shi 2019), & (Wang et al. 2019) and other scholars further explored the performance evaluation system, and made some innovations in the performance evaluation methods. With the deepening of theoretical research and social practice, hospital employee performance management has developed into a mature knowledge system. Therefore, systematic review of the research results in this field is conducive to fully understand its research history, grasp the research hotspots and frontier issues, which is of great significance to theoretical innovation in the field of hospital employee performance evaluation.

In recent years, the changes of internet, big data and visualization technology have constantly driven the development of traditional scientific metrology, making it a new trend in the field of scientific metrology to study documents and knowledge by using advanced visualization technology such as knowledge mapping. The benefits of knowledge mapping are establishing information gap, promote academic achievement, streamline decision-making, enhance cross-team cooperation, increase knowledge-centered assistance, and so on. Automation has been inextricably linked to visualization technologies. Whenever construction activities as well as digitization are displayed in the form of graphs and charts, contours, and progress reports to make readers understand them easier, this is known as systematic visualization or brand development. By placing information in a graphical context, such as landscapes or infographics, data visualization helps us understand the meaning. This means the information easier intuitive to understand for the subconscious person, making it simpler to see tendencies, correlations, and anomalies in vast data sources. A knowledge map is a visual tool that depicts where information may be obtained inside a group or organization, as well as how to locate the most knowledgeable individuals. These maps, which are sometimes alluded to as an index of learning, are arranged utilizing multiple interacting networks to put things easy to obtain data.

(Kuhn, 1962) put forward the paradigm theory and revealed the scientific development course of "pre-paradigm science-conventional science-scientific revolution-new conventional science". A paradigm is a collection of ideas or cognitions in science and history that includes hypotheses, methodological approaches, propounded, and guidelines over what comprises genuine additions to a discipline. A shared base of beliefs, a library of recognized concepts, and rules for admitting latest findings and hypotheses into that cannon are the great attributes of a paradigms, according to Kuhn. Whenever the new approach adequately discusses the findings and gives a description which is nearer to actual, subjective experience; and the transformation is entirely inconsistent with

the past, a reform movement happens. (Price, 1965) believed that the intricate quotation relations among papers would form various networks, and the networks formed by various quotation relations could be aggregated to form various features similar to graphs. (Granovetter, 1990) proposed the theory of social network analysis, and believed that information spreads rapidly among nodes with strong network relationships, and new information or opinions are generated from the relationships between these nodes and other network nodes. (Chen et al. 2010) believed that the development of a research field is based on the time-variant duality between the research front and the knowledge base, and created a competition model for the map of scientific knowledge on the basis of Kuhn's model theory, and analyzed the knowledge network nodes by using the turning point theory in the social network analysis. Thomas Kuhn contended that research does not progress approaching truth in a linear fashion. Whenever present hypotheses fail to describe a phenomenon and somebody suggest an alternative theory, academia has a worldview that stays unchanged until passing across a fundamental change. The two steps of conceptualizing (collecting thoughts and then organizing ideas) are combined in a clustered or mapping. It also helps us to do at a glimpse which areas of the issue they have far more to discuss, that might assist you in deciding how to narrow down a large topic for composition. The above research is similar to the formation, accumulation, diffusion and conversion of citation clustering in knowledge mapping, which provides a reasonable basis for the application of knowledge maps in the field of literature and knowledge.

In view of this, the relevant literature in the field of hospital employee performance evaluation from 2015 to 2020 in the Web of Science database was used as the data source and CiteSpace 5.3.R4 was used as the visualization tool draw a knowledge map to systematically sort out the distribution of relevant literature of hospital employee performance evaluation, including time distribution, journal distribution, author distribution, etc., and conduct a systematic research on the research hotspots and research frontiers in the field of hospital employee performance evaluation, which provides a beneficial reference for the theoretical research and practical innovation of domestic hospital employee performance evaluation.

DATA SOURCES AND RESEARCH METHODS

DATA SOURCES

The Web of Science database is authoritative and representative in the domestic and international research field. Web of Science, formerly named as Data mining and knowledge discovery, is an interdisciplinary collection of bibliographical references that requires health, economic, and sociology publications, as well as arts magazines. Therefore, the literature included in the Web of Science database was studied, using the keywords "hospital staff performance evaluation" or "hospital personnel performance evaluation" or "hospital employee performance evaluation" or "hospital worker performance evaluation" for subject search with English as the language and Article as the literature type from January 1, 2011 to July 31, 2020 on August 7, 2020. A total of 351 articles were retrieved. As shown in Figure 1, from 2011 to 2019, the number of relevant literatures on hospital employee performance was 21, 33, 35, 27, 36, 50, 42, 36 and 45 respectively, showing an upward trend in general.

Figure 1. Number of papers published in the field of hospital employee performance evaluation from 2011 to 2019
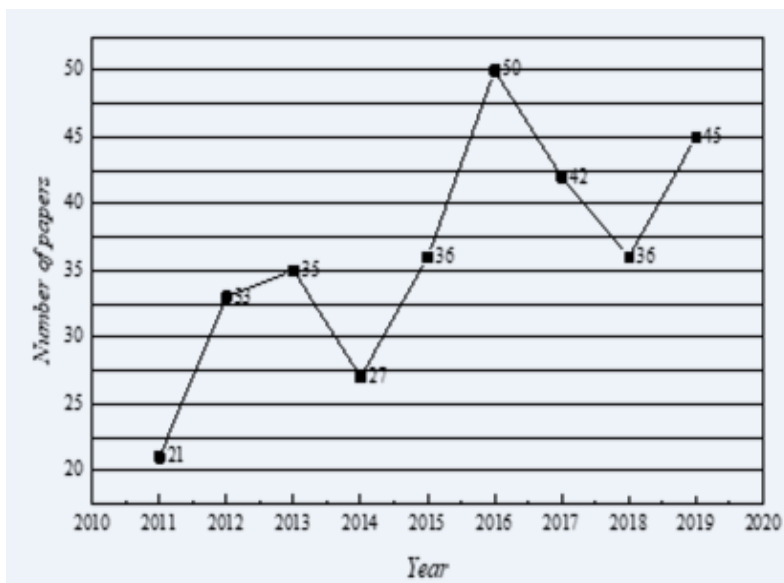
RESEARCH METHODS

In this paper, the visualization tool CiteSpace 5.3.R4, developed by Professor Chen Chaomei of Drexel University in 2004, was used to analyze the relevant literature, which is a visualization knowledge analysis tool for multivariate, time-sharing and dynamic complex network analysis written in JAVA language, and can not only help researchers discover the key path of knowledge evolution through diachronic analysis, but also reveal the research focus and frontiers of knowledge in this field by mutation detection, and has been widely used in the construction of knowledge mapping in various disciplines due to its powerful, scientific, accurate, convenient and fast functions. In all fields of biotechnology, mutation detection is critical. Unexpected abnormalities can be discovered by analyzing kilobases of DNA across a large number of people. As a result, technologies to screening DNA for abnormalities and also ways to identify recently identified mutations have been developed.

ANALYSIS AND RESULTS

Analysis of Key Journals

Co-citation analysis is an important quantitative research method in bibliometrics and scientific metrology. Analyzing sets of publications that are referenced with each other in the original publications is called co-citation analysis. Clustering of studies start to emerge whenever numerous writers mention the same pair of publications. These groups of co-cited publications seem to have a shared subject. (Small, 1973), (Marshakova, 1973) proposed the concept of co-citation for the first time, which means that when two documents A and B are simultaneously cited by the third document C, the two documents A and B have a co-citation relationship. In addition to references, journals, authors, topics, and so on can also be used to establish a co-citation network. Document co-citation analysis, a quantitative design of the study, is shown to be a useful tool for identifying essential material for cross-disciplinary concepts. Document co-citation analysis (DCA) is a strategy for preventing scholarly solitude, accelerating data exchange, and, eventually, fostering cross-disciplinary illumination. When a collection of writers cites the same set of papers, such co-citations reveal texts that may include

conceptual symbols—ideas, investigations, else procedures that have earned peer acknowledgment, as evidenced through their co-occurrence of references. Results can be obtained can be used for the reasons mentioned: To determine the influence of a publication through determining which other writers have founded their research on it or mentioned it in their own publications. To get a better understanding of a discipline or issue by locating important findings in that subject. In this paper, firstly a co-citation analysis of journals is made to fully understand the distribution of relevant core journals. Co-citation refers to the situation where two journals are cited by the same document at the same time, and is often used to explain the disciplinary relevance between different journals. Using the CiteSpace 5.3.R4 tool, the Node types option was set as Cited Journal, and Years Per Slice as 1 year. The results of co-citation analysis for the top 30 journals are shown in Figure 2.

Figure 2. Map for co-citation of journals for hospital employee performance evaluation
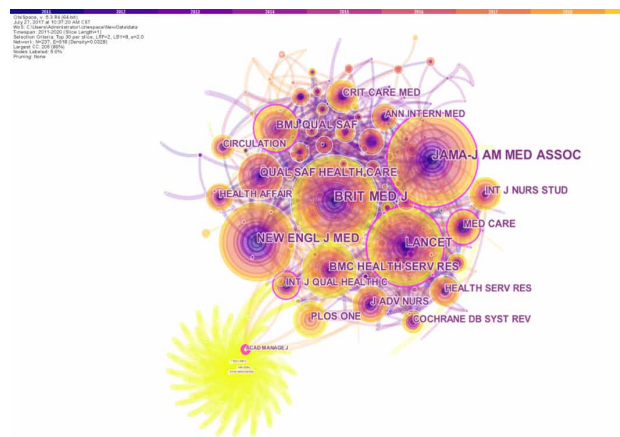

Judging from the number of co-citations of journals, JAMA-Journal of the American Medical Association, BMJ-British Medical Journal, New England Journal of Medicine, Lancet, BMC Health Services Research, Quality and Safe in Health Care, BMJ Quality and Safety, Journal of Advanced Nursing, Plos One, International Journal of Nursing Studies and other journals were cited more frequently, which were 97 times, 93 times, 81 times, 80 times, 60 times, 48 times, 48 times, 42 times, 42 times and 38 times respectively. Thus, it is clear that the above journals play an important role in the field of hospital employee performance evaluation and are the main channel for publishing relevant research results and an important platform for scholars to share knowledge achievements.

In terms of the centrality of the journals' co-citation, the journals such as ACAD-Academy of Management Journal, Medical Care, BMJ Quality and Safety, International Journal for Quality in Health Care, JAMA-Journal of the American Medical Association, Lancet, New England Journal of Medicine, Annals of Internal Medicine, BMC Health Services Research, Social Science and Medicine have a higher centrality, i.e. 0.4, 0.16, 0.14, 0.13, 0.11, 0.10, 0.9, 0.9, 0.8 and 0.8, which indicates that the above journals have a higher influence on the hospital employee performance evaluation and the quality of published literature is better. In addition, the journals such as BMC Health Services Research, JAMA-Journal of the American Medical Association, Lancet, New England Journal of Medicine, BMC Health Services Research rank the top in both citation times and centrality, indicating that these two journals are important core journals in the research field of hospital employee performance evaluation.

ANALYSIS OF KEY AUTHORS

Co-citation analysis of authors refers to the situation where two authors are cited in the same document at the same time. It is often used to explain the close academic relationship between the two scholars. The higher the number of co-citations, the closer the academic relationship between the two scholars is. In this paper, Node types is set as Cited Author, Years Per Slice as 1-year, Top N per slice as 30, other parameters remain unchanged, anonymous authors and institutional authors are removed after running the program, and the co-citation knowledge map of authors in the field of hospital employee performance evaluation are obtained as shown in Figure 3. Among them, the co-citation authors are the first authors in all the references.

Figure 3. Co-citation knowledge map of the authors of hospital employee performance evaluation
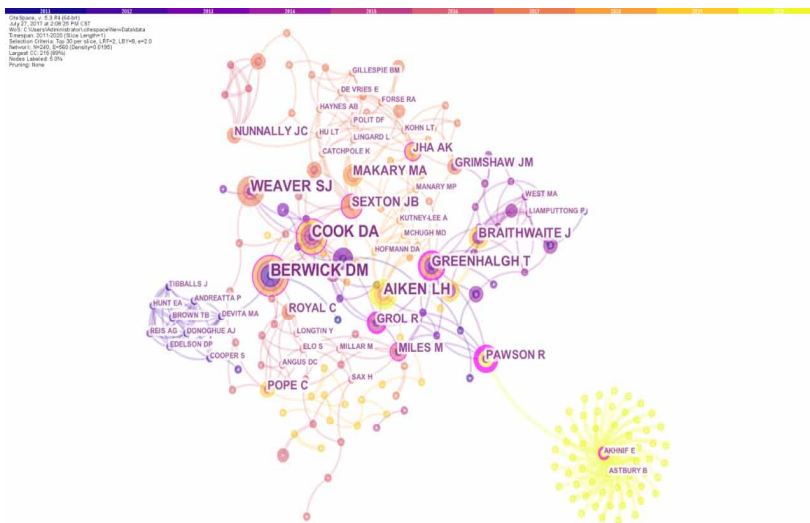
In terms of the times of co-citation of the authors, the top 10 authors are Berwick, Cook, Aiken, Weaver, Greenhalgh, Dixon-Woods, Cohen, Makary, Sexton and Braithwaite, who are cited 9 times, 8 times, 7 times, 7 times, 6 times, 5 times, 5 times, 5 times, 5 times and 5 times respectively, indicating that the above-mentioned authors have a higher academic position in the field of hospital employee performance evaluation research. In terms of the centrality of the author co-citation, the top ten authors are Pawson, Greenhalgh, Grol, Akhnif, Berwick, Jha, Miles, Cook, Sexton and Braithwaite,

respectively, 0.62, 0.39, 0.39, 0.35, 0.19, 0.18, 0.16, 0.11 and 0.09, reflecting the great influence of the above authors in the field of hospital performance evaluation. Five scholars, Berwick, Cook, Greenhalgh, Sexton and Braithwaite, have prominent positions in the academic field, and their research results have a great impact on the hospital employee performance evaluation and contribute greatly to knowledge innovation in this field.

REFERENCE ANALYSIS

Document co-citation refers to the phenomenon that two references are cited by the same document. The knowledge structure of a research field can be revealed by analyzing the clustering and key nodes in the co-citation network. In this paper, Node types is set as Cited Reference, Years Per Slice as 5 years due to the small number of documents in each year, Top N per slice as 50, and other parameters remain unchanged. After running the program, the knowledge map for document co-citation in the field of hospital employee performance evaluation is obtained as shown in Figure 4.

Figure 4. Knowledge map for document co-citation in the field of hospital employee performance evaluation
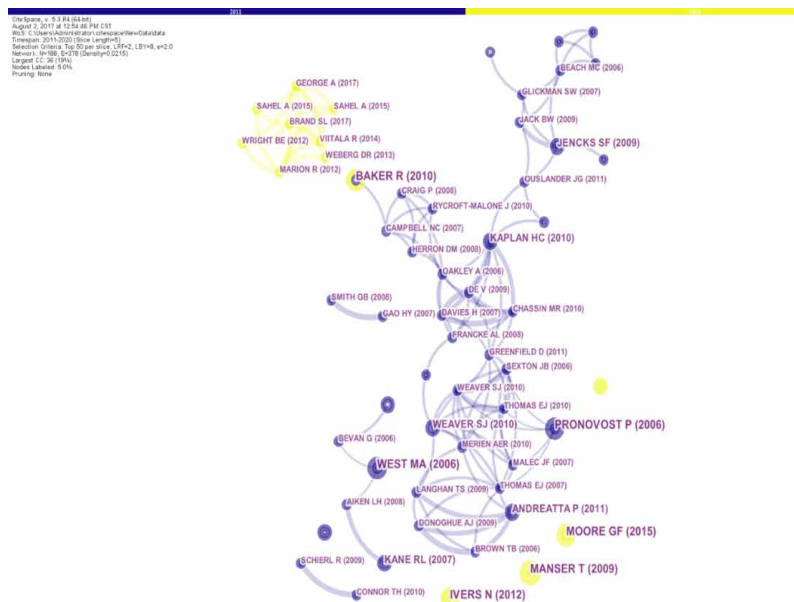

Figure 4 shows that the most frequently cited documents are Moore et al., West et al., Manser, Ivers et al., and Baker. Among them, Moore et al. (2015) described a new framework for evaluating complex intervention processes based on three themes in the 2008 MRC Guidelines, and proposed a systematic approach for designing and evaluating processes using descriptions of intervention theory and identification of key process issues, and finally, verified the validity of the framework and approach by case analysis. (West et al. 2006) studied the relationship between hospital human resource management and patient care outcomes in 52 UK hospitals and concluded that there was a significant correlation between hospital human resource management and patient mortality, excluding other factors. To improve the level of patient care, managers and policy makers should pay attention

to improving the efficiency of human resource management in hospitals. (Manser, 2009) studied the relationship between teamwork in the medical field and patient care safety, and the results showed that good teamwork can effectively avoid adverse hospital accidents. He also found that employees' perceptions of teamwork and leadership style are related to their well-being, which can enhance the ability of medical staff to provide safe patient care, thereby affecting the quality and safety of hospital patient care. Further, he proposed a communication model, collaboration model and leadership model for efficient teamwork. Finally, he believed that how to conduct team performance evaluation is the main direction for future research.

Data structures are methodical depictions of the activity that aid in comprehending how interaction may be accomplished. The collaborative model (also known as the interactive paradigm) is a personality psychology way of explaining how talking as well as comprehending function in discussion, especially how individuals in discussion collaborate to identify precise connections. A leadership model demonstrates how to set a good example. This is distinct from a management style, that describes how an individual's manages characteristics and personal, business, work environment, as well as values drawn from many management styles.

(Ivers et al. 2012) pointed out that assessment and feedback are important ways to help healthcare professionals improve their improper behavior, and further studied the impact of assessment and feedback on health care workers' behavior and patient cure rate, and finally analyzed the specific factors affecting the effect of assessment and feedback. Their studies showed that assessment and feedback often result in small but significant improvements in health care professionals' professional behavior, and that the effectiveness of assessment and feedback depends on basic performance and the way they are fed back. (Baker et al. 2010) assessed the effectiveness of intervention on medical professional behavior and disturbance of patient cure rate, and compared the difference between targeted intervention and non-targeted intervention by conducting 26 studies, and finally concluded that targeted intervention can more effectively change medical professional behavior and improve patient cure rate, and that it is reasonable to adopt low-cost targeted intervention in practice. In countries with low-level and localized HIV infections, targeted interventions offer a cost-effective strategy to administer HIV prevention and treatment program. In more widespread outbreaks, they're also a cost-effective approach to access the individuals who are at danger.

The top literatures in centrality are Kaplan et al., Ouslander et al., and Greenfield et al. Among them,

Kaplan et al. (2010) carried out a systematic study on 47 documents concerning the influencing factors of medical quality improvement, and found that management leadership, organizational culture, data facilities and information systems, and years of quality improvement are the main factors influencing the effectiveness of medical quality improvement, and that other influencing factors include medical staff engagement, micro-environmental incentives, quality improvement resources, and leadership of quality improvement teams. (Ouslander et al. 2011) argued that the reform of medical insurance payment would lead to more hospitalized treatment behavior and reduce the quality of medical care in the absence of medical resources. They also introduced an intervention to reduce hospitalization behavior of residents in private pension homes and concluded through a six-month evaluation of 25 private pension homes in three states that the intervention can effectively reduce the number of self-paid hospitalizations and save the national health insurance expense. (Greenfield et al. 2011) studied the influencing factors of different career improvement measures in health organizations and found that 6 important factors included site acceptance, team issues, leadership, impact of health care relationships, impact of quality and safety, and degree of institutional embeddedness of projects. They believed that improvements can improve the quality of care in health institutions and patient safety, and that improvements in the quality of health care depend to a certain extent on providing a more flexible and supportive social environment.

ANALYSIS OF RESEARCH HOTSPOTS

Keyword co-occurrence refers to the occurrence of two or more keywords in the same document, which mainly reflects the internal structure and research hotspots of a certain discipline by describing the relevance of keywords. In this paper, Node types is set as keyword, Years Per Slice as 1-year, Top N per slice as 30, and other parameters remain unchanged. After running the program, the knowledge map for research hotspot in the field of hospital employee performance evaluation is obtained as shown in Figure 5.

Figure 5. Knowledge map for research hotspot in the field of hospital employee performance evaluation
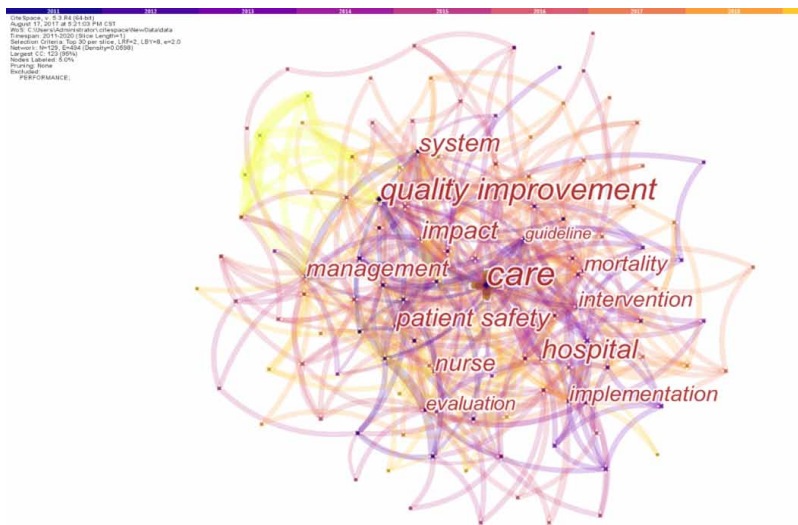

In terms of the co-occurrence frequency, the keywords with higher frequency are care, quality improvement, hospital, system, patient safety, impact, management, nurse, communication, implementation, which are 87 times, 50 times, 28 times, 23 times, 22 times, 21 times, 20 times, 17 times, 15 times and 15 times respectively. The top performers in centrality are care, nurse, quality improvement, system, patient safety, implementation, mortality. Frequency ranking is basically the same as centrality ranking. Thus, it is clear that care, nurse, quality improvement, system, patient safety, implementation and other keywords rank first in both co-occurrence frequency and centrality. Cluster analysis of high frequency words revealed that the main categories of hospital employee performance evaluation include emergency doctor management, infectious disease control, patient information sharing, community care, new nurses, case study, regional disparity, sedation level, etc. (As shown in Figure 6).

In terms of health care, (Yu&Kim, 2015) found that increasing the number of registered nurses and increasing the level of nurse staffing can shorten the overtime hours of nurses and improve their work performance. (Gao et al. 2018) used balanced scorecard to evaluate the performance of county-level hospitals in underdeveloped regions, by firstly determining the performance evaluation index system, and then modified the index system by the Delphi method, and finally evaluated the department performance in the hospital via Topsis method, and concluded that resource utilization efficiency, medical service price, personnel structure and doctor-patient relationship are the main factors influencing the performance of departments in the hospital. The Delphi method is a way of

polling a group of scientists to arrive at an opinions or conclusion. Specialists complete numerous sessions of surveys, with the results compiled and presented with the community at the end of every iteration. (Butler et al. 2018) argued that traditional hospital employment performance evaluation tends to result in inaccurate and unfair results by comparing individual performance averages with performance goals, without considering relevant changes. (Dolan et al. 2016) assessed the performance of influenza vaccination for new medical personnel in 1 000 US hospitals between 2012 and 2013, and found that larger medical institutions face more challenges than smaller ones, but these challenges will diminish over time. (Seren et al. 2018) proposed a tool for evaluating the work performance of hospital nurses and proved its validity and reliability by analyzing the work performance data of 240 nurses in 4 Istanbul hospitals. (Yeh&Lai, 2015) analyzed the effectiveness of more than 30 management tools such as strategic management, balanced scorecard, total quality management and so on in the field of hospital employee performance management by using V-type evaluation matrix, and listed the factors to improve the effectiveness of tool application including senior management participation, department communication and coordination, team work, hospital participation, education and training, consultant professionalism, internal audit, computerized process, incentive pay, etc.

Figure 6. Cluster view of research hotspots in hospital employee performance evaluation
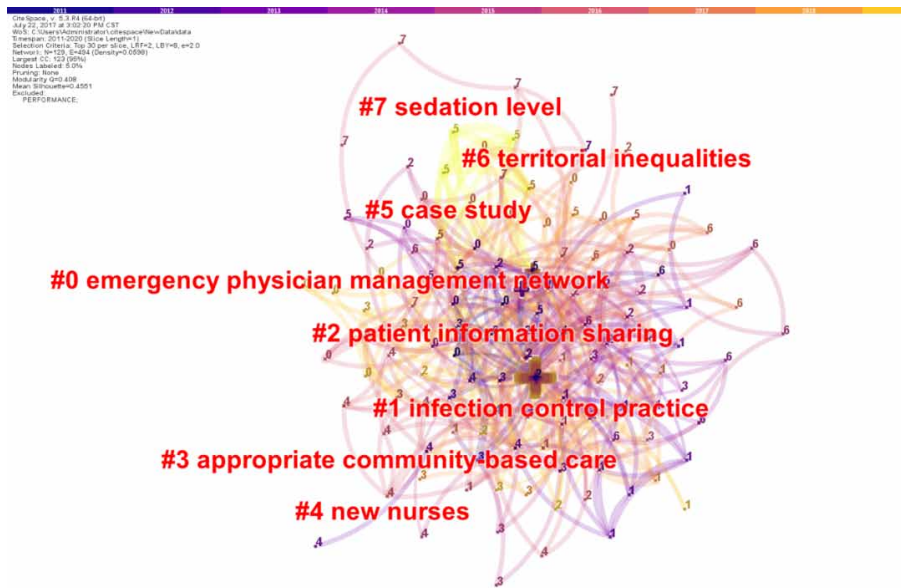
In terms of quality improvement, Nadiri&Tanova, (2016) used the least square method to analyze the impact of managers' attitudes towards service quality, workplace support, managers fairness and organizational commitment on medical personnel service performance, and found that workplace support indicators such as hospital customer service, teamwork, service training, etc. have no significant correlation with service performance, and that hospital managers should pay more attention to internal rewards and give more autonomy to staff to provide service performance. Utilizing least-squares approach, a researcher will create a linear equation that illustrates the possible link among variables of the study. The least-squares approach explains why the lines of greatest fit should be placed where it is one of the pieces of information being analyzed. Several analytical

operating systems that do not provides greater probability estimations may include non-linear least squares technology. (Sinkowitz-Cochran et al. 2012) proposed a quantitative and qualitative method to evaluate the relationship between organizational culture and medical quality improvement at different levels of the hospital, and concluded that the organizational culture of leadership has a greater impact on personnel performance and medical quality improvement. (Girault et al. 2017) and others conducted a study on the impact of the implementation of the performance pay system in hospitals and found that most managers have a positive attitude towards the performance pay system, but the lack of understanding of the performance pay system by hospital staff is mainly due to the unclear rules and time constraints. They also believed that it is necessary for hospital managers to evaluate the implementation of the performance-based salary system. (Weng et al. 2016) believed that hospitals shall incorporate patient priorities into their performance evaluation system for health care professionals, and that the combination of organizational and personal goals can help hospital staff better understand and clarify the expected performance of the organization and service-oriented behavior. (Hassona et al. 2012) found a positive correlation between medical education training and hospital staff performance through a survey of Egyptian hospitals. (Vanoli et al. 2012) introduced a quality certification standard for medical departments in hospitals, and evaluated the performance of medical departments through self-evaluation and peer-evaluation.

In terms of the hospital department, Soares et al. (2019) evaluated the performance of 45 hospital nurses in Sao Paulo, Brazil, and further studied the factors affecting performance, and established a 27-index evaluation system from four dimensions: profession, communication, management and nursing process, and finally concluded that the interviewed nurses have less communication with hospital administrators, less participation in academic research and application of results, but performed better in terms of on-time work and workload, and professional ethics commitment. (Nag et al. 2019) proposed a dynamic evaluation method based on structured data before, during and after cardiothoracic surgery, which can effectively improve the performance of cardiothoracic surgeons. (Ramos et al. 2015) established an evaluation index system for department performance of Brazilian hospitals, including the proportion of hospital staff per bed, average hospitalization expenses, bed occupancy, average hospitalization time, bed turnover and patient mortality, and found that size, type of department and educational activities have significant impact on the performance of hospital departments. (Mulfinger et al. 2019) demonstrated through grouping experiments that organizational intervention can affect mental health and well-being of employees and improve job performance indicators of hospital employees. (Monto et al. 2016) believe that regular collection of patients' quality of health and life data better supports cost-benefit analysis of hospital departments, and that data collection often involves incomplete data and ambiguous management processes, so the key to obtaining reliable data is clear ownership of the process, automated data collection, and better employee training. (Jones&Nanda, 2016) introduced that the assessment of Australian pre-service doctors is mainly based on the feedback from designated consultants or other medical professionals, but the assessor and the pre-service doctors spend limited time together due to the constraints of actual conditions, which affects the consistency and reliability of performance evaluation. Therefore, they proposed a performance evaluation system for the pre-service doctors based on the workplace.

In terms of systematicness, Geis et al. (2011) used the Mayo High Performance Team Scale to simulate the performance of the medical team (the lower the score, the less team collaboration), and came to the conclusion that the simulated evaluation helps determine the workload of the medical staff and refine the responsibilities of team members. (Jeffery et al. 2018) evaluated the performance of 490 surgical nurses in 129 hospitals in terms of patient experience, employee engagement, employee placement, professional practices, and clinical treatment, and later clarified the rationality of the indicator framework by artificial intelligence analysis methods after identifying the top 5% by manual scoring. (Lin et al. 2019) established a performance evaluation model for public hospital personnel based on DRGs theory, which is based on workload and comprehensively considers factors such as the labor risk, technical difficulty and labor cost of doctors with different diseases. The DRG's objective

is to link a hospital's complement towards the requirements in addition to expenses that come with those needs. Moreover, the performance evaluation scheme of medical staff established by them can reflect the investment of labor value and meet the requirements of hospital personnel management in the new medical reform. (Foster et al. 2018) used the big data method to analyze the factors affecting the work performance of hospital doctors, including income potential, number of patients, disease complexity, patient experience, etc., and concluded that the number of patients and basic complexity are the key factors determining the income potential, and the income potential is also positively related to the patient experience. (Ider et al. 2011) discussed the game between performance appraisal and nosocomial infection report in Mongolian hospitals, and found that hospital employees would minimize the number of nosocomial infection cases reported as much as possible due to the penalty measures in performance appraisal, so they suggested replacing the original index of nosocomial infection prevention and control measures with the original index of nosocomial infection rate. (Trebble et al. 2014) attempted to apply general human resource management theory to the practice of hospital physician management, including organizational performance evaluation and decision-making, organizational empowerment, personal performance evaluation, rewards, recognition and personnel management, and they believed that management of hospital staff performance, behavior, and development should be incorporated into organizational strategies.

In terms of patient safety, Feather et al. (2018) found that the pro-social behavior of hospital nurses can effectively promote their work performance and quality of work, and good leadership level can enable employees to generate pro-social behavior at work, thereby improving work efficiency and quality of care. (Fiorio et al. 2018) quantitatively assessed hospital performance using the patient-centered model and concluded that although the implementation of the patient-centered model required a redefinition of the responsibilities and powers of hospital staff, the average level of hospital MDC improved significantly. (Ballangrud et al. 2017) believes that teamwork is an important component of complex medical care, not only for patient safety, but also for effective team performance. (Chung et al. 2018) found that network-based and face-to-face simulation training can improve patient management and work performance of hospital nurses, because network-based simulation training is more convenient, and face-to-face simulation training is more able to develop practical skills and teamwork awareness. (Dahl et al. 2017) evaluated the effectiveness of TeamSTEPPS training and concluded that effective communication is the key to medical team collaboration, and that hospitals should encourage a culture of public speaking in the workplace to improve medical staff performance and patient safety. (Dinius et al. 2019) pointed out that patient safety is an important aspect of hospital employee performance appraisal and that key areas of patient safety include teamwork, error management and patient involvement. (Ebadi et al. 2017) believed that the performance of the surgical team depends not only on individual members, but also on the collaboration among team members, which can affect the post-operative patient safety. Later, they developed an assistant decision support system for the staffing of the surgical team, taking into account factors such as membership, work history and patient characteristics.

In terms of influencing factors, Sadatsafavi et al. (2015) considered that the hospital environment can affect the work performance of medical staff, and further studied the factors affecting the environmental assessment of patients, work areas and staff areas, and concluded that the assessment of safe and comfortable working environment by medical staff is greatly influenced by factors such as decoration materials, indoor air quality and furniture design. (Niks et al. 2013) found that higher job demand reduces the well-being and job performance of hospital staff, which needs to be reduced through some customized work interventions. (Haldar&Sahu, 2015) conducted a study on the work performance of nurses under the shift system in hospitals, and found that the morning and evening nurses are vulnerable to more occupational stress, which leads to reduced work efficiency. (Perry et al. 2018) pointed out that attitudes of hospital nurses affect their work performance, and the main factors influencing their work attitudes are leadership support, staffing level, teamwork, adoption of care practices and promotion opportunities. (Davies et al. 2019) explored the use of Lean Six Sigma

to improve patient care performance and patient satisfaction, and concluded that implementing Lean Six Sigma can reduce patient turnaround time, increase length of care, and improve patient-to-patient ratio. (Codier et al. 2013) found that developing the emotional intelligence capability of hospital medical staff can reduce the negative impact of a high-intensity environment and effectively improve employee stability, job performance and teamwork. (Jiang et al. 2019) considered that patient satisfaction is an important part of performance evaluation system. A linear regression is a functional that represents the connection among a responding, reliant, or targeted factor and one or many predictors variable. Several methods of forecasting and assessing the impacts on attribute values are based on linear regression. They further analyzed the relevant factors affecting satisfaction by establishing a multi-level linear regression model. Finally, they concluded that treatment feedback, frequency of psychological treatment, doctor-patient communication, privacy protection and other factors have a high correlation with patient satisfaction.

In terms of management, Belrhiti et al. (2020) believed that the leadership of hospital managers can influence employee performance, and further found through a study of a high-performance hospital in Morocco that leadership effectiveness depends on the degree of response to the basic needs of employees, including autonomy, relationships, organizational support and supervisory support. (Friedman&Rabkin, 2018) found that hospital performance evaluation concerns more about the medical quality, patient safety, financial efficiency and other aspects, but less about administrative operations, institutional culture, and inadequate leadership, inefficiency, problematic management behavior will easily make employees dissatisfied, which will affect the hospital's output, medical quality, innovation, public image and attraction of patients, etc. (Aujirapongpan et al. 2020) used the balanced scorecard method to analyze 16 key performance indicators and development trends of 52 community hospitals and departments in Thailand from four aspects: customer, finance, internal process and learning growth. Among them, the customer aspect includes the patient complaint rate, outpatient waiting time; The financial aspect includes the proportion of income cost, the proportion of drug consumption to cost; The internal process aspect includes the bed turnover rate, the hospital infection rate; The learning growth aspect includes the staff turnover rate, the number of research results. (Belrhiti et al. 2020) explored the relationship between leadership behavior and staff performance incentives in Moroccan public hospitals, and concluded that leadership effectiveness depends on the degree of reflection of employees' psychological needs, including autonomy, ability and relationship, organizational support and leadership support, and that good staff performance in hospitals needs to be achieved by a good match of leadership style, organizational characteristics and staff personal attributes, while excessive control of leadership will reduce employees' satisfaction with the need for autonomy and mutual respect. (Katz et al. 2013), (Gavurova et al. 2017) used Logistic regression to analyze the relationship between patient satisfaction in emergency rooms and the incidence of returns, and concluded that personal care evaluation and waiting time are significantly related to the incidence of returns. (Gonzalez et al. 2018), (Abdel-Wahed et al. 2013), (Choudhury, et al. 2021) considered that the energy consumption of hospital departments is related to weather conditions, building area, gross domestic product (GDP), geographic location, number of beds and number of employees, and that that it is most appropriate to use the number of beds as a quantitative indicator of energy consumption in actual evaluation of energy consumption of hospital departments.

ANALYSIS OF RESEARCH FRONTIER

Keyword mutation refers to the sudden increase in the frequency of using keywords over a period of time, which is often used to analyze cutting-edge issues in a discipline. The term cutting edge refers to the much more recent besides sophisticated version of the software else business. CIOs as well as other IT managers are under new environmental conditions or may be even adopt which is trying to cut technology solutions as consumers search it out every major challenge. By using the word frequency detection technology provided by CiteSpace 5.3.R4, the words with higher frequency change rate

are identified as the frontier and trend of theoretical research in this field by investigating the time distribution of word frequency. The measurement is based on two factors such as, SUBTLEXWF is the recurrence for every thousand syllables (subheading frequency such as word form frequency) while, SUBTLEXCD is a proportion of videos where a team appears. In this paper, Node types is set as keyword, Top N per slice as 30, Term Type as Burst Terms, other parameters remain unchanged, and Timezone as the display mode after running the program. The knowledge map for research frontier of hospital employee performance evaluation is obtained as shown in Figure 7.

Figure 7. Knowledge map for research frontier of hospital employee performance evaluation
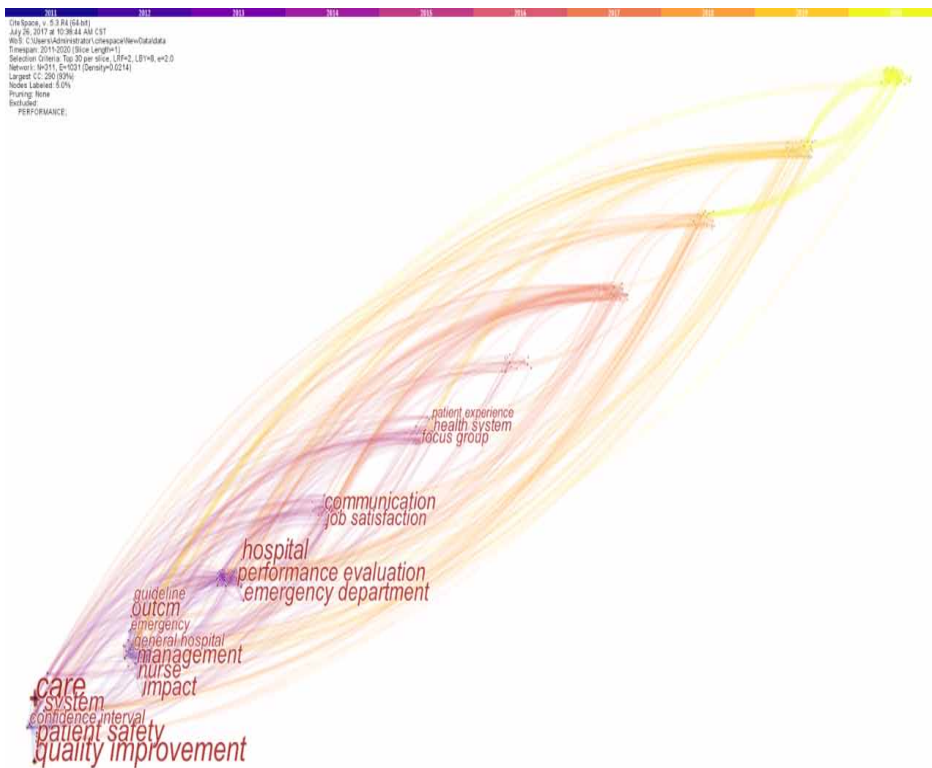
To further analyze the research trends in the field of hospital employee performance evaluation, the top 8 high-intensity mutation keywords were sorted by mutation intensity as shown in Table 1. Higher ranking means greater mutation intensity, which indicates that the trend around this keyword is more obvious.

Table 1 shows that the research frontiers in the field of hospital employee performance in the past 10 years include health, intervention, clinical practice, secondary efficacy evaluation, process evaluation, diagnosis, health care system and verification. Among them, "health" is the keyword with the highest mutation intensity in hospital employee performance evaluation research, with a mutation intensity of 3.6261 from 2014 to 2015; "Intervention" has a mutation intensity of 3.3282 from 2013 to 2015; "Clinical practice" of 2.9169 from 2014 to 2015; "Secondary efficacy evaluation" of 2.9067 from 2011 to 2012; "Process evaluation" of 2.8312 from 2011 to 2014; "Diagnosis" of 2.5846 from 2014 to 2015; "Health care system" of 2.5621 from 2016 to 2017; And "verification" of 2.4821 from

2017 to 2018. Therefore, "health care system" and "verification" are the new research frontiers in the field of hospital employee performance evaluation.

Table 1. Mutation ranking of high intensity keywords in the field of hospital employee performance evaluation

Ranking	Keyword	Start year	Mutation intensity	Period
1	health	2011	3.6261	2014-2015
2	intervention	2011	3.3282	2013-2015
3	clinical practice	2011	2.9169	2014-2015
4	secondary outcm	2011	2.9067	2011-2012
5	process evaluation	2011	2.8312	2011-2014
6	diagnosis	2011	2.5846	2014-2015
7	healthcare system	2011	2.5621	2016-2017
8	validation	2011	2.4821	2017-2018

CONCLUSION

In this paper, 351 documents in the field of hospital employee performance evaluation in the Web of Science database are used as data sources, and CiteSpace 5.3.R4 is used as the visualization tool draw a knowledge map to analyze the core journals, main authors and important references in the field of hospital employee performance evaluation, and systematically sort out the current research hotspots and research frontiers in this field, providing a beneficial reference for the theoretical research and practical innovation of hospital employee performance evaluation. The following conclusions are drawn:

(1) Core journals in the field of hospital employee performance evaluation. In this paper, the co-citation analysis shows that BMJ Quality and Safety, JAMA-Journal of the American Medical Association, Lancet, New England Journal of Medicine and BMC Health Services Research come out on top in terms of times of co-citation and centrality, indicating that the above journals are important core journals in the field of hospital employee performance evaluation.

(2) The main authors in the field of hospital employee performance evaluation. The author co-citation analysis carried out in this paper shows that Berwick, Cook, Greenhalgh, Sexton and Braithwaite come out on top in terms of times of co-citation and centrality, indicating that the above 5 scholars have a prominent position in the discipline field, and their research results have a great impact on the theoretical research and innovation in the field of hospital employee performance evaluation.

(3) Important references in the field of hospital employee performance evaluation. The document co-citation analysis carried out in this paper shows that "Process evaluation of complex interventions: Medical Research Council guidance", "Reducing patient mortality in hospitals: the role of human resource management", "Teamwork and patient safety in dynamic domains of healthcare: a review of the literature", "Audit and feedback: effects on professional practice and healthcare outcomes" and "Tailored interventions to overcome identified barriers to change: effects on professional practice and health care outcomes" are cited most frequently, and "The Influence of Context on Quality Improvement Success in Health Care: A Systematic Review of the Literature", "Interventions to Reduce Hospitalizations from Nursing Homes: Evaluation

of the INTERACT II Collaborative Quality Improvement Project" and "Factors that shape the development of interprofessional improvement initiatives in health organisations" come out on top in terms of centrality, indicating that they have great influence on the theoretical research in the discipline field.

(4) Research hotspot in the field of hospital employee performance evaluation. The keyword co-occurrence analysis made in this paper shows that the keywords such as care, nurse, quality improvement, system, patient safety, implementation rank top in 2 aspects: co-occurrence frequency and centrality. Besides, the cluster analysis of high-frequency words shows that the research hotspots in the field of hospital employee performance evaluation include emergency doctor management, infectious disease control, patient information sharing, community care, new nurses, etc.

(5) Research frontiers in the field of hospital employee performance evaluation. According to the ranking of the top 8 high-intensity mutation keywords by mutation intensity, the research frontiers in the field of hospital employee performance in recent 10 years include health, intervention, clinical practice, secondary efficacy evaluation, process evaluation, diagnosis, health care system and verification. Among them, "health care system" and "verification" are the new research frontiers in the field of hospital employee performance evaluation.

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