ORIGINAL RESEARCH

Visualization and Analysis of Infectious Disease Research on Nursing Care Based on CiteSpace in China

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Objective: To analyze the relevant research publications on infectious disease nursing in China to understand the current research status of infectious disease in nursing.

Methods: Retrieve relevant literature on infectious disease in nursing from the establishment of the Chinese Biomedical Literature Database, China National Knowledge Infrastructure (CNKI), VIP Database, and Wanfang Database until May 10, 2021. Conduct bibliometric analysis using CiteSpace software. Key words were analyzed using cluster analysis.

Results: A total of 4693 relevant literature on infectious disease research in nursing care were included in this study. The overall number of publications on infectious disease research in nursing showed an increasing trend, with a peak in 2010. There were 324 papers funded by scientific research funds, mainly from provincial-level fund projects. The core journal with the most published articles was Nursing Research. The research on infectious disease in nursing mainly focused on various aspects of infectious disease in nursing and infection control. CiteSpace cluster analysis of keywords showed that a total of six clusters were formed: infectious diseases, infectious disease care, health education, mental health, infectious disease nurses, and etiology. After 2015, high-mutation keywords included "quality nursing" and "infection control".

Conclusion: Chinese research on infectious disease research in nursing closely follows clinical reality and has developed rapidly. Currently, research focuses on infectious disease research in nursing and infection control. Future research trends will further broaden the depth and breadth of the research, enhance research on infection control and quality nursing, and improve the breadth and depth of the research.

Keywords: infectious disease in nursing, bibliometrics, CiteSpace, nursing care

Introduction

The infectious diseases refer to the diseases caused by pathogens that can be transmitted among humans, animals, and between humans and animals.[1] The sudden occurrence of infectious disease outbreaks, which cause or have the potential to cause significant harm to public health, not only poses risks to people's physical well-being but also leads to severe economic losses for the country.[2,3] Nurses play diverse roles such as managers and executors in the care of major infectious diseases.[4] The risk of infection from infectious diseases and social biases exacerbate the psychological pressure and workload on nurses, resulting in frequent negative emotions such as anxiety and depression.[5–7] Research suggests that the level of professional fatigue among nurses in infectious disease hospitals is high, leading to a high

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turnover rate.[8] How to effectively carry out infectious disease prevention and control, improve the capacity for treating infectious diseases, and ensure patient safety has become the focus of attention for infectious disease in nursing professionals. Consequently, there has been an increasing number of related studies; however, there is a lack of systematic summarization and analysis of infectious disease in nursing care research. The current situation in the field of infectious disease care can be understood by retrospective analysis of relevant articles in the field of infectious disease care, which can provide direction for future research in this field. At the same time, the nursing work of infectious diseases can be summarized. This study retrospectively analyzes the literature on infectious disease in nursing care research in China from a bibliometric perspective to understand the current research status in this field and explore the development trends and research hotspots of infectious disease in nursing research in China, providing references for further studies in infectious disease in nursing.

Materials and Methods
Literature Retrieval and Screening
Literature published in China retrieval was conducted in CNKI, Wanfang, VIP, and the Chinese Biomedical Literature Database using "keywords" as the search criteria. The search strategy was as follows: Topic = ((Infectious Diseases) OR (COVID-19) OR (Novel Coronavirus Pneumonia) OR (HIV/AIDS)) AND (Nursing). The search period ranged from the establishment of the databases to May 10, 2021. The inclusion criteria for the literature were as follows: research content related to infectious disease in nursing care. The exclusion criteria were: 1) non-scientific articles such as news or call for papers; 2) animal-based research articles; 3) duplicate papers reporting the same data in different formats.

Analytical Methods
The literature import and organization were conducted using the literature management software NoteExpress 3.0. An Excel spreadsheet was used to establish a database, and two trained researchers independently extracted data from the included literature. The extracted data mainly included publication year, journal of publication, funding support, funding type, and research content. In cases where there were disagreements between the two researchers, a third researcher acted as an arbitrator. CiteSpace 5.8.R1 software was utilized for keyword analysis. CiteSpace was used to segment the literature time into 1 year, all term sources were selected, node types were set as co-occurrence keywords, and node data were filtered to TOPN = 50, that is, the first 50 co-occurrence frequency keywords were extracted from each time slice to form a keyword co-occurrence map (N = 134, E = 148, network density 0.0166). Sorted by frequency of occurrence. Keyword cluster analysis was performed using the log-likelihood ratio (LLR) algorithm. Emerging terms in keywords were detected using the "Burstness" option in CiteSpace software.

Results
Literature Screening Results
A total of 7433 articles were initially retrieved, including 276 from CNKI (China National Knowledge Infrastructure), 6581 from WanFang Data, 375 from VIP (VIP Information), and 201 from the China Biomedical Literature Database. After the screening process, a total of 4693 articles were included. The literature screening process and results are shown in Figure 1.

Publication Volume and Year of Publication Distribution
A total of 4693 articles that met the criteria were included in this study, with a time span from 1986 to 2021. Overall, the publication volume of infectious in disease nursing research showed an increasing trend. According to the overall curve characteristics of the publication volume, infectious disease in nursing research can be divided into three stages. The period from 1986 to 2003 was the starting stage, during which the research outcomes of infectious disease in nursing were relatively scattered but laid the foundation for the study of infectious disease in nursing in China. The period from 2003 to 2010 was the development stage of infectious disease in nursing research, during which infectious disease in nursing gradually became a focus of nursing research, and the publication volume increased year by year. After 2010, the
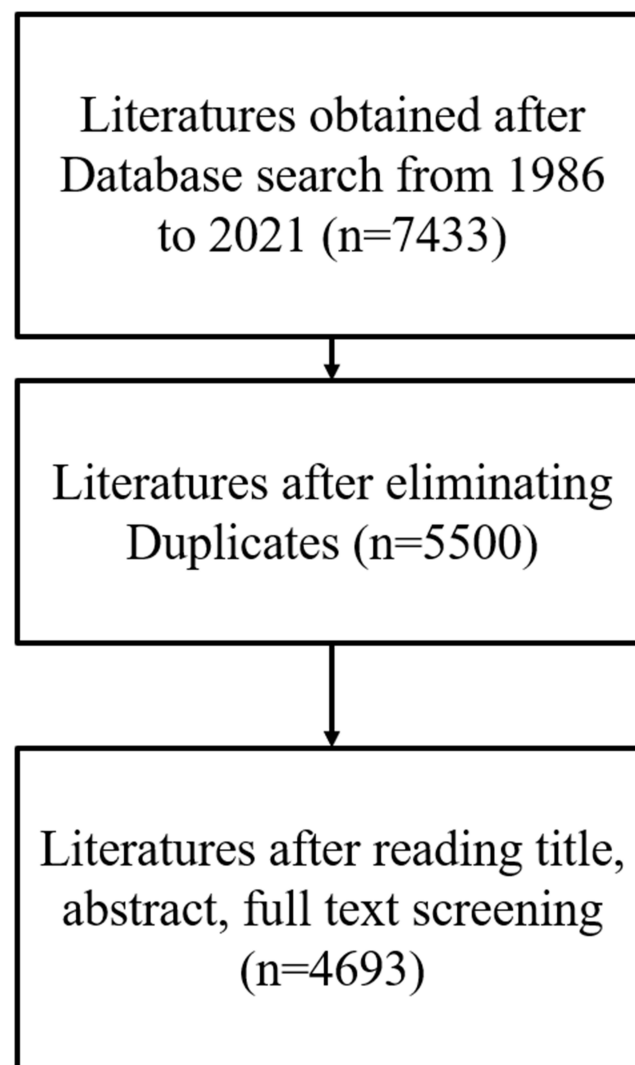
Figure 1 Literature Screening Process and Results in Research Literature on Infectious Disease in Nursing in China from 1986 to 2021.

publication volume of infectious disease in nursing research slightly decreased; however, it showed an increasing trend again after 2019, as shown in Figure 2.

Articles Cited Frequently in 2011–2021

The frequency of citation in the article to some extent reflects the higher the academic level of the article and journal, the higher the quality of the literature, and the more reliable the research results. This study lists the top 10 articles with citation frequency (Table 1). Through bibliometric analysis, see Table 1.

Journal Distribution

Among the 4114 journal articles analyzed out of the 4693 included in this study, they were published in a total of 477 different journals. The core journal with the highest number of publications in infectious disease in nursing is "Nursing Research", followed by "Chinese Journal of Practical Nursing", "Chinese Journal of Modern Nursing", "Journal of Modern Integrated Traditional Chinese and Western Medicine", "Chinese Journal of Nursing", and "Nursing Continuing Education". There were 187 journals that published only one article each, and 75 journals that published two articles each. The top 10 core journals with the highest publication volume in infectious disease in nursing literature from 1986 to 2021 are shown in Figure 3.
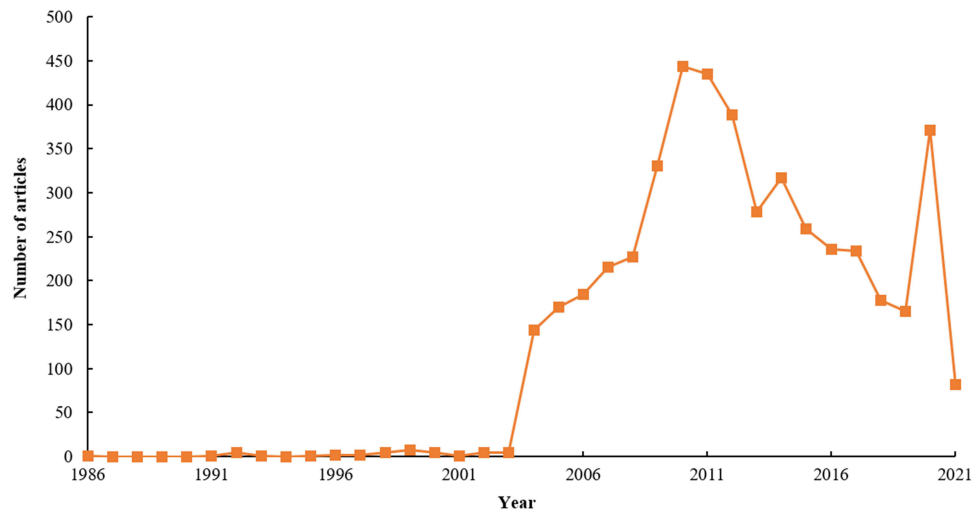
Figure 2 Distribution of Publication Time in Research Literature on Infectious Disease in Nursing in China from 1986 to 2021.

Funding Support

Among the 4693 articles included in this study, 324 articles received research funding, accounting for 6.9% of the total literature. Among them, 40 articles were funded at the national level, 130 at the provincial level, 94 at the bureau level, and 60 at levels below the bureau. Among the articles funded at the national level, 7 of them received support from the National Natural Science Foundation.

High-Frequency Keywords in Literature

Keywords condense the essence of an article and provide a concise summary of its core content. The co-occurrence frequency of keywords can to some extent indicate the research hotspots in the field.[9–11] Table 1 presents the frequency and centrality statistics

Table 1 Co-Occurrence Statistics of the Top 20 Keywords in the Field of Infectious Disease Nursing Research in China from 1986 to 2021

| Number	Frequency	Keywords	Centrality
1	672	Infectious diseases	0.58
2	348	Hand, foot and mouth disease, HFMD	0.11
3	217	Health education	0.23
4	190	Psychological nursing	0.15
5	126	Nursing management	0.09
6	124	Tuberculosis	0.05
7	106	HIV/AIDS	0.05
8	102	Nursing staff	0.11
9	93	COVID-19	0.03
10	86	Infectious disease nursing	0.11
11	82	Nursing experience	0.15
12	69	Nursing intervention	0.03
13	63	Infectious disease hospital	0.05
14	58	Occupational exposure	0.01
15	57	Clinical nursing	0.07
16	55	Acute respiratory infectious diseases	0.04
17	50	H1N1 influenza A	0.01
18	48	Nursing measures	0.04
19	47	Infectious disease nursing	0.07
20	47	Humanized nursing	0.00
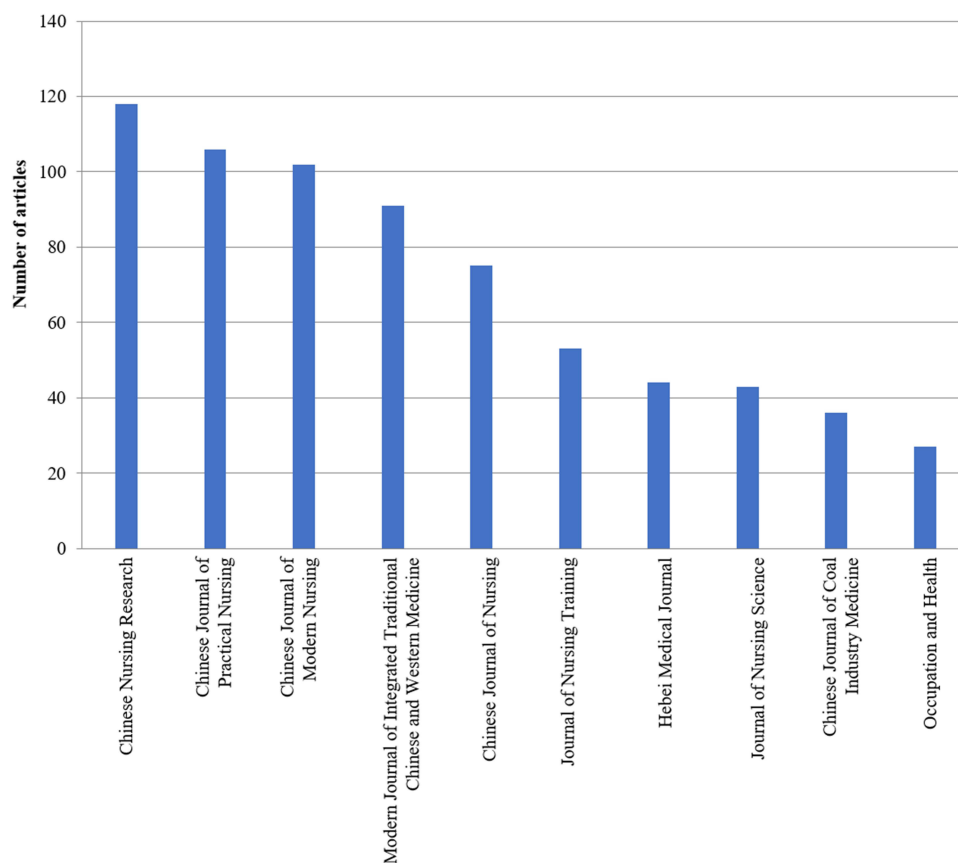
Figure 3 Top 10 Core Journals with the Most Document Citations in Research Literature on Infectious Disease in Nursing in China from 1986 to 2021.

of high-frequency keywords extracted from the co-occurrence graph. From the keywords, it can be observed that the research in infectious in disease nursing primarily focuses on two main areas: various infectious disease in nursing and infection control. Nursing, health education, psychological care, and nursing management related to various infectious diseases such as hand, foot, and mouth disease, tuberculosis, AIDS, and acute respiratory infectious diseases have consistently been research hotspots in the field of infectious disease in nursing.

Cluster Analysis of Keywords

Include the keyword frequency of 4693 articles in the analysis, use CiteSpace to segment the literature time into 1 year, select all term sources, set the node type as co-occurrence keywords, and filter the node data to TOPN=50, that is, extract the top 50 co-occurrence frequency keywords from each time slice to form a keyword co-occurrence graph (N=134, E=148, network density of 0.0166). According to the frequency of occurrence, the top 10 are: infectious diseases, hand foot mouth disease, health education, psychological care, nursing management, tuberculosis, AIDS, nursing staff, COVID-19 pneumonia, infectious disease care; According to the centrality, the top 10 are: infectious diseases, health education, psychological care, hand foot mouth disease, nursing staff, infectious disease care, nursing management, tuberculosis, AIDS, COVID-19 pneumonia. Using CiteSpace to cluster and analyze keywords, a total of 6 clusters were formed: infectious diseases, infectious disease care, health education, mental health, infectious disease nurses, and etiology [extracted using the logarithmic likelihood rate (LLR) algorithm]. The modularity (Q value) of the clustering module is 0.8201, indicating a significant structure of the clustering. The average contour value (Silhouette, S value) of the clustering is 0.9589, indicating a high level of reliability and homogeneity in the clustering results.
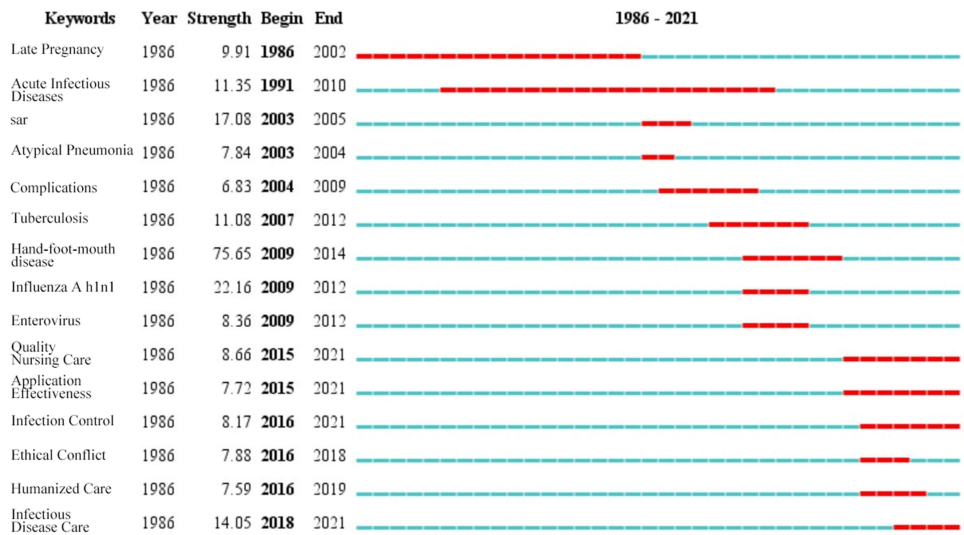
Keywords	Year	Strength	Begin	End	1986 - 2021
Late Pregnancy	1986	9.91	**1986**	2002	
Acute Infectious Diseases	1986	11.35	**1991**	2010	
sar	1986	17.08	**2003**	2005	
Atypical Pneumonia	1986	7.84	**2003**	2004	
Complications	1986	6.83	**2004**	2009	
Tuberculosis	1986	11.08	**2007**	2012	
Hand-foot-mouth disease	1986	75.65	**2009**	2014	
Influenza A h1n1	1986	22.16	**2009**	2012	
Enterovirus	1986	8.36	**2009**	2012	
Quality Nursing Care	1986	8.66	**2015**	2021	
Application Effectiveness	1986	7.72	**2015**	2021	
Infection Control	1986	8.17	**2016**	2021	
Ethical Conflict	1986	7.88	**2016**	2018	
Humanized Care	1986	7.59	**2016**	2019	
Infectious Disease Care	1986	14.05	**2018**	2021	

Figure 4 Detection of High-Frequency Keyword Emergence in Research on Infectious Disease in Nursing from 1986 to 2021.

Analysis of Keyword Burstiness in Infectious Disease in Nursing Research

Emerging terms refer to words that appear frequently within a certain period and can indicate the forefront of a field's development.[12] CiteSpace software enables the detection of emerging terms, visualizes the relationships between clusters in a timeline view, displays the historical span of literature within a cluster, and reveals the flow of scientific knowledge and development trends in a specific field. This facilitates the exploration of knowledge evolution at different stages.[13] In order to further observe the degree of variation of a specific keyword in different years, this study utilized the "Burstness" option in CiteSpace software to detect emerging terms among the top 15 keywords in the literature. The results are shown in Figure 4. This method uses color variations in different time periods to represent the burstiness trend of a keyword, thereby indicating potential research turning points in certain years.[14] As shown in Figure 3, the forefront of infectious disease in nursing research in China has been in a dynamic development with changing emphasis at different stages over time. After conducting a statistical analysis of the top 15 bursting keywords in the field of infectious disease in nursing research in China, it was found that since 2015, the keywords "infectious disease in nursing", "quality care", "infection control", and "application effectiveness" exhibited the highest degree of burstiness, as shown in Figure 4.

Discussion

Bibliometrics, as the most widely used quantitative analysis method, represents a paradigm shift in data organization and analysis methods in the context of big data. It effectively avoids the subjectivity and arbitrariness in literature processing and analysis, thereby improving the authenticity and credibility of the results.[15] In this study, through bibliometric analysis of Chinese infectious disease in nursing research, we have summarized the current status and development trajectory of domestic infectious disease in nursing research. In addition, utilizing CiteSpace software for visual analysis of keywords, we have identified established research hotspots and development trends.

In terms of publication volume, the research output in infectious disease in nursing has shown an overall increasing trend from 1986 to 2021. The publication curve exhibits significant peak and valley fluctuations, with peak years closely related to the occurrence of major infectious diseases in China. This indicates that nursing professionals are keenly aware of the timeliness of research on major infectious disease in nursing, and they conduct studies closely aligned with clinical practice. Regarding the publication journals, the literature of Chinese infectious disease in nursing research is relatively scattered, with a relatively low proportion in core journals. This suggests the need for further strengthening the depth and level of infectious disease in nursing research in China, as well as improving the quality of published papers.

Funded papers are an important indicator for evaluating the academic level and quality of journals in the journal evaluation system. Research funding reflects the level, trends, and achievements of research development at the national, regional, or departmental levels. It has a forward-looking nature and, to some extent, can represent new dynamics and trends

in a field.[16,17] In the literature of Chinese infectious disease in nursing research, the proportion of papers that received research funding is 6.9%, with only 7 papers being supported by the National Natural Science Foundation. This indicates a relatively low funding ratio in the literature of infectious disease in nursing research in China. The relevant departments need to increase investment and attention to clinical nursing research funds. At the same time, it is necessary to enhance the research level and capabilities of nursing personnel to promote disciplinary construction and development.[18]

From the analysis of co-occurring keywords, the research direction of infectious disease in nursing mainly focuses on various aspects such as infection control, health education, psychological care, and nursing management. The nursing of various infectious diseases including hand-foot-mouth disease, tuberculosis, HIV/AIDS, and acute respiratory infections has been a key issue that continuously receives attention in this field. Mutation analysis of keywords reveals that "infection control" and "quality nursing" have been the frontiers and hotspots of research since 2015. Effective infection control and nursing practices in hospitals are crucial measures for reducing and treating infectious diseases, particularly in handling outbreaks of public infectious events.[19,20] Meanwhile, the increasing expectations of patients regarding the quality of medical and nursing services have become a global trend. Consequently, the concept of nursing has deepened, with a focus on providing high-quality care as a guiding principle for future development. Enhancing nursing standards can effectively ensure the quality and safety of nursing care, and improve overall healthcare outcomes.[21]

The limitations of this study lie in the fact that it only analyzed research from domestic databases. In future research, it is necessary to expand the data sources and conduct comparative analyses by incorporating international studies. This will provide a more comprehensive exploration of the developmental trends in infectious disease in nursing research, thus enhancing the accuracy and comprehensiveness of the results. At the same time, this study lacks the search for specific infectious diseases, which may lead to the lack of a small part of the literature, and more studies should be carried out subsequently for specific infectious diseases.

Conclusion

In summary, infectious disease in nursing research in China is closely related to clinical practice. China needs to further increase funding for infectious disease care research while improving research capacity among care professionals. Currently, research in the field of infectious diseases focuses on infectious disease care and infection control. Future research trends will further increase the scope of infectious disease care and strengthen research on infection control and quality care. Meanwhile, the data sources need to be further expanded to further validate the conclusions of the article.

Data Sharing Statement

The original contributions presented in this study are included in the article, further inquiries can be directed to the corresponding author/s.

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Disclosure

The authors report no conflicts of interest in this work.

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