

Letter to the Editor



Global Research Trends in Traditional Chinese Medicine and COVID-19: A Comprehensive Bibliometric and Visual Analysis*

Lei Zhang^{1,&}, Lin Tong^{1,&}, Zihan Jia^{2,&}, Dan Li³, Songwang Wang⁴, Qiujie Cai⁵, Sihong Liu¹, Guangkun Chen¹, Ziling Zeng², Hongjie Gao¹, Yan Ma^{5,#}, and Huamin Zhang^{6,#}

Coronavirus disease (COVID-19) has spread rapidly since its onset in 2019^[1]. The pandemic is being effectively controlled in China, with traditional Chinese medicine (TCM) playing a significant role^[2,3]. The World Health Organization (WHO) issued the “WHO Expert Meeting on Evaluation of Traditional Chinese Medicine in the Treatment of COVID-19” on March 31, 2022, which determined the clinical efficacy and safety of TCM for COVID-19. The WHO declared an end to the COVID-19 global health emergency on May 5, 2023, though it remained a global health threat. More than 7.7 billion people are infected with COVID-19 globally, with more than 230,000 new cases and 27,000 new hospitalized patients, causing over 3,300 deaths globally during the period July 1–28, 2024^[4]. Thus, COVID-19 remains a threat due to constant viral variations, and new outbreaks may occur at any time.

TCM has attracted widespread attention for its effective treatment of COVID-19^[4,5], but a comprehensive and systematic analysis of articles on TCM and COVID-19 using a bibliometric and visual analysis is necessary. In this study, we conducted this type of analysis to assess global research trends and hotspots in TCM and COVID-19, providing references for clinicians and new insights into fighting COVID-19.

We searched English databases, including PubMed and Web of Science, and Chinese databases, including the China National Knowledge Infrastructure, Wanfang Data, and China Biology Medicine. Publication dates were January 1, 2020 to August 13, 2024. The search terms used to recognize

the publications with the closest fit included “COVID-19” “novel coronavirus” “novel coronavirus pneumonia” “severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)” “2019-nCoV” “TCM”, and “traditional Chinese medicine”. Studies related to TCM research on COVID-19 were included. Newsletters, reports, newspaper articles, statements, doctoral theses, master’s theses, withdrawn literature, and duplicates (preferred for newly published literature) were excluded from the analysis. Two reviewers independently screened and evaluated the literature, and the researchers evaluated any conflicting results.

The results of the retrieved literature were imported into EndNote 8 to remove duplicate and irrelevant literature, and Excel 2016 was used to unify extracted authors, journals, keywords, and author affiliations to improve data accuracy. We combined the terms “Corona Virus Disease 2019”, “COVID-19” “Coronavirus Disease 2019”, and “2019-nCoV” into “COVID-19” and unified “traditional Chinese medicine” “Chinese medicine” “Chinese traditional medicine”, and “TCM” into “TCM”. We mainly used VOSviewer 1.6.16 (Leiden University, Leiden, the Netherlands) to objectively display the study authors and keyword clustering hotspots. We created a keyword cloud for this research field using the online text cloud generator, WordArt. com (<https://wordart.com/>).

A total of 5,009 publications were retrieved. Of these, Chinese and English publications constituted 65.78% (3,295/5,009) and 34.22% (1,714/5,009),

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1. Institute of Information on Traditional Chinese Medicine, China Academy of Chinese Medical Sciences, Beijing 100700, China; 2. Institute of Chinese Materia Medica, China Academy of Chinese Medical Sciences, Beijing 100700, China; 3. Beijing Center for Diseases Prevention and Control, Beijing 100013, China; 4. Chinese Center for Disease Control and Prevention, Beijing 102206, China; 5. Institute of Basic Research in Clinical Medicine, China Academy of Chinese Medical Sciences, Beijing 100700, China; 6. Institute of Basic Theory for Chinese Medicine, China Academy of Chinese Medical Sciences, Beijing 100700, China

respectively. After applying the inclusion and exclusion criteria, 1,992 papers were included in our analysis: 53.92% (1,074/1,992) were Chinese and 46.08% (918/1,992) were English (Supplementary Figure S1, available in www.besjournal.com). The growth trend of monthly publications is shown in Supplementary Figure S2, available in www.besjournal.com, which indicates a prominent rising trend from January to March 2020. However, most English-language papers were published between April and May 2021. The 1,992 papers were published in 610 journals. In terms of Chinese journals, the three journals with the most publications were the *Journal of Traditional Chinese Medicine* (68/1,992, 3.41%), *Modernization of Traditional Chinese Medicine and Materia Medica-World Science and Technology* (64/1,992, 3.21%), and *Pharmacology and Clinics of Chinese Materia Medica* (62/1,992, 3.11%). The three English journals with the most publications were *Medicine* (68/1,992; 3.41%), *Frontiers in Pharmacology* (50/1,992; 2.51%), and *Phytomedicine* (32/1,992; 1.61%)

(Supplementary Figure S3, available in www.besjournal.com). In total, 1,992 articles were authored by 13,954 researchers from 3,121 institutions across 46 countries and regions. Among the 13,954 researchers, the top five authors in terms of the number of published papers were Yanping Wang (31), Junhua Zhang (26), Boli Zhang (26), Fengwen Yang (20), and Luqi Huang (12), as shown in Figure 1. Among the 3,121 different institutions, the top five institutions in terms of published papers were the China Academy of Chinese Medical Sciences (730), Beijing University of Traditional Chinese Medicine (581), Chengdu University of Traditional Chinese Medicine (525), Tianjin University of Traditional Chinese Medicine (416), and Shandong University of Traditional Chinese Medicine (265). Further, 1,992 papers were published in 46 countries and regions. Among them, 1,846 (92.67%) were published in China's Mainland. Other countries with large numbers of publications were the USA (34), India (22), Malaysia (7), and Germany (6) (Supplementary Figure S4, available in www.besjournal.com).

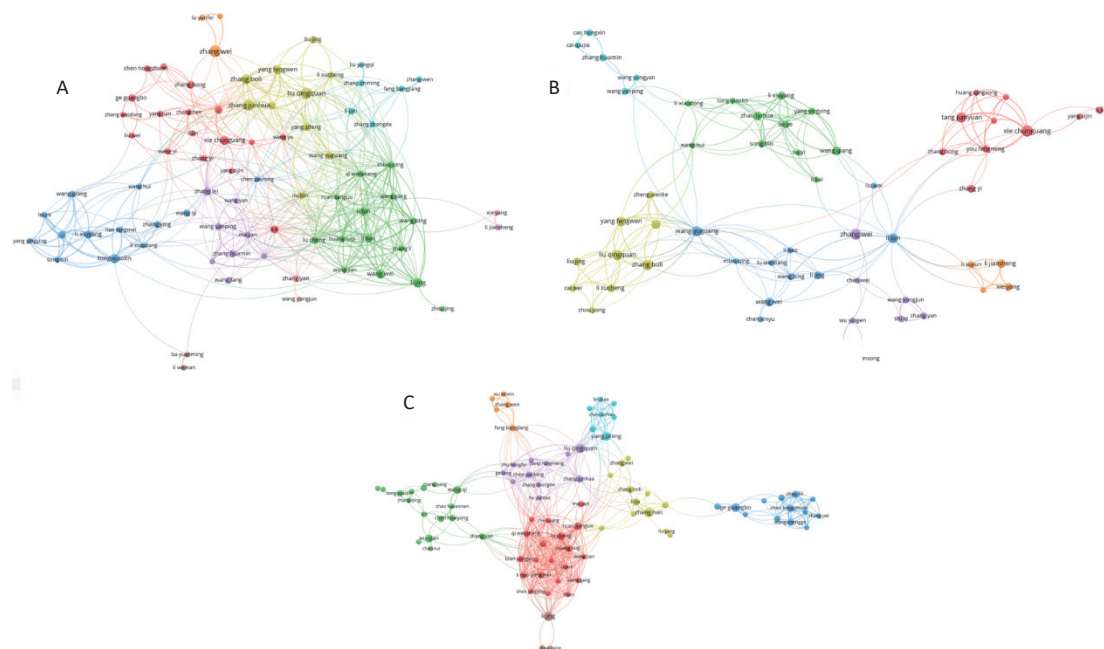


Figure 1. Co-authorship network of authors. (A) all papers, (B) Chinese papers, (C) English papers. The blue cluster represents the research team of the China Academy of Chinese Medical Sciences and Beijing Traditional University of Chinese Medicine (12 authors); the red cluster contains 19 authors from Chengdu University of Traditional Chinese Medicine and Shanghai University of Traditional Chinese Medicine. Wang Yi was an important node connected to the blue and red clusters. The yellow cluster consists of authors from Tianjin University of Traditional Chinese Medicine and Beijing Hospital of Traditional Chinese Medicine. The aqua green cluster was created by the research team of the Guangdong Hospital of Traditional Chinese Medicine. The green and purple clusters consisted of authors from the China Academy of Chinese Medical Sciences.

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A total of 3,637 keywords were extracted from the 1,992 articles. By deleting words with the same meaning as COVID-19 and TCM, a word cloud was created to display the frequency of keywords that appeared more than 10 times. “Drug therapy” and “pharmacology” were the most frequently used keywords (Supplementary Figure S5, available in www.besjournal.com). We conducted a cluster analysis of keywords with a frequency of more than five and generated a visual map (Figure 2A) containing the four main themes of TCM related to COVID-19. A total of 1,927 Chinese keywords were extracted from 1,074 articles. A visual map was generated for keywords that co-occurred more than five times (Figure 2B). COVID-19 was the most frequently used keyword with 873 (45.30%) co-occurrences, followed by TCM (224, 11.62%), network pharmacology (82, 4.26%), novel coronavirus (81, 4.20%), molecular docking (55,

2.85%), coronavirus disease (46, 2.39%), and data mining (41, 2.13%) (Table 1). In addition, 1,820 English keywords were extracted from the 918 articles. A visual map was generated for keywords with more than three co-occurrences (47 keywords) (Figure 2C). COVID-19 was the most frequently used keyword with 732 (40.22%) co-occurrences, followed by traditional Chinese medicine (256, 14.07%), novel coronavirus (245, 13.46%), humans (136, 7.47%), drug therapy (128, 7.03%), pharmacology (126, 6.92%), and therapeutic use (112, 6.15%) (Table 1).

We conducted a bibliometric and visual analysis to understand global research trends in TCM and COVID-19. Based on the visual analysis of keywords and cluster hotspots, the main hotspots in this field were identified as follows. Theme 1 is clinical research on the treatment of COVID-19 using TCM, mainly focusing on treatment based on syndrome differentiation and the combination of TCM and conventional therapy. Many hospitals and research

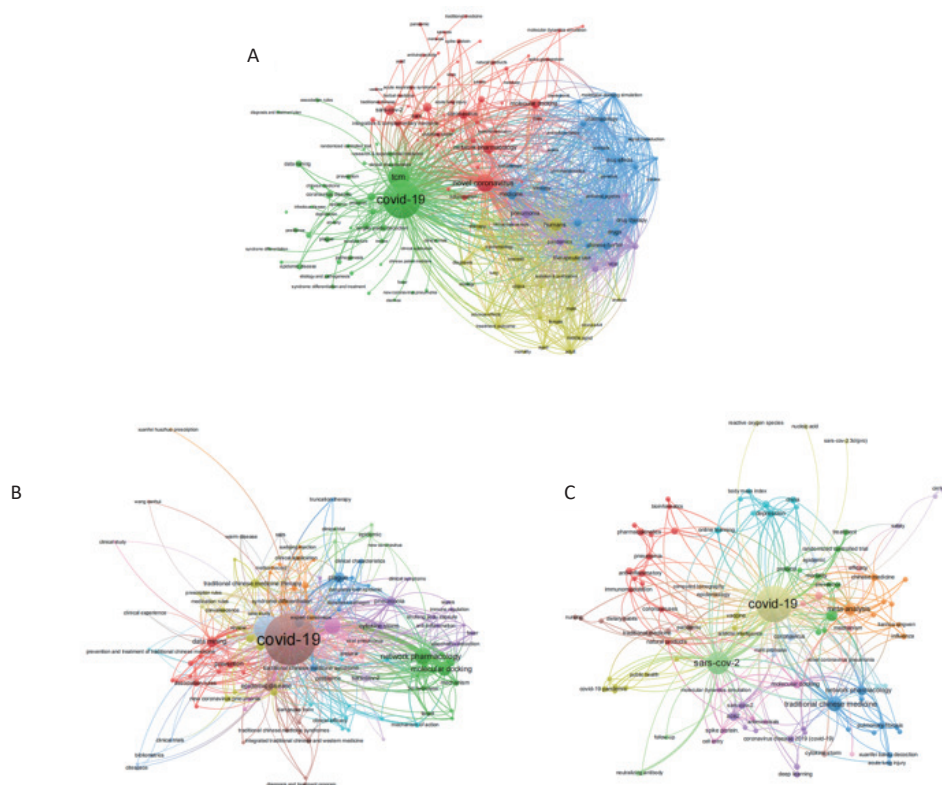


Figure 2. Bibliometric analysis of the keywords in publications. (A) all papers, (B) Chinese papers, (C) English papers. Theme 1 (green cluster): Clinical research on TCM for the treatment of COVID-19 mainly focusing on TCM syndrome differentiation and treatment with traditional Chinese medicine combined with conventional therapy. Theme 2 (red and blue clusters): Active TCM compounds for the treatment of COVID-19 based on network pharmacology and molecular docking methods. Theme 3 (purple): The etiology and pathogenesis of COVID-19. Theme 4 (yellow): Characteristics of the population treated with traditional Chinese medicine for COVID-19.

institutes have conducted clinical studies on COVID-19 and TCM, assessed their clinical value and advantages in its prevention and treatment, and provided evidence for the effectiveness of TCM. The “Three medicines and three prescriptions” (3M3F) approach consisted of the Jinhua Qinggan granules, Lianhua Qingwen capsules/granules, Xuebijing injection, Qingfei Paidu decoction (QFPDD), Huashi Baidu formula, and Xuanfei Baidu granules. This approach is reputed to have significant therapeutic effects. Thorough systematic reviews and meta-analyses have been conducted on Lianhua Qingwen capsules/granules and QFPDD^[2,3,6], offering reasonably reliable evidence for the clinical utilization of TCM to combat COVID-19. However, systematic reviews and meta-analyses on other prescriptions are lacking. This gap in the literature presents opportunities for future research.

Theme 2 focuses on conducting research using network pharmacology and molecular docking methods to identify the active compounds in TCM that can be used to treat COVID-19. This involves analyzing the chemical components, target interactions, and signaling pathways of TCM prescriptions, such as QFPDD and Cold-Damp Plague Formula. The underlying mechanisms of the action

of TCM prescriptions can be elucidated at the molecular level by employing molecular docking techniques to explore interactions between the active compounds and their targets. This study provides a strong foundation for the development and application of TCM for the treatment of COVID-19^[7,8]. In the field of network pharmacology prediction, some studies have carried out *in vitro* experiments to verify the prediction results. For example, Yuan et al. evaluated the therapeutic mechanism of Maxing Shigan decoction (MXSGD) used to treat COVID-19 using network pharmacology and *in vitro* experimental verification, revealing antiviral and anti-inflammatory pharmacodynamic substances and the mechanism of MXSGD, which may provide new insights into the vital role of TCM in the fight against COVID-19^[9].

Regarding theme 3, from the perspective of TCM, many experts have analyzed and explained the etiology and pathogenesis of COVID-19, a combination of ancient scholars’ understanding of plagues and typhoid fever. They have carefully observed the pathogenesis of COVID-19, treated the disease according to the syndrome, and promoted early recovery^[2,10].

Theme 4 addressed characteristics of the

Table 1. The top 20 keywords for COVID-19 research in English and Chinese [*n* (%)]

Rank	Chinese keywords	<i>N</i> (%), <i>N</i> = 1,927	English keywords	<i>N</i> (%), <i>N</i> = 1,820
1	Coronavirus disease (COVID-19)	873 (45.30)	COVID-19	732 (40.22)
2	Traditional Chinese medicine	224 (11.62)	Traditional Chinese medicine	256 (14.07)
3	Network pharmacology	82 (4.26)	Novel coronavirus	245 (13.46)
4	Novel coronavirus	81 (4.20)	Humans	136 (7.47)
5	Molecular docking	55 (2.85)	Drug therapy	128 (7.03)
6	Coronavirus disease	46 (2.39)	Pharmacology	126 (6.92)
7	Data mining	41 (2.13)	Therapeutic use	112 (6.15)
8	Qingfei Paidu Decoction	37 (1.92)	Medicine	95 (5.22)
9	Epidemic disease	32 (1.66)	Drug effects	90 (4.95)
10	Plague	30 (1.56)	Metabolism	85 (4.67)
11	Recovery period	29 (1.50)	Chemistry	82 (4.51)
12	severe acute Respiratory syndrome coronavirus 2 (SARS-CoV-2)	27(1.40)	Coronavirus	82 (4.51)
13	Pneumonia	25 (1.30)	SARS-CoV-2	77 (4.23)
14	Prevention	23 (1.19)	Pneumonia	74 (4.07)
15	Traditional Chinese medicine therapy	22 (1.14)	Chinese Herbal	72 (3.96)
16	Angiotensin converting enzyme II	21 (1.09)	Drugs	72 (3.96)
17	Pathogenesis	21 (1.09)	Pharmacology & Pharmacy	72 (3.96)
18	Pestilence	21 (1.09)	Chinese Traditional	65 (3.57)
19	Syndrome Differentiation and Treatment	18 (0.93)	Epidemiology	61 (3.35)
20	Etiology and pathogenesis	16 (0.83)	Immunology	57 (3.13)

population treated with TCM for COVID-19. Coughing was the most prevalent symptom, and nearly half of the patients had digestive disorders, loss of appetite, or insomnia. In addition, chest tightness, wheezing, and breathing difficulties could indicate a severe condition. A high number of patients manifested a reddish tongue or one with yellow fur, while numerous patients with severe cases exhibited a dull tongue and rapid pulse.

Based on a visual analysis of the keywords, studies on “drug therapy” and “pharmacology” are possible directions for current and future research in this field. TCM is composed of many different herbs or components with known or unknown active ingredients that can target various pathways for a given class of medical indications and be adjusted according to the individual’s overall condition, including symptoms. TCM exerts its anti-influenza activity by regulating the immune response to interfere with the viral infection and host reactions and might be used as an alternative treatment for influenza. “Pharmacology” is used to explain the mechanism of TCM drugs. TCM can inhibit the replication and transcription of SARS-CoV-2, interfering with the normal physiological functions of the virus and weakening a series of infection-related processes, including cytokine storms and coagulation abnormalities.

In our study, only Chinese and English studies were included; however, relevant publications may exist in other languages, such as Korean and Japanese. These publications were not within the scope of our study, which is a limitation.

Our findings demonstrate the status of research and current global trends in the field of TCM treatment for COVID-19. The results suggest that drug therapy, pharmacology, and therapeutic use will be the focal points and hotspots for future research. Rich experiences with TCM in the prevention and control of infectious diseases have been fully reflected in the fight against COVID-19. TCM should be integrated into the national infectious disease prevention and control system; with full play given to the advantages of TCM, a long-term emergency mechanism to ensure its participation in the prevention and control of infectious diseases can be established. This convergence with contemporary medicine could further enhance epidemic prevention and treatment. *Author Contributions* Lei Zhang, Lin Tong, and Zihan Jia identified the research questions, methodology, and analysis and wrote the original draft; Dan Li, Songwang Wang, and Sihong Liu carried out data

extraction and analysis; Qiujie Cai, Guangkun Chen, Ziling Zeng, and Hongjie Gao conducted writing supervision and examination; and Yan Ma and Huamin Zhang prepared the dataset and revised the manuscript. All the authors read and approved the final version of the manuscript.

[&]These authors contributed equally to this work.

[#]Correspondence should be addressed to Yan Ma, E-mail: mayan0825@sina.com; Huamin Zhang, E-mail: Hm_zhang01@163.com

Biographical notes of the first authors: Lei Zhang, female, born in 1993, PhD, majoring in evidence-based evaluation of traditional Chinese medicine; Lin Tong, female, born in 1985, PhD, majoring in data mining and knowledge organization of traditional Chinese medicine; Zihan Jia, female, born in 1998, PhD, majoring in artificial intelligence combined with traditional Chinese medicine.

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