

Knowledge Map Analysis of Basic Medical and Health Service Research Based on Web of Science

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Abstract: *At present, the contradiction between people's growing demand for basic public health services and the unbalanced and insufficient development of basic public health services is becoming increasingly acute. Analyzing the research status and the latest progress in this field is of great significance to improve the level of basic medical public health services in various countries. This paper takes 5610 related studies of web of science from 2007 to 2020 as the research object, and uses CiteSpace, SPSS and other software to conduct co word analysis, literature cluster analysis and factor analysis. The results and conclusions are as follows: (1) There are great differences in the research and development level of basic medical public health services in the world, and the development efficiency is low. The country with the highest level of theory and technology development is the United States, followed by Canada and China; (2) In chronological order: the results of the frontier analysis of basic medical and health services in different periods have a strong inheritance relationship. The core evolution path is: Research on basic medical service level and medical quality in grass-roots communities → research on advanced life support theory and technology research on higher-level and higher-quality intelligent medical services; (3) The research on basic medical and health services has attracted a high degree of attention, mainly including cardiopulmonary resuscitation, medical services, emergency medical treatment and medical education.*

Keywords: *Basic medical and public health services; Keywords co-word matrix analysis; Multidimensional scaling analysis; Citespace*

1. Introduction

Basic medical and health services are services for disease prevention, diagnosis, treatment, care and rehabilitation that cover all citizens and are necessary to maintain their health, and their goal is to guarantee the basic right to life and health of workers or members of society, so that workers or members of society can receive basic treatment in the process of disease prevention and treatment in accordance with the prevention and treatment requirements [1-2]. Basic health care is an important component of human development and a basic human right for citizens, but in developing countries there is a large gap between this basic right and the reality of public spending on basic health care services. In 2015, the World Health Organization and the World Bank jointly released the report Tracking Universal Health Coverage^[3], which highlighted that 400 million people worldwide do not have access to this basic human right. 6% of the population in low- and middle-income countries are trapped in extreme poverty due to health expenditures. The World Health Organization and the World Bank state that anyone in any region should be free from poverty due to illness, however, countries pursuing universal basic health care coverage must provide basic health care services to at least 80% of the population, which shows that the biggest challenge in the process of promoting basic health care and public health services is the growing demand for public basic health services and the unbalanced and inadequate development of public basic health services. The contradiction between the growing demand for public basic health services and the unbalanced and insufficient development of public basic health services [4]. Currently, in addition to the major internal contradictions mentioned above, its development is facing a huge impact brought to it by the new crown epidemic. On February 7, 2022, the World Health Organization stated that 92% of countries worldwide have been forced to interrupt their basic health services due to epidemics. The development of primary care is struggling under the weight of internal and external contradictions.

Given that basic health care public services have a key role in guaranteeing citizens' rights and maintaining social justice, harmony, and sustainable development [5]. Therefore, basic healthcare has

become a hot topic of common interest in finance, finance, and public administration. In recent years, researchers have developed a large number of research results around the following five aspects: including basic medical quality assessment, resource allocation efficiency, and facility service layout; (ii) basic medical insurance, financial subsidies; basic medical graded diagnosis and treatment, and medical association; basic medical service regional disparity, health disparity; equalization of basic medical and health services, accessibility, etc. As the research progresses, the research focus of basic healthcare continues to change. In terms of research themes, with the continuous optimization of medical technology and basic health services, it has evolved from quality assessment of unitary medical institutions to research on the integration of health resources in medical associations, and efforts to realize the co-build and share of diversified medical services; in terms of research scales, it has evolved from global to regional research, and from macro to micro. The research objects are more specific, the research conclusions are more targeted, and it is more representative to explore the regional differences in basic medical care and put forward countermeasure suggestions. With the upgrading of theories, technologies and concepts, related academics continue to advance, the width (coverage) and depth (scope of protection) of basic medical care continue to increase, and the macro-micro scale changes are complex. Although some scholars have summarized the development of basic medical research, there are few holistic compendiums of basic medical-related research progress.

2. Data sources and analysis methods

2.1 Literature data sources

This article was selected from the Web of Science ("WOS") core dataset with the citation search setting "Social Sciences Citation Index (SCI-EXPANDED - 1900-present)". The search was set to "Social Sciences Citation Index (SCI-EXPANDED - 1900-present)", with "Basic medical" OR "public service" OR "Basic medical and health services"; the time span is set to "2007-01-01-2022-12-31", the language is selected as "English" The time span was set as "2007-01-01-2022-12-31", the language was selected as "English", and the document type was selected as "Articles".

2.2 Analysis methods

In this paper, the information obtained from the collated literature information is analyzed using a combination of qualitative research and quantitative analysis for information analysis. The qualitative analysis mainly consists of visualization and analysis of the dataset collected from the WOS data analysis module using Citespace (5.5R2), which mainly includes the volume of publications, literature sources, and core authors to objectively evaluate the current status of basic health service research.

3. Results and Analysis

3.1 Time-series distribution characteristics of the literature volume

In order to systematically analyze the research history in the field of basic health services, the volume of publications from 2007 to 2022 was summarized and analyzed, and Figure 1 is a time-series distribution chart that reflects the characteristics and change patterns of the literature volume. From the fluctuation of the volume of publications, there are three obvious sudden increase points in the volume of international research publications in the field of basic health services, which are 2008, 2015, and 2021.

The trend of the overall volume and cumulative volume of the literature from 2007 to 2022 during the period examined shows that the volume of the literature has been growing continuously from 2007 to 2021, with the lowest volume in 2022, mainly because this paper was written in April 2022, so the latest literature collected was in April 2022, but the above situation does not affect the analysis of the volume of the literature. The growth rate of literature publication is mainly divided into slow growth fortunately and fast growth type. The cumulative number of articles is an important indicator of the growth trend of the number of articles, so we analyzed the cumulative number of articles through a curve regression model and obtained the trend line of the cumulative number of articles: $y=353.92=0.9066$, indicating that the curve fits well with the trend line, which shows that the number of articles in this research area is growing exponentially and the research on basic medical and public health services is gradually receiving attention and attention from scholars.

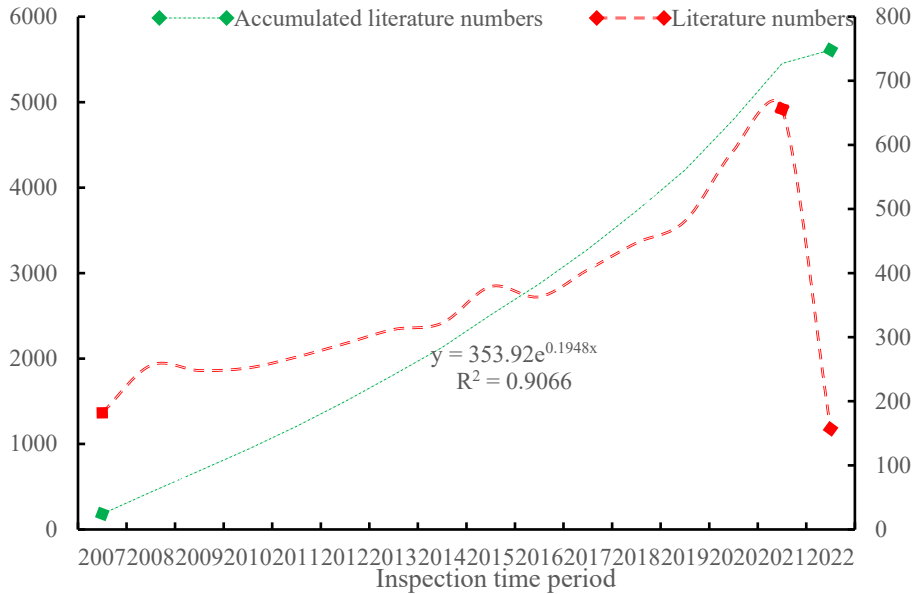


Figure 1: Ttime series distribution of foreign literature in the field of basic medical and health services from 2007 to 2022

3.2 Analysis of authors and institutions

Statistical analysis of the main authors can identify the core authors who have explored the field in depth and their main research topics. Price's theorem is more commonly used in academia to determine the core authors. The specific formula is as follows.

$$Q = 0.749 \times \sqrt{C} \tag{1}$$

Where Q is the minimum number of core authors' publications; C is the maximum number of publications.

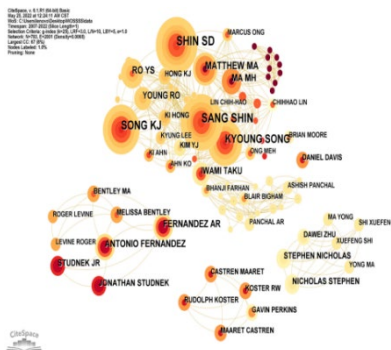


Figure 2: Co-occurrence of core authors in the field of basic medical and public health research

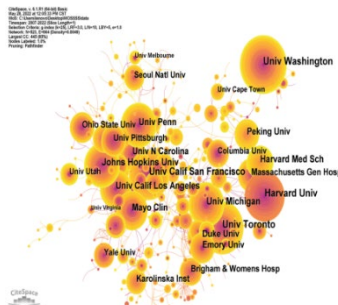


Figure 3: Institutional analysis of basic medical public health services issuance in the WOS literature, 2007-2022

According to the statistics, there are two groups of publishing teams with 17 articles each and the most number of articles. Bringing $Q=17$, into equation (1), we get $C \approx 3.08$ then the number of publications should be at least 4, which can be identified as core authors, and through analysis, there are 54 core authors. Figure 2 shows the core author cooperation network, forming four author cooperation groups with Song Shin, Studnek, Rudolph, Stephen and others as the core, among which the nodes of the author cooperation group with Sang Shin as the core are many and large, and the connections are dense. The nodal letter of Sang Shin and Song KJ is 0.19 and 0.21 respectively, which indicates that they have a large number of publications and cooperate closely with other authors. The main research directions are emergency medical services, emergency medical dispatching, and out-of-hospital cardiac arrest management, etc. They have conducted in-depth research on emergency medical care, especially in the field of human cardiac resuscitation. Stunek is the center of the publishing team, the main research direction includes the quality evaluation of medical services, disease attack management, drug management, etc. Rudolph, Maaret and others mainly focus on cardiopulmonary resuscitation and cardiovascular emergency research, especially in the field of mechanical cardiac resuscitation research is more concerned. Stephen Nicholas and others are the smallest of the four core author groups, and their research focuses on health insurance, treatment costs, and resource allocation, using mathematical thinking to analyze medical data and summarize conclusions.

As can be seen from Figure 3, among the top 20 institutions in terms of the number of publications only, U.S. institutions occupy 17 seats with a total of 1061 publications, accounting for 18.9% of the valid literature. It is noteworthy that some institutions use the names of secondary institutions in their bylines. In terms of primary research institutions, the University of Washington is the largest primary research institution in this research area, with 111 publications. However, in terms of secondary research institutions, among them, Brigham and Women's Hospital is the second largest hospital affiliated with Harvard Medical School in the United States. If secondary research institutions are classified as primary institutions, then Harvard University is the largest publisher in this field. As can be seen above, the Top 3 institutions in terms of number of publications are the University of Washington, Harvard University, and the University of Toronto, all three of which have more than 100 publications, far more than any other institution. The University of Washington was one of the first schools in the world to open a medical school, and its medicine and nursing are among the top programs in the country; Harvard Medical School is the world's top medical school, and it is famous in the world for its high medical technology and the smallest number of students admitted each year; the 10 world-class research hospitals under the University of Toronto constitute the largest medical and life science research cluster in Canada.

3.3 Research hotspots and emergent analysis

3.3.1 Literature co-citation analysis

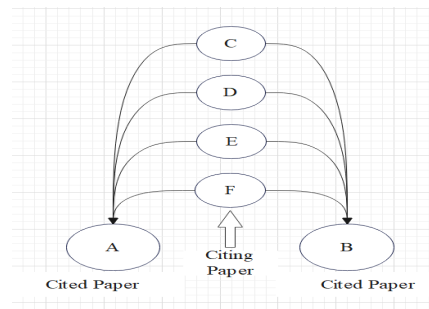


Figure 4: Graphical representation of literature co-citations

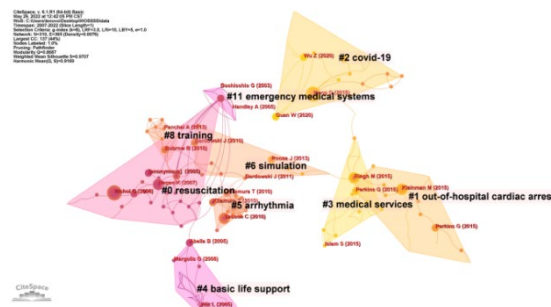


Figure 5: Co-citation clustering map of basic medical public service literature

Two or more papers cited by the latter paper or papers at the same time will form a co-citation relationship that constitutes the literature (figure 4), and Citespace is able to establish a literature co-citation network based on the reference database, which can better reflect the development of basic research by identifying the knowledge groups of literature topics through topic clustering of the co-cited literature. In this study, a total of 5610 cited documents and 93,825 cited documents were included; the minimum number of citations was set to 8, and 310 citations were finally obtained. For the selected 310 documents to draw the literature co-cited clustering map. The $Q=0.8687$ indicates that the effect of co-citation clustering is obvious; the S -value is 0.9707, which indicates the high homogeneity and concentration of co-cited literature. From Figure 5, we can see that seven clustering themes were obtained in the literature co-citation clustering mapping. Since Citespace could not recognize medical terminology, after reading and analyzing the 7 clustering themes, the study of the basic medical and health service knowledge base terminology, the above 7 clustering themes were combined and summarized into the following 5 knowledge bases.

Knowledge Base 1: CPR Technical Research and Action Guide

The #(0, 1, 5, 11) clustering themes all focused on the study of data on survival rates after receiving CPR for lifesaving treatment in emergency medical services, Katz MH et al. compared the survival rates of cases receiving CPR versus CO-CPR between 2005 and 2009, and found that the survival rates of patients receiving CPR and CO-CPR were 7.8% and 13.8%, respectively. Michalei.R.Sayre et al. showed that after 4 minutes of continuous chest compressions without rescue breaths, providing 2 rescue breaths per 100 compressions had the advantage of improving patient survival over chest compressions alone. In a 2008 Bentley J case study of patients with cardiac arrest and ventricular fibrillation, survival increased from 4.7% before not receiving MICR to Aufderheided's experiment on the frequency of ventilation during CPR demonstrated an inverse relationship between mean endotracheal pressure and coronary perfusion pressure during CPR. Additional education of CPR providers is urgently needed to reduce the fatal consequences of hyperventilation during CPR.

In another 3 studies from the leading cardiology journal *Circulation*, which provides guidelines for maintaining basic adult vital signs for CPR and emergency cardiovascular care in patients presenting with cardiac arrest, Gavin D. Perki et al. identified the key rescue steps of BLS as prevention, activation of the emergency response system, administration of CPR, and use of a defibrillator. Monica E. Kleinman et al. concluded that cardiac arrest is the leading cause of death in the United States, and to improve the survival rate of patients in cardiac arrest, CPR should be performed to ensure adequate rates of chest compressions, adequate depth of chest compressions, and adequate recoil during compressions to avoid interruption of compressions.

Knowledge Base 2: Smart Management for the Health Services Industry

A survey conducted by the World Health Organization (WHO) in 2013 stated that "the global health workforce shortage will reach 12.9 million people in the coming decades". The main reasons for this are twofold: the declining interest of young people in the profession and the aging of the existing workforce, and the increased risk of non-communicable diseases such as cancer, heart disease, and stroke. Thus relying on traditional medical manual services alone can no longer adequately address healthcare issues. Research on smart healthcare is beginning to emerge, with Luca Catarinucci et al. proposing IoT-aware smart architectures that automatically monitor and track patients, personnel, and biomedical devices within hospitals and care facilities, building smart hospital systems based on the IoT vision. s. M. Riazul Islam et al. propose IoT healthcare networks applied to the care and monitoring of pediatric, geriatric, and chronic patients' care and supervision and management of private health and fitness, specifically to medication management, temperature, blood pressure, oxygen saturation, ECG monitoring, and wheelchair management [55]. Ellinor Berglund et al. investigated the role of a smartphone app in guiding lay health care professionals in the treatment of out-of-hospital cardiac arrest patients, and showed that the smartphone app could guide CPR to lay volunteers trained in CPR, largely increasing survival rates.

Knowledge Base 3: Medical Education Methods

Medical simulation is a medical training technique that allows students to learn simulated experiences by simulating medical situations. medical simulation is used for training purposes in addition to enabling medical students to demonstrate their skills through treatment of model cases to mentors or authorities who certify physicians, and is an important method of basic medical education that contributes to the learning of professional skills of medical students and lays the foundation for better delivery of medical care in the future. salman Riaz aimed to study the differences in satisfaction with medical simulation in obstetrics and gynecology compared to internal medicine and in clinical practice, and the results pointed to high similarity between clinical practice and medical simulation results and high student satisfaction.

tomasz Klosiewicz et al. studied surgical methods in a safe way to ensure the quality of medical care through the application of multiple types of medical simulation in obstetrics and gynecology. scott Pappada has delved into the field of medical simulation research into clinical decision-making systems applied to the intensive care setting to ensure patient safety and improve the quality of care. katarzyna Studnicka et al. aim to study the quality of medical simulation in nurse training by developing medical simulations to instruct nursing students at an optimal level, mastering professional skills and acquiring skills related to communication or decision-making within the team related skills. The development of professional skills training for nurses facilitates the transfer of students' theoretical knowledge to the clinical environment.

Knowledge Base 4: Epidemiologic Features of New Covid

Knowledge Base 4 contains mainly Covid-19 clinical symptom studies. In February 2020, Zunyou Wu studied 72,314 cases and derived the epidemiological characteristics of COVID-19 outbreaks, mostly presenting as non-pneumonia or mild pneumonia, with severe patients showing symptoms such as infectious shock and respiratory failure. The data show that the virus has a low morbidity and mortality rate relative to SARA and MERS, but is extremely infectious. Therefore immediate isolation of confirmed cases and rapid establishment of 2 hospitals, he stressed the importance of active investment in the construction of basic health facilities to effectively respond to epidemics such as Covid-19 as. Wei-jie Guan et al. analyzed data on confirmed cases of Covid-19 in 30 provinces and autonomous regions in China and found that the most common symptoms in confirmed patients were fever and cough. Fei Zhou et al. analyzed 191 inpatients (135 in Jinyintan Hospital and 56 in Wuhan Pulmonary Hospital), most of whom were male, and half of whom had comorbidities, with hypertension being the most common followed by diabetes mellitus and coronary heart disease. The main symptoms were fever and cough, followed by sputum and fatigue, and 40% of patients suffered from lymphopenia. The above findings are consistent with those of Wei-jie Guan and Zunyou Wu.

3.3.2 Keyword co-occurrence matrix analysis

Factor analysis simplifies the data by studying the internal interrelationships among multiple variables, exploring the basic structure of the study data, and representing the main information of multiple variables with a few factors. That is, a method of data analysis used to identify, analyze, and generalize the interrelationships between variables among many variables and describe such relationships with simple variables (factors). In the factor analysis under the keyword co-occurrence matrix (50*50), five factors were extracted. The magnitude of each keyword loading coefficient represents the degree of loading of that keyword in each factor, with higher loading values indicating a higher degree of significance within the field of basic health services research. Seventeen keywords showed high loading values (loading value ≥ 0.8) in the individual factors, among which the keywords Medical student, Resuscitation, Prevalence, Medical service, and Medical systems were significant in their connected branches 1, 3, and 5 (load value ≥ 0.9), and 15 keywords had significant performance (load value ≥ 0.6) on multiple research branches under intergroup connections, such as Management, Services, Health-Care, Curriculum, etc. Among them, the cumulative contribution of about 92.317% total variance had five and all took values greater than 1. This indicates that the keywords represented are all research hotspots in basic health public services, with contribution rates of 42.855%, 23.235%, 15.797%, 7.971%, and 2.459%, respectively.

According to the results of factor analysis data, the R-type clustering method in cluster analysis was used to do co-citation cluster analysis, and a keyword word clustering analysis genealogy diagram was obtained, with the vertical axis being each literature keyword, reflecting the interconnection of keywords with strong relevance to the literature research content. The genealogy chart can reflect the relevance and attribution level of each research branch in basic health care services more intuitively, and each research branch is formed by the set of keywords with different affinity. The average score of the clustering evaluation index of Pearson's correlation coefficient was calculated, and the entropy value was 0.4297, and the class-based F value was 0.7935, which is a smaller entropy value and a larger class-based F, indicating that the clustering results are more reasonable; meanwhile, there is a higher consistency compared with the results of factor analysis, and the dashed line is the optimal solution for each keyword clustering. The five factors with loadings scores greater than 0.9 in multiple branches, based on the keyword clustering results in Figure 5, can indicate the research branches within the field of basic medical and health services research: (1) cardiopulmonary resuscitation relief techniques and basic life support; (2) health management methods and intelligent technology development; (3) medical education concepts and clinical practice research; (4) research on the impact of emergency care processes on patients' quality of life; (5) Analysis of clinical characteristics of epidemic and infectious diseases and research on the impact of general outpatient services on vulnerable populations.

4. Conclusion

This paper uses the Web of science literature retrieval engine as a data source to perform industry knowledge mining by constructing a knowledge map of basic medical and health services research. Using CiteSpace and SPSS as the supporting tools, a combination of qualitative analysis and quantitative research was used to analyze the literature data on the topic of basic medical public health services from 2007-2022 in a multifaceted way from the perspective of knowledge mapping. The information analysis methods constructed in this paper of literature volume chronological analysis (macro), keyword co-occurrence matrix analysis (micro, intuitive), keyword co-occurrence cluster analysis (complex, holistic), and keyword mutation detection analysis (special) are reasonable and effective.

This paper analyzes the development status of basic medical public health service research by statistical analysis method, and analyzes the research themes, research hotspots and research frontiers in this research field by constructing knowledge mapping method, and the research finds that.

The level of development of basic medical public health service research varies greatly internationally, and the development efficiency is low. The country with the highest level of theoretical and technological development in this research is the United States, followed by Canada and China. In addition, the level of cooperation between research institutions and core authors in this field is low, the number of highly productive authors is low, and researchers are mostly individuals with little cross-team communication. The study found that the level of relevant theories and medical technologies in the field of basic health services research is mainly limited by the level of economic development of the country. However, with the gradual economic recovery in the last decade or so, research fund investment has gradually increased, and the research interest of many experts and scholars, research institutions, and national governments in this research area has grown significantly, and the study has found more innovative points. In the analysis of numerous research literature, it is found that basic health care service research has received much attention in several fields, and the main ones that have received higher attention are cardiopulmonary resuscitation, medical services, emergency medical care, medical education, and the emergence of new coronavirus and other related research literature after 2020. It indicates that this research field presents complex features of multiple research objectives, multiple research levels, and cross-fertilization of multiple research disciplines. The analysis of the results shows that the knowledge network structure of research hotspots is closely connected, with rich process characteristics in the time dimension, and there are clear and prominent research hotspots in each stage of the diagram, and the degree of clustering is high, indicating a good research atmosphere within the research field of basic medical and health services.

According to the results of the analysis of research frontiers in each time period of basic medical and health services between 2007 and 2022, it can be seen that the research frontiers have strong inheritance relationships and are closely connected with each other, and the core evolution path is reflected as follows: research on the level and quality of basic medical services in the primary community → research on advanced life support theory and technology → research on higher level and higher quality intelligent medical services", based on the premise that basic medical services are accessible to the basic population, and promoting research on medical technologies related to cardiopulmonary resuscitation, critical care, and emergency medicine. It shows that as theoretical research continues to progress, this research area is shifting from macro and common theoretical research to medical technology application research with this as the basic regional and characteristic.

The main limitation of this study is its focus on published literature in English. Therefore, relevant information in other languages may be lost. Also, in terms of database selection, only the representative Web of Science was chosen as the literature collection database in this study, and no other databases were used. These limitations can be further addressed as part of future research.

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