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Research Hotspots and Trends in Health Science Popularization in China (1994-2024): A Bibliometric Analysis Visualized with CiteSpace

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Abstract

Objective: To analyze the research hotspots and trends of health science popularization in China from 1994 to 2024, and to provide a scientific reference for understanding its development. **Methods:** A computerized search was conducted across three Chinese databases - CNKI, WanFang, and VIP Database - for articles published from January 1, 1994, to December 31, 2024. Bibliometric analysis was performed using Excel and CiteSpace. **Results:** A total of 9,285 articles were retrieved, with 2,100 meeting the inclusion criteria. The annual number of articles on health science popularization research showed a consistent upward trend from 1994 to 2024, increasing from 10 articles in 1994 to 337 in 2024. The top three academic journals publishing in this field were Chinese Journal of Health Education (n=110), Public Communication of Science & Technology (n=59), and Health Education and Health Promotion (n=54). The most prolific authors were Wu YiBo (n=17), Han Ye (n=11), and Wang Tao (n=10). The leading institutions by article count were People's Medical Publishing House (n=32), Peking University (n=20), Chinese Health Education Center (n=15), and Shanghai Health Promotion Center (n=15). The top three keywords by frequency were health science popularization (n=325), medical science popularization (n=238), and health education (n=159). The largest keyword clusters were health science popularization, medical science popularization, and health education. The strongest citation bursts were observed for medical science popularization, WeChat, and health communication. **Conclusion:** Health science popularization research has attracted significant attention from experts and scholars. Its development can be divided into three stages: initial emergence, steady growth, and rapid development. Research hotspots have evolved considerably across these stages, with a recent focus on health science popularization through new media platforms.

Keywords

Health science popularization; Bibliometric analysis; CiteSpace; Research hotspots

Introduction

Health science popularization is an extension and application of general science popularization in the field of health [1]. It refers to the behavior of popularizing scientific health concepts, knowledge and skills to the public through various forms of communication, so as to improve the public's health literacy and health self-management ability. Survey results indicate that in 2024, the health literacy rate among Chinese residents was 31.87%, which still shows a certain gap compared to developed countries [2], indicating that health science popularization efforts need further strengthening. The Healthy China Action (2019-2030) explicitly states that popularizing health knowledge and improving national health literacy are among the most fundamental, economical, and effective measures to enhance public health [3], and represent a crucial initiative in building a Healthy China.

Health science popularization research applies principles and methods from medicine, communication studies, education, psychology, and other disciplines to study health science activities, summarize their patterns, and guide the development of health science popularization [4]. Academic research plays a significant role in the field of health science popularization, contributing to strengthening communication theories, improving practical implementation, and enhancing the effectiveness of health science dissemination. Moreover, with social progress and technological advancement, significant changes have occurred in health science policies, formats, and content [5], leading to corresponding shifts in research hotspots.

Unfortunately, there is currently no article reporting on the status and evolving hotspots of health science popularization research in China over the past three decades. This study selects 1994—the year when science popularization was officially elevated to a national strategy—as the start date for articles retrieval, and 2024 as the end date. Through bibliometric analysis, it aims to examine the current status and hotspots of health science popularization research in China, providing a scientific basis for understanding its development and promoting further progress in the field.

1. Materials and Methods

1.1 Article Search

A computerized search was conducted across three Chinese databases—China National Knowledge Infrastructure (CNKI), WanFang, and VIP database—using the subject headings health science popularization and medical science popularization. The search was limited to academic journal articles published between January 1, 1994, and December 31, 2024. An expanded search of references and related articles from the retrieved articles was also performed to avoid omissions.

1.2 Article Screening

Two researchers independently screened the articles by reading titles, abstracts, and full texts according to the inclusion and exclusion criteria. After completing the screening, the two researchers cross-verified the results and made final decisions jointly.

Inclusion criteria: Academic articles related to research on health science popularization, including theoretical studies, practical studies, survey research, etc. Exclusion criteria: Duplicate articles; Dissertations, conference papers, news reports, policies, reports, notices, etc.; Disease science popularization articles; articles for which full text could not be obtained.

1.3 Statistical Analysis

Excel was used to summarize basic information such as the title, publication year, journal, and province/city of the health science popularization research articles, and to analyze the article volume and journal distribution. CiteSpace was used to perform visual analyses of authors, institutions, and keywords. The time slicing was set from 1994 to 2024, with a single time slice of one year.

The following specific analyses were conducted using CiteSpace:

Co-occurrence analysis of authors to examine frequency and collaboration networks. Core authors were identified based on Price's Law [6], calculated using the formula $M = 0.749\sqrt{N_{\max}}$, where M represents the minimum number of articles required to be a core author in the field, and $N_{\max}$ is the number of articles by the most prolific author in the field.

Co-occurrence analysis of institutions to examine frequency and collaboration networks.

Co-occurrence analysis of keywords to examine frequency and centrality. Centrality, an indicator of keyword importance, is represented by a purple ring outside the circle when centrality ≥ 0.1, indicating a key node [7].

Cluster analysis of keywords using the LogLikelihood Ratio (LLR) algorithm to identify major research themes. A modularity $Q > 0.3$ suggests significant cluster structure, with higher Q values indicating better clustering. The mean silhouette S measures cluster homogeneity; $S > 0.5$ is considered reasonable, and $S > 0.7$ indicates highly consistent and reliable clustering. The cluster ID is inversely related to cluster size—a smaller cluster ID indicates more keywords within the cluster [8].

Burst detection analysis to identify research hotspots in health science popularization across different years.

2. Results

2.1 Articles Search and Screening

A total of 9,285 articles were retrieved. After removing 3,636 duplicates, 1,883 articles that did not match the study topic, and 1,666 articles that did not meet other inclusion/exclusion criteria, 2,100 articles were finally included. Details are shown in Figure 1.

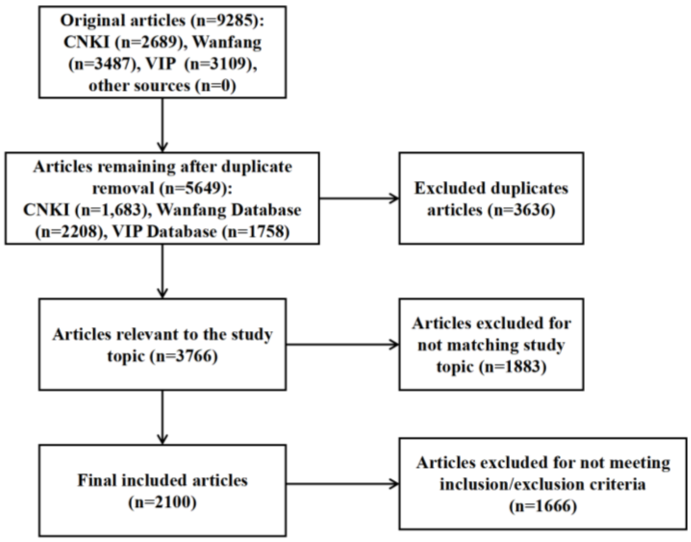

Figure 1. Flowchart of Article Inclusion and Exclusion.

2.2 Publication Trends

Overall, the number of articles on health science popularization research showed an upward trend from 1994 to 2024, increasing from 10 articles in 1994 to 337 in 2024. Specifically, from 1994 to 2015, the number of articles exhibited fluctuating growth, with an average of 16.25 articles per year from 1994 to 2005, and 28.60 articles per year from 2006 to 2015. From 2016 to 2024, the number of articles increased significantly, rising rapidly from 54 to 337 articles, with an average of 179.33 articles per year. Details are shown in Figure 2.

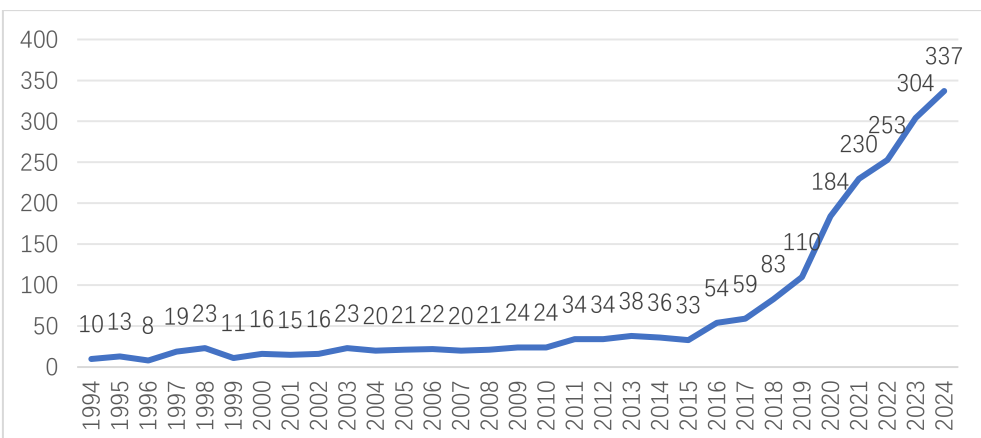

Figure 2. Annual Number of Articles on Health Science Popularization Research (1994-2024).

2.3 Journals of Articles

From 1994 to 2024, a total of 768 academic journals published articles on health science popularization research. Among them, 26 journals published more than 10 articles each, accounting for 647 articles (30.80%). Three journals—Chinese Journal of Health Education, Science and Technology Communication, and Health Education and Health Promotion—published more than 50 articles each, with 110, 59, and 54 articles, respectively. Details are shown in Table 1.

Table 1. Number of Research Articles on Health Science Popularization Published in Academic Journals (1994-2024)

Rank	Journal	Count
1	Chinese Journal of Health Education	110
2	Public Communication of Science & Technology	59
3	Health Education and Health Promotion	54
4	Journal of News Research	33
4	Modern Hospital Journal	32
4	Health Vocational Education	27
7	Jiangsu Health System Management	24
7	Science-Technology & literature	24
9	Acta Editologica	22
9	Journalism Communication	19
9	Society	19
9	China Health Human Resources	19
9	Studies on Science Popularization	18
14	Research on Transmission Competence	17
14	Journal of Traditional Chinese Medicine Management	17
14	Publishing Reference	16
14	Youth Journalist	16
14	New Media Research	16
14	Chinese Journal of Scientific and Technical Periodicals	16
14	Healthy China Observation	15

2.4 Authors of the Articles

From 1994 to 2024, a total of 4,741 authors published articles on health science popularization research. The co-authorship network analysis revealed that Wu YiBo from the School of Public Health at Peking University had the largest node, indicating the highest number of articles, with 17 articles published from 2017 to the present. This was followed by Han Ye from the Beijing Center for Disease Prevention and Control, with 11 articles published since 2021, and Wang Tao from Shanghai Tongji Hospital, with 10 articles published since 2015.

Regarding the annual increase in authors contributing to health science popularization research, the period from 1994 to 2005 showed a relatively slow growth rate, with an average annual increase of 18.08 authors. From 2006 to

2015, the growth rate accelerated, with an average annual increase of 53.70 authors. From 2016 to 2024, the growth rate increased significantly, with an average annual increase of 443.00 authors. Details are presented in Table 2, Table 3, and Figure 3.

Table 2. Top 20 Authors by Number of Articles in Health Science Popularization Research (1994-2024)

Rank	Name	Institution	Province/City	Number of Articles	First Publication
1	Wu YiBo	School of Public Health, Peking University	Beijing	17	2017
2	Han Ye	Beijing Center for Disease Prevention and Control	Beijing	11	2021
3	Wang Tao	Shanghai Tongji Hospital	Shanghai	10	2015
4	Zheng XiaoYang	Fujian Science and Technology Publishing House	Fujian	9	1995
4	Huang QiSheng	Family Doctor Magazine Agency	Guangdong	9	1997
4	Wang JiaDong	Family Doctor Magazine Agency	Guangdong	9	1997
7	Zeng Tie	Xuhui Campus, Shanghai Open University	Shanghai	8	2017
7	Wang Jing	Northern Jiangsu People's Hospital	Jiangsu	8	2016
9	Hu Yang	Beijing Center for Disease Prevention and Control	Beijing	7	2023
9	Qiu CaiXia	Family Doctor Magazine Agency	Guangdong	7	2004
9	Wang Lu	Peking Union Medical College Hospital, Chinese Academy of Med-	Beijing	7	2019
9	Zhang Li	Jilin Provincial Health Education Center	Jilin	7	2016
9	Zhu JianPing	Zhejiang Provincial Health Education Institute	Zhejiang	7	1997
14	Du MengKai	Xuanwu Hospital, Capital Medical University	Beijing	6	2018
14	Wang Lei	Xuanwu Hospital, Capital Medical University	Beijing	6	2018
14	Hong Wei	Beijing Center for Disease Prevention and Control	Beijing	6	2021
14	Huang XiaoLan	Shanghai Health Promotion Center	Shanghai	6	2017
14	Wang LiXiang	General Hospital of Chinese People's Armed Police Forces	Beijing	6	2016
14	Xu Fei	Beijing Center for Disease Prevention and Control	Beijing	6	2023
14	Zheng FangJiang	Gansu Provincial Hospital of Traditional Chinese Medicine	Gansu	6	2022

Table 3. Authors and Institutions Publishing Health Science Popularization Research Articles (1994-2024)

Year	Author Statistics		Institution Statistics	
	Annual Increase	Cumulative Total	Annual Increase	Cumulative Total
1994	14	14	10	10
1995	18	32	12	22
1996	8	40	5	27
1997	24	64	16	43
1998	16	80	20	63
1999	13	93	8	71

Table 3. Continued

2000	16	109	9	80
2001	11	120	10	90
2002	16	136	13	103
2003	35	171	18	121
2004	26	197	12	133
2005	20	217	13	146
2006	28	245	18	164
2007	42	287	14	178
2008	52	339	17	195
2009	41	380	21	216
2010	37	417	20	236
2011	72	489	33	269
2012	52	541	28	297
2013	75	616	31	328
2014	74	690	27	355
2015	64	754	33	388
2016	99	853	48	436
2017	142	995	54	490
2018	171	1166	72	562
2019	261	1427	95	657
2020	419	1846	140	797
2021	564	2410	194	991
2022	597	3007	217	1208
2023	801	3808	254	1462
2024	933	4741	257	1719

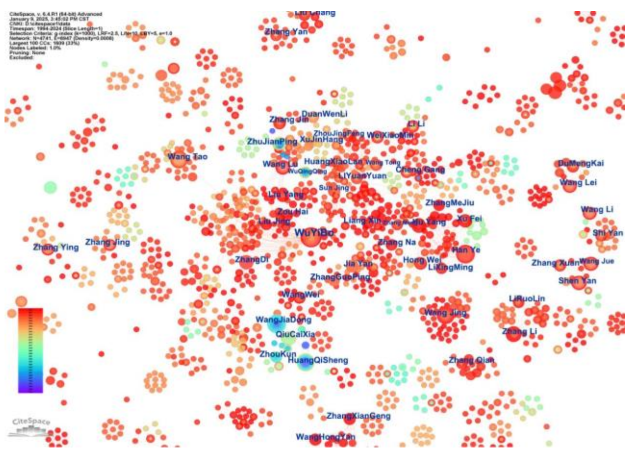

Figure 3. Co-occurrence Network Nap of Authors Publishing Health Science Popularization Research Articles.

According to Price's Law, with N_{max}=17 in this study, M is calculated as 3, meaning authors with three or more articles are considered core authors. Statistical analysis showed that 189 core authors published a total of 735 articles, accounting for 35% of the total articles. This figure does not meet the half criterion stipulated by Price's Law, indicating that a stable core author group has not yet been formed in health science popularization research.

2.5 Article Publishing Institutions

From 1994 to 2024, a total of 1,719 institutions published articles on health science popularization research. The institution with the highest number of articles was the People's Medical Publishing House, which also appeared as the largest node in the institutional co-occurrence network map, having published 32 articles since 2006. Peking University ranked second, with 20 articles published since 2017. Tied for third place were the Chinese Health Education Center and the Shanghai Health Promotion Center, each having published 15 articles since 2013 and 2019, respectively.

In terms of the annual increase in institutions publishing health science popularization research, growth remained relatively moderate from 1994 to 2005, with an average annual increase of approximately 12.16 institutions. From 2006 to 2015, the growth rate accelerated, with an average of 24.20 new institutions per year. From 2016 to 2024, institutional growth increased significantly, with an average of 147.89 new institutions annually.

Regarding collaboration between the aforementioned four institutions and others, the People's Medical Publishing House showed no recorded collaborative ties. Peking University collaborated extensively with 16 institutions, including the Chinese Health Education Center, Shandong University, Harbin Medical University, Guangxi University of Chinese Medicine, and the Children's Hospital of Fudan University. The Chinese Health Education Center collaborated with nine institutions, such as Peking University, the Chinese Center for Disease Control and Prevention, Peking University Third Hospital, and Xuanwu Hospital of Capital Medical University. The Shanghai Health Promotion Center collaborated with five institutions, including the Shanghai Municipal Health Commission, the School of Public Health at Fudan University, the First Affiliated Hospital of Sun Yatsen University, and Guangzhou First People's Hospital. Details are provided in able 4, and Figure 4.

Table 4. Top 20 Institutions Publishing Health Science Popularization Research Articles (1994-2024)

Rank	Institution	Province/City	First Publication Year	Number of Articles
1	People's Medical Publishing House	Beijing	2006	32
2	Peking University	Beijing	2017	20
3	Chinese Health Education Center	Beijing	2013	15
4	Shanghai Health Promotion Center	Shanghai	2019	15
5	Shandong University	Shandong	2017	14
6	Beijing Center for Disease Prevention and Control	Beijing	2021	13
7	Sun Yatsen University	Guangdong	2002	12
8	Anhui Medical University	Anhui	2002	11
9	Chinese Center for Disease Control and Prevention	Beijing	2008	11
10	Sichuan Nursing Vocational College	Sichuan	2019	10
11	Shanghai Jiao Tong University	Shanghai	2020	10
12	West China Hospital, Sichuan University	Sichuan	2003	9
13	Xuanwu Hospital, Capital Medical University	Beijing	2019	9
14	Fudan University	Shanghai	2018	8
15	Guangzhou Medical University	Guangdong	2017	8
16	Capital Medical University	Beijing	2018	8

Table 4. Continued

17	Beijing Shijitan Hospital, Capital Medical University	Beijing	2016	7
18	Guangxi University of Chinese Medicine	Guangxi	2016	7
19	Anhui Science and Technology Publishing House	Anhui	2013	7
20	Shanghai University of Medicine & Health Sciences	Shanghai	2020	7

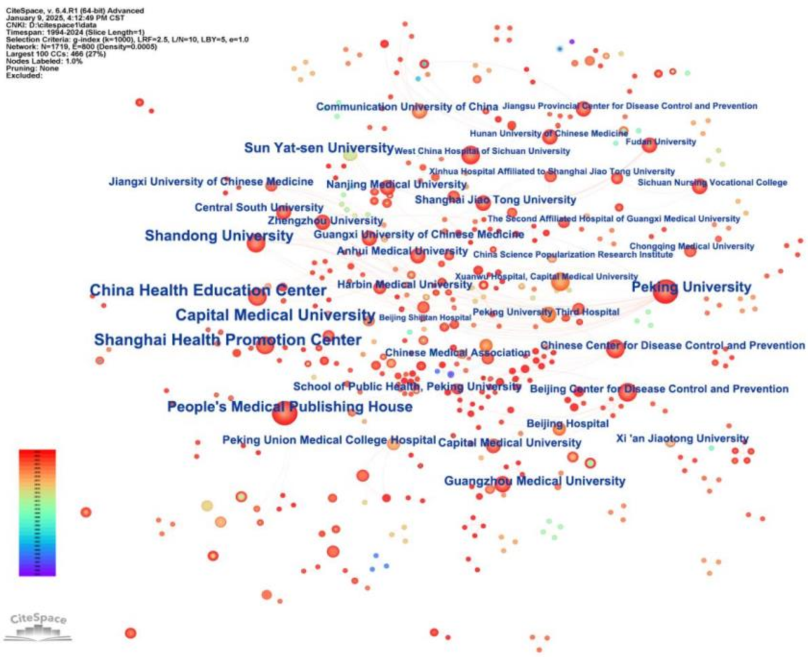

Figure 4. Co-occurrence Network Map of Institutions Publishing Health Science Popularization Research Articles.

2.6 Regional Distribution of Articles

From 1994 to 2024, the top five provinces/**cities** with the highest number of articles in health science popularization research were Beijing, Shanghai, Guangdong, Jiangsu, and Zhejiang. Among them, 154 institutions in Beijing published 458 articles, ranking first in both number of articles and participating institutions. The number of articles from Beijing significantly exceeded that of Shanghai, which ranked second with 278 articles. Details are provided in Table 5.

Table 5. Articles and Institutions of Health Science Popularization Research by Province/City (1994-2024)

Province/City	Articles Statistics			Institution Statistics		
	Rank	Count	Percentage	Rank	Count	Percentage
Beijing	1	458	19.0%	1	154	11.8%
Shanghai	2	278	11.5%	3	111	8.5%
Guangdong	3	201	8.3%	4	107	8.2%
Jiangsu	4	187	7.8%	2	122	9.4%
Zhejiang	5	125	5.2%	6	87	6.7%
Sichuan	6	121	5.0%	7	60	4.6%
Shandong	7	119	4.9%	5	89	6.8%
Hubei	8	89	3.7%	8	59	4.5%

Table 5. Continued

Hunan	9	87	3.6%	9	47	3.6%
Guangxi	10	80	3.3%	14	36	2.8%
Henan	11	72	3.0%	10	43	3.3%
Shaanxi	12	62	2.6%	11	40	3.1%
Chongqing	13	62	2.6%	13	38	2.9%
Liaoning	14	54	2.2%	12	39	3.0%
Tianjin	15	49	2.0%	16	31	2.4%
Anhui	16	48	2.0%	18	22	1.7%
Fujian	17	47	2.0%	17	27	2.1%
Hebei	18	44	1.8%	15	32	2.5%
Jilin	19	38	1.6%	19	21	1.6%
Heilongjiang	20	31	1.3%	21	19	1.5%
Yunnan	21	27	1.1%	20	21	1.6%
Shanxi	22	26	1.1%	22	19	1.5%
Jiangxi	23	22	0.9%	23	16	1.2%
Gansu	24	22	0.9%	24	13	1.0%
Xinjiang	25	20	0.8%	25	13	1.0%
Guizhou	26	19	0.8%	26	13	1.0%
Hainan	27	9	0.4%	27	9	0.7%
Inner Mongolia	28	6	0.2%	28	5	0.4%
Qinghai	29	4	0.2%	29	4	0.3%
Ningxia	30	2	0.1%	30	2	0.2%
Macao	31	1	0.0%	31	1	0.1%
Tibet	32	0	0%	32	0	0%
Taiwan	32	0	0%	32	0	0%

2.7 Keyword Co-occurrence Analysis

In the keyword co-occurrence analysis, the top ten keywords by frequency were: health science popularization (n=325), medical science popularization (n=238), health education (n=159), science popularization (n=120), health communication (n=107), new media (n=107), public hospitals (n=78), short video (n=74), health literacy (n=71), and Healthy China (n=52). Four keywords with centrality greater than 0.1 were identified as key nodes: medical science popularization (centrality=0.57), health education (centrality=0.27), health science popularization (centrality=0.24), and science popularization (centrality=0.14). Details are shown in Table 6 and Figure 5.

Table 6. Top 20 Keywords by Frequency in Health Science Popularization Research Articles (1994-2024)

Rank	Keyword	First Appearance Year	Centrality	Frequency
1	health science popularization	2004	0.24	325
2	medical science popularization*	1994	0.57	238
3	health education	1996	0.27	159

Table 6. Continued

4	science popularization	1994	0.14	120
5	health communication	2005	0.08	107
6	new media	2015	0.07	107
7	public hospitals	2014	0.03	78
8	short video	2019	0.04	74
9	health literacy	2010	0.07	71
10	Healthy China	2017	0.05	52
11	communication	1998	0.02	43
12	medicine	1994	0.08	40
13	health	2005	0.04	36
14	medical students	2003	0.03	36
15	science popularization education	2003	0.03	33
16	communication effects	2016	0	32
17	influencing factors	2020	0.01	32
18	hospital	2003	0.02	27
19	practice	2012	0.01	25
20	WeChat	2016	0.02	23

Note: *Medical science popularization is mainly about the concepts, knowledge and skills related to medical science, which is different from the concept of health science popularization.

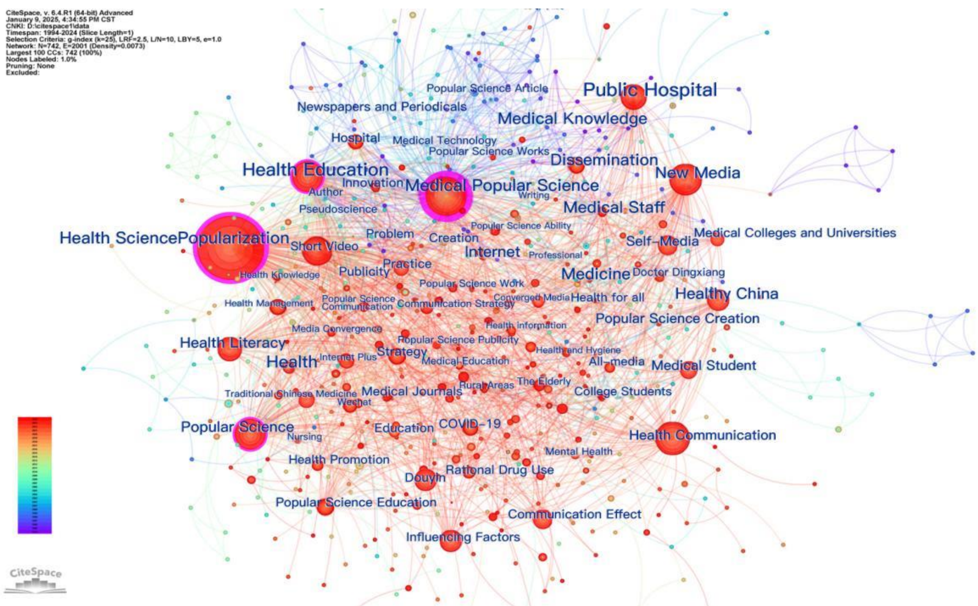

Figure 5. Keyword Co-occurrence Network Map of Health Science Popularization Research Articles (1994-2024).

2.8 Keyword Cluster Analysis

Using the clustering function in CiteSpace with the LLR algorithm, 14 clusters were identified based on keywords. The modularity Q value was 0.562, and the mean silhouette S value was 0.7737, indicating significant cluster structure and high homogeneity. Among the 14 clusters, the larger ones were: #0 Health science popularization, which emerged in 2019 and includes 147 keywords such as health science popularization, health communication, public hospitals, new media, and short videos; #1 Medical science popularization, which emerged in 2003 and includes 99 keywords such as medical science popularization, health science popularization, medical knowledge, newspapers and periodicals, and popular science articles; #2 Health education, which emerged in 2011 and includes 92 keywords such as health education, science popularization, nursing, health science popularization, and doctor-patient relationships. The timeline view of clusters illustrates the chronological order of keyword appearances within each cluster. Details are provided in Table 7, Figure 6, and Figure 7.

Table 7. Keyword Clusters in Health Science Popularization Research Articles (1994-2024)

Cluster ID	Cluster Label	Size	Silhouette	Emerged Year	Top 5 Terms by LLR
#0	health science popularization	147	0.698	2019	health science popularization, health communication, public hospitals, new media, short video
#1	medical science popularization	99	0.815	2003	medical science popularization, health science popularization, medical knowledge, newspapers, popular science articles
#2	health education	92	0.785	2011	health education, science popularization, nursing, health science popularization, doctor-patient relationship
#3	medical student	42	0.883	2014	medical students, science popularization ability, public health, science popularization education, social practice
#4	college student	40	0.852	2008	college students, mental health, science popularization promotion, Henan, health propaganda
#5	health	37	0.877	2014	public health, communication, converged media, internet, health information
#6	medicine	30	0.867	2003	medicine, professionals, science popularization journals, popular science books, reflections
#7	Hospital	26	0.928	2013	hospitals, propaganda, health management, internet+, chronic diseases
#8	medical staff	20	0.969	2002	medical staff, quality of life, modern medicine, medical research, educational activities
#9	author	18	0.994	2002	authors, issues, public health, manuscripts, health popularization TV programs
#10	strict control	13	0.996	1999	strict review, program content, radio programs, radio stations, the masses
#11	pseudoscience	10	0.981	2006	pseudoscience, health knowledge, insights, communication content, motherland

Table 7. Continued

#12	medical colleges and universities	8	0.988	2007	medical institutions, propaganda education, tularemia, medical products, healthcare
#13	fixed point	6	0.995	1997	designated points, professional technicians, knowledge lectures, methods, temporary
#14	essential trace elements	5	0.996	1995	essential trace elements, Xinmin Evening News, sexual medicine, people's health, socialist market economy
#15	rural revitalization	5	0.992	2021	rural revitalization, quality safety, nutrition health, rural voices, rural science popularization

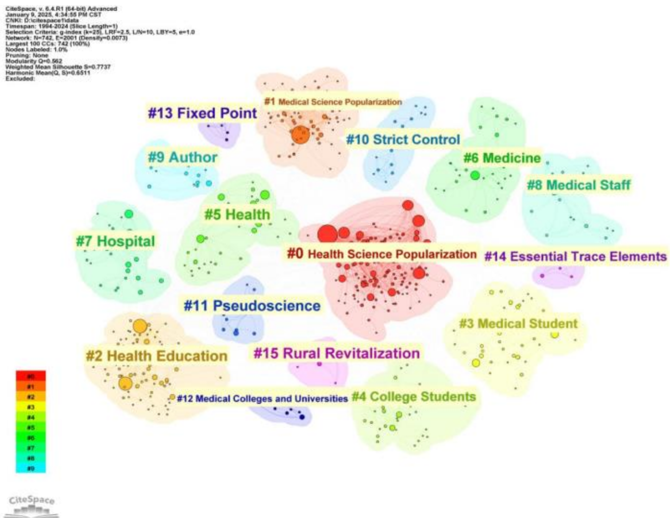

Figure 6. Keyword Cluster Network Map of Health Science Popularization Research Articles (1994-2024).

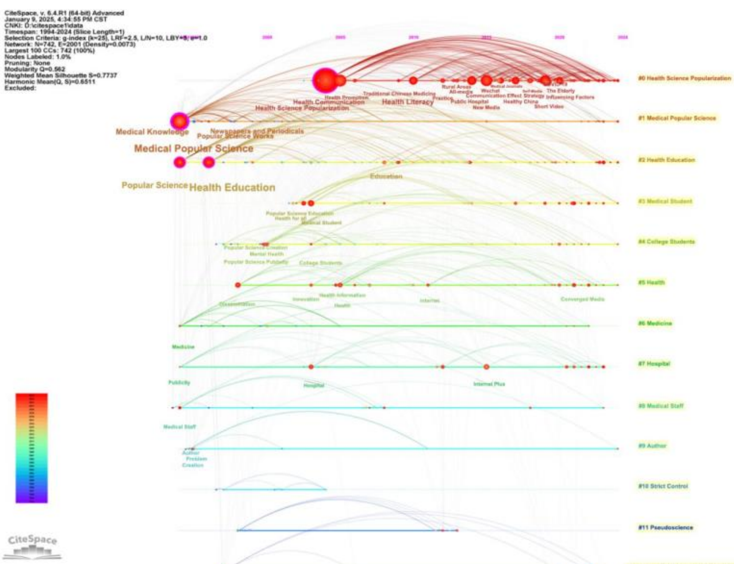

Figure 7. Timeline View of Keyword Clusters in Health Science Popularization Research Articles (1994-2024).

2.9 Keyword Burst Analysis

CiteSpace was used to identify 25 keywords with the strongest burst intensity in the field of health science popularization research from 1994 to 2023. Based on the burst start time, early burst keywords included medical knowledge (1994), medical science popularization and popular science articles (1995), while recent burst keywords included COVID-19 (2020), self-media, converged media, short video, communication strategies (2021), and health promotion and health (2022).

In terms of burst strength, the highest burst keywords were observed for: medical science popularization (1995-1999, strength 8.41), WeChat (2016-2020, strength 7.92), health communication (2019-2022, strength 7.39), health (2007-2019, strength 6.21), medicine (1997-2016, strength 6.03), COVID-19 (2020-2022, strength 4.67), health education (2018-2019, strength 4.57), and medical knowledge (1994-2005, strength 4.54). Details are shown in Figure 8.

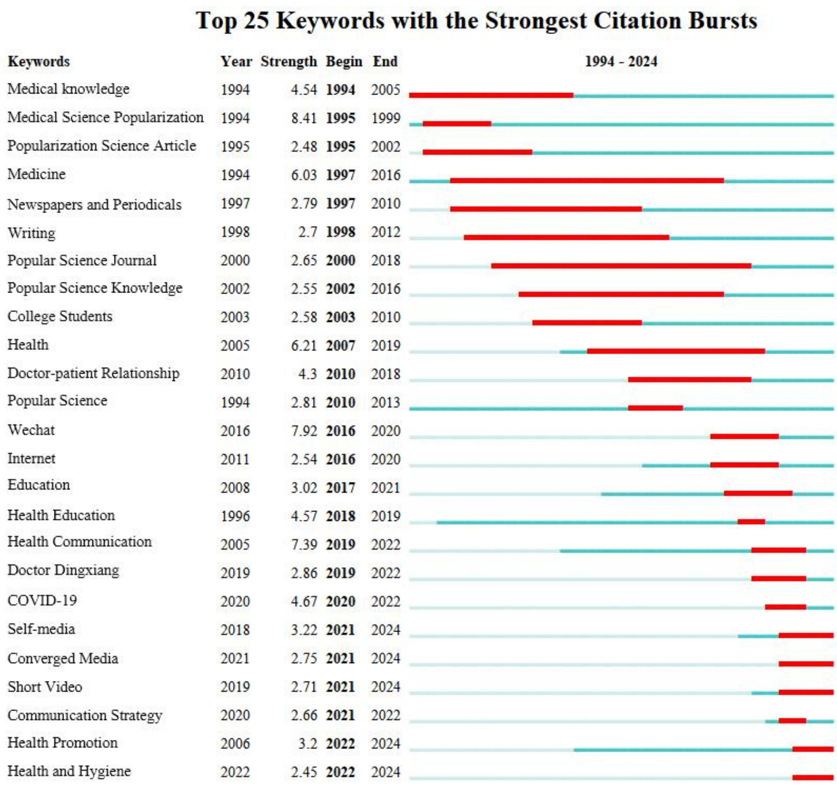

Figure 8. Keyword Burst Detection Map of Health Science Popularization Research Articles (1994-2024).

3. Discussion

This study conducted a bibliometric analysis of health science popularization research articles in China from 1994 to 2024. Overall, the number of articles in this field showed an upward trend. The top three academic journals publishing the most articles were *Chinese Journal of Health Education*, *Science and Technology Communication*, and *Health Education and Health Promotion*. The most prolific authors were Wu YiBo from the School of Public Health at Peking University, Han Ye from the Beijing Center for Disease Prevention and Control, and Wang Tao from Shanghai Tongji Hospital. The institutions with the highest number of articles were the People's Medical Publishing House, Peking University, the Chinese Health Education Center, and the Shanghai Health Promotion Center. The top three keywords by frequency were health science popularization, medical science popularization, and health education. The three largest keyword clusters were health science popularization, medical science popularization, and science popularization. The keywords with the strongest burst intensity were medical science popularization, WeChat, and health communication.

3.1 Three Developmental Stages of Health Science Popularization Research

Since the founding of the People's Republic of China, the development of the science popularization policy system has evolved from scratch and from fragmentation to systematization, providing a robust legal and institutional foundation for advancing science popularization in China [9]. As an important component of science popularization, the release of policies related to both general science popularization and health science popularization has played a crucial role in promoting research in health science popularization. Based on the issuance of relevant policies, combined with the number of articles and the annual growth of authors and institutions, this study divides the development of health science popularization research into three stages: the initial emergence stage (1994-2005), the steady growth stage (2006-2015), and the rapid development stage (2016-2024). Each stage exhibits distinct characteristics in health science popularization research.

During the initial emergence stage (1994-2005), the annual number of articles in health science popularization research was relatively low, with slow growth in the number of authors and institutions. In this stage, China introduced key science popularization policy documents, marking important steps toward systematizing science popularization efforts [9]. In 1994, the first comprehensive guiding document on science popularization, *Several Opinions on Strengthening Science and Technology Popularization Work*, was promulgated [10-11]. The *Law of the People's Republic of China on Science and Technology Popularization*, enacted in 2002, legally mandated science popularization efforts for the first time [11]. In 2005, the National Medium and LongTerm Science and Technology Development Plan (2006-2020) explicitly proposed the implementation of a national action plan to improve scientific literacy among all citizens [12].

During the steady growth stage (2006-2015), the annual number of articles, authors, and institutions in health science popularization research gradually increased. In this stage, policies such as the *Outline of the National Action Plan for Scientific Literacy (2006-2010-2020)* (2006), the *Several Opinions on Strengthening National Science Popularization Capacity* (2007), and the *Notice on Issuing the Development Plan for Science Popularization Infrastructure (2008-2010-2015)* (2008) were promulgated. These policies enhanced the development of science popularization infrastructure and improved the capacity for science popularization efforts across the country [11].

During the rapid development stage (2016-2024), the annual number of articles, authors, and institutions in health science popularization research grew rapidly. This stage also saw the introduction of numerous policies significantly promoting health science popularization research. Examples include the *Healthy China 2030 Plan Outline* (2016), the *Opinions on Implementing the Healthy China Initiative* (2019), and the *Guiding Opinions on Establishing and Improving the Release and Dissemination Mechanism for Health Science Knowledge Through All Media* (2022), the National Science Popularization Development Plan for the 14th Five-Year Period (2022), and the *Opinions on Further Strengthening Science and Technology Popularization in the New Era* (2022).

3.2 Articles Volume, Authors, Institutions, and Provinces/Cities in Health Science Popularization Research

From 1994 to 2024, the annual number of articles in health science popularization research increased from 10 to 337, indicating a growing interest among domestic experts and scholars in this field. Particularly since 2016, the rapid growth in articles has significantly promoted health science popularization efforts. The health literacy rate among residents rose from 11.58% in 2016 [13] to 31.87% in 2024, achieving the Healthy China initiative's goal of reaching 30% by 2030 six years ahead of schedule.

Regarding authors, the three most prolific contributors were Wu YiBo, Han Ye, and Wang Tao, who first published in 2017, 2021, and 2015, respectively. These experts have played important roles in advancing health science popularization research over the past decade, although no collaboration among them was observed. Moreover, the number of core authors in this field from 1994 to 2024 did not meet the half criterion of Price's Law, indicating that a core author group has not yet formed. This may be due to a lack of sustained research efforts and stable team composition [14]. It is recommended that research teams emphasize systematic and sustainable studies while strengthening collaboration and exchange.

Among institutions, the People's Medical Publishing House produced the most articles but had no collaborative ties. Peking University, ranked second, and the Chinese Health Education Center and Shanghai Health Promotion Center, tied for third, had more collaborations, though these were mostly limited to local partners, with minimal inter-provincial cooperation. Most institutions engaged in health science popularization research were from the healthcare sector, aligning with national policies designating medical institutions as the main bodies and healthcare workers as the key contributors in health science popularization. This finding is consistent with another study [15], suggesting that healthcare-related institutions prioritize this research. However, since health science popularization involves multiple disciplines such as medicine, communication, psychology, and sociology, cross-disciplinary collaboration should be enhanced.

The emphasis on health science popularization across provinces/cities is somewhat related to economic development levels. According to China's 2024 Provincial Economic Performance Report [16], the top five provinces/cities in articles—Beijing, Shanghai, Guangdong, Jiangsu, and Zhejiang—are all economically advanced, while the bottom five—Tibet, Ningxia, Qinghai, Inner Mongolia, and Hainan—are less developed. This suggests that higher economic development levels correlate with greater emphasis on health science popularization. Notably, Shanghai has pioneered many innovative efforts, such as incorporating health science popularization into local regulations, including it in senior professional title evaluations, launching health science popularity rankings, establishing a provincial-level converged media center for health science, and promoting innovative formats like health talk shows. These initiatives have been well received and are worth referencing.

3.3 Research Hotspots in Health Science Popularization Articles

Keywords represent the core content of academic research. The frequent appearance of a keyword in the articles of a specific research field indicates that the topic it represents is a hotspot in that area [17]. By integrating keyword co-occurrence analysis, cluster analysis, and burst detection analysis, this study reveals that health science popularization research exhibited distinct hotspot directions across the three stages: the initial emergence stage (1994-2005), the steady growth stage (2006-2015), and the rapid development stage (2016-2024).

The research hotspots in health science popularization are closely related to the dominant social communication media of each period. During the initial emergence stage (1994-2005), internet penetration was still in its early phases, and traditional media such as newspapers, television, and radio remained the primary channels for public communication. Research hotspots in this stage focused on traditional media, as reflected in burst keywords such as newspapers, popular science articles, science popularization journals, popular science books, television programs, and radio stations. Representative articles included *How to Ensure the Scientificity of Medical Science Popularization Journals* (1995) [18], *On the Application of Health Science Popularization TV Programs in Health Education* (1997) [19], and *On the Editing Techniques of Medical Science Popularization Newspapers and Journals* (2002) [20].

During the steady growth stage (2006-2015), health science popularization research began to emphasize health education in public hospitals, health science popularization, health promotion efforts, and the relationships between health science popularization, health literacy, and doctor-patient relationships. More importantly, research focus started shifting from traditional media to new internet-based media, as evidenced by the emergence of the keyword new media in 2005. Chinese health science popularization scholar YiBo Wu noted that new media developed rapidly as channels for health science popularization and attracted increasing attention from researchers [4], which aligns with the findings of this study. During this period, internet and mobile communication devices became widely adopted in China. By December 2015, the number of internet users in China reached 688 million, with mobile internet users amounting to 620 million, indicating that half of the Chinese population had access to the internet and marking a new phase in internet popularization [21]. The rise of social media platforms such as Weibo and WeChat accelerated the growing attention to new media [4], greatly propelling research on health science popularization through these channels. Representative articles included *On Hospital Health Education and doctor-patient Relationship* (2011) [22], *Analysis of the Advantages of Online Science Popularization in Health Communication* (2013) [23], *Health Science Popularization is an External Publicity in Bounden Duty of Public Hospital's Social Function* (2014) [24], and *Research on the Hospital WeChat Information Service in China in the Internet+ Era* (2015) [25].

During the rapid development stage (2016-2024), internet and mobile communication devices became even more widespread. Due to their fast dissemination, broad reach, strong interactivity, and diverse formats [2628], new media platforms such as WeChat, Weibo, and TikTok gradually replaced traditional media as the primary sources of information for the public. In this stage, research hotspots shifted to studies on new media, as reflected in burst keywords such as WeChat, internet, selfmedia, converged media, and short video. Furthermore, with the introduction of the Healthy China strategy in 2016, experts and scholars placed greater emphasis on health education, health promotion, and communication strategies, leading to an increase in articles exploring ways to enhance the reach and impact of health science popularization through new media. Representative articles included *Application of New Media in*

Health Education (2018) [29], *Analysis of the Status and Outlook of "Internet +" New Media Medical Science Popularization: Take the WeChat Official Account "A Lan Xiao Doctor" as an Example* (2022) [30], and *Exploration and Thinking of Popular Science Short Videos on the High-Quality Development of Hospital Health Promotion* (2023) [31].

4. Conclusion

With social development and the introduction of policies related to health science popularization, research in this field has garnered increasing attention from domestic experts and scholars. Health science popularization research in China can be divided into three stages: the initial emergence stage (1994-2005), the steady growth stage (2006-2015), and the rapid development stage (2016-2024). The research hotspots have also evolved over time, most notably shifting from how to enhance the communication impact of health science popularization through traditional media to how to improve its dissemination and influence via new media. In summary, this study represents the most comprehensive and longest-spanning bibliometric analysis of health science popularization research in China to date. It provides a scientific basis for understanding the current status and hotspot directions in this field, filling a gap in related research in China.

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