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REVIEW

A Comprehensive Bibliometric Analysis of Brucellosis Research: Insights from CNKI and Web of Science Databases (2014-2023)

Jin Wang [1,2,]*, Qing Cao [3,]*, Shijun Guo [1,2], Yonglin Li [1,2], Guowei Li [1,2], Chunjiang Yan [1,2], Minan Zheng [1,2], Dawei Wang [4], Xiaotu Xi [1,2]

[1]Emergency Department, The Second Affiliated Hospital of Guangzhou University of Chinese Medicine(Guangdong Provincial Hospital of Chinese Medicine), Guangzhou, Guangdong, People's Republic of China; [2]The Second Clinical College of Guangzhou University of Chinese Medicine, Guangzhou, Guangdong, People's Republic of China; [3]The First Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou, Zhejiang, People's Republic of China; [4]The First Affiliated Hospital of Guangzhou University of Chinese Medicine, Guangzhou, Guangdong, People's Republic of China

*These authors contributed equally to this work

Correspondence: Dawei Wang, The First Affiliated Hospital of Guangzhou University of Chinese Medicine, Guangzhou, Guangdong, People's Republic of China, Tel +8613580469953, Email david@gzucm.edu.cn; Xiaotu Xi, Emergency Department, The Second Affiliated Hospital of Guangzhou University of Chinese Medicine(Guangdong Provincial Hospital of Chinese Medicine), Guangzhou, Guangdong, People's Republic of China, Tel +8613929556092, Fax +86-020-81887233, Email xxttm@gzucm.edu.cn

Purpose: This study aimed to analyze the current status, research hotspots, and frontiers of brucellosis from 2014 to 2023 using data from China National Knowledge Infrastructure (CNKI) and Web of Science (WoS) via CiteSpace, and to provide new insights for researchers in the field.

Material and Methods: Articles related to brucellosis published from 2014 to 2023 were retrieved from CNKI and WoS databases. CiteSpace V.6.3.R3 was employed to generate network maps and perform bibliometric analysis.

Results: A total of 467 references from CNKI and 3686 references from WoS were analyzed. In CNKI, the annual publication trend showed a decline, with Xu Liqing, Ma Li, and Yang Xuxin being the most prolific authors, and the Chinese Center for Disease Control and Prevention being the leading institution. The keyword cluster analysis identified 13 main clusters, while the keyword emergence map highlighted 15 keywords with the strongest emergence intensity. In contrast, WoS displayed an increasing trend in annual publications, with Heinrich Neubauer, Egyptian Knowledge Bank (EKB), and China as the top contributors in terms of authors, institutions, and countries, respectively. "Infection" was the most frequently occurring keyword. WoS analysis revealed 16 primary clusters and 25 keywords with high emergence intensity.

Conclusion: Between 2014 and 2023, CNKI saw a slight dip in brucellosis studies, while WoS research on it gained growing attention. CNKI literature primarily focuses on epidemiology, clinical manifestations, complications, and diagnostic methods, while WoS literature emphasizes pathogenesis and public health management. Effective prevention and control of brucellosis require interdisciplinary, cross-sectoral, and transnational cooperation.

Keywords: brucellosis, bibliometric analysis, CiteSpace, zoonotic infectious disease, One Health

Introduction

Brucellosis is a zoonotic infectious disease caused by bacteria of the genus *Brucella*, characterized by a wide range of clinical manifestations, including prolonged fever, fatigue, and joint pain. These symptoms not only affect human health but also have significant implications for animal husbandry.[1] Brucellosis remains a significant public health concern, with over 500,000 new cases reported globally each year. However, due to inadequate epidemiological reporting in many areas, official statistics likely capture only a small portion of the true incidence.[2,3] In China, brucellosis also continues to pose a growing threat. According to data from the National Bureau of Statistics (Available from: https://data.stats.gov.cn/

easyquery.htm?cn=C01), brucellosis is the fifth most commonly reported notifiable infectious disease in China's Category A and B classifications. In 2022, a total of 66,138 cases were officially reported nationwide, corresponding to an incidence of 4.69 cases per 100,000 people. Moreover, the number of reported cases has shown a sustained annual increase. The disease's diverse transmission routes, which are closely tied to residents' lifestyles, present significant challenges for effective epidemic prevention and control.[4]

In 1985, the World Health Organization (WHO) classified *Brucella* into six species: *Brucella abortus, B. melitensis, B. suis, B. ovis, B. canis*, and *B. neotomae*. More recently, four additional species have been identified: *B. inopinata, B. pinnipedialis, B. ceti*, and *B. microti*. Among these, *B. abortus, B. melitensis*, and *B. suis* are the primary species responsible for human infection.[5] Brucellosis transmission occurs through various routes, most commonly via direct or indirect contact with infected animals or contaminated environments, such as during animal husbandry, slaughtering, or fur processing. It can also be contracted by consuming contaminated food, such as improperly pasteurized dairy products and undercooked meat, inhaling aerosolized particles, or through insect vectors. Given these diverse transmission pathways, the prevention and control of brucellosis present significant public health challenges.[6]

Extensive research on brucellosis has been conducted both in China and globally, covering a wide range of topics including clinical analysis, diagnostic methods, epidemiology, and mechanistic studies. However, research trends and focal areas vary significantly across different regions.[7] CiteSpace, a software tool for bibliometric analysis, enables the examination and visualization of citation networks, helping researchers uncover the knowledge structure, research frontiers, and evolving trends in various scientific disciplines.[8] This study utilizes the CiteSpace bibliometric analysis method to systematically analyze and summarize the current status, trends, and hotspots of brucellosis research in China and worldwide, focusing on literature published from 2014 to 2023. Through a visual analysis of temporal trends, research hotspots, and collaboration networks, this study aims to identify the key characteristics and evolution patterns of brucellosis research, providing valuable insights for future studies and public health policy development.

Materials and Methods
Data Sources
For Chinese citations, data was sourced from the China National Knowledge Infrastructure (CNKI) database. The search query was formulated as follows: "Subject = Brucellosis", with the publication date set from January 1, 2014, to December 31, 2023. The source category was limited to "Core Journals of Peking University", and the literature classification was restricted to "Medical and Health Sciences and Technology". Irrelevant literature, including introductions, editorials, Q&A sections, and popular science articles, were excluded. The selected literature was exported in RefWorks format and subsequently converted into a format compatible with CiteSpace software for analysis.

For English citations, data was retrieved from the Web of Science (WoS) Core Collection. The search query used was: "Topic = ('Brucellosis' OR 'Brucella Disease')", with the publication years spanning 2014 to 2023. The document type was limited to "Article" or "Review Article", and the language was specified as "English". The retrieved records were exported in Full Record and Cited References format as plain text files.

Data Normalization and Description
To ensure consistency and accuracy in data analysis, several normalization steps were undertaken. These included merging synonymous keywords, completing abbreviations of institution names, removing suffixes representing sub-departments or laboratories within institutions, and consolidating institutions that have undergone name changes or have alternative names. These measures were implemented to streamline the data and facilitate more effective analysis within the CiteSpace software.

Data Analysis
The bibliographic information from the aforementioned Chinese and English literature was imported into CiteSpace 6.3. R3 (64-bit) Advanced for analysis. Parameter settings were based on guidelines from related literature.[9] The time span was set from January 2014 to December 2023, with each time slice representing one year. The threshold was set to Top

50, and the selected node types included author, institution, country, and keywords. The g-index was set to k=25 for Chinese data and k=15 for English data. The pruning method applied was pathfinder network scaling, including pruning the sliced networks and pruning the merged network. The software was then executed based on these settings. In the generated visual maps, the nodes represent research authors, institutions, or keywords, with the size of the nodes indicating the frequency of occurrence. The color of the nodes corresponds to the year of publication. The lines connecting nodes represent co-occurrence relationships, with the thickness of the lines indicating the strength of co-occurrence.

Ethics Approval and Informed Consent
This study does not involve ethics approval or informed consent from patients.

Results

Analysis of Literature Quantity
As illustrated in Figure 1, a total of 467 core journal articles on brucellosis research were retrieved from the CNKI database for the period from 2014 to 2023. The highest number of Chinese publications occurred in 2015, with 70 articles, followed by a general decline in subsequent years. In contrast, 3,686 English-language journal articles were retrieved from the WoS database over the same period. The trend in English publications shows an overall increase, peaking in 2022 with 435 articles, before experiencing a slight decline in 2023.

Analysis of Author, Institution, and Country Collaboration
Among the 467 core journal articles on brucellosis retrieved from the CNKI database, as shown in Figure 2A, a total of 319 authors contributed to the research. These authors formed 479 collaborative links, resulting in a network density of 0.0094. The largest author collaboration group was centered around Liqing Xu, Li Ma, Xuxin Yang, and Hongmei Xue from the Qinghai Institute for Endemic Disease Prevention and Control, each of whom published over 10 articles in the past decade. Additionally, as shown in Table 1, Hai Jiang, Buyun Cui, Zhiguo Liu, and Lingling Ren exhibited higher centrality compared to other authors, indicating more frequent collaborations within the network.

In the 3,686 English-language articles from the WoS database, as shown in Figure 2B, 532 authors contributed to the research, forming 1,063 collaborative links and resulting in a network density of 0.0075. The largest author collaboration group included Heinrich Neubauer and Falk Melzer from the Friedrich-Loeffler-Institut in Germany, Jacques Godfroid from the University of Tromsø-The Arctic University of Norway, and Maryam Dadar from the Agricultural Research, Education, and Extension Organization (AREEO) in Iran. Gamal Wareth, with the highest centrality, emerged as the most collaborative author according to Table 1.

Institutional Collaboration
In the CNKI database, authors of the Chinese literature were affiliated with 243 institutions, forming 204 collaborative links and resulting in a network density of 0.006. As shown in Figure 3A, the Chinese Center for Disease Control and Prevention had the highest publication volume. Additionally, Table 2 indicates that this institution also exhibited the most extensive collaboration with other institutions.

In the WoS database, authors were affiliated with 368 institutions, forming 483 collaborative links, yielding a network density of 0.0072. The institution with the highest publication volume was the Egyptian Knowledge Bank (EKB), as illustrated in Figure 3B. Table 3 lists the top ten institutions in brucellosis research publications and their centrality within the WoS database.

Country Collaboration Network
The analysis of the country collaboration network for English-language literature, as depicted in Figure 4A and Table 4, shows contributions from authors in 148 countries and regions. China led in publication volume, followed by the United States, India, Brazil, Iran, and Turkey, with a network density of 0.0223. Figure 4B illustrates a consistent annual increase
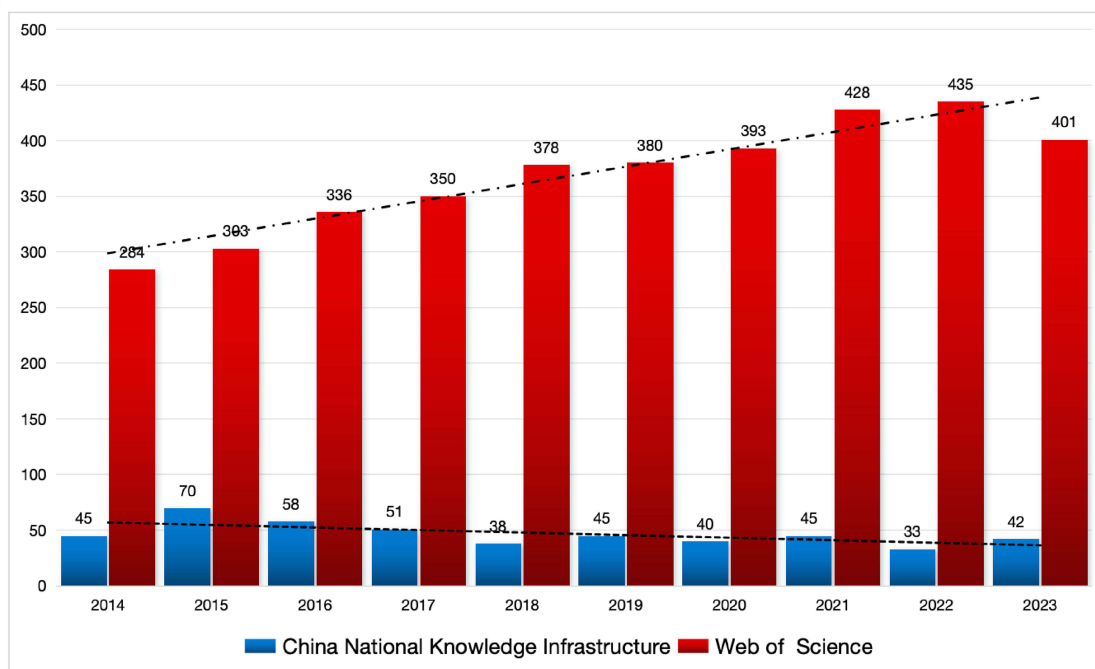
A.
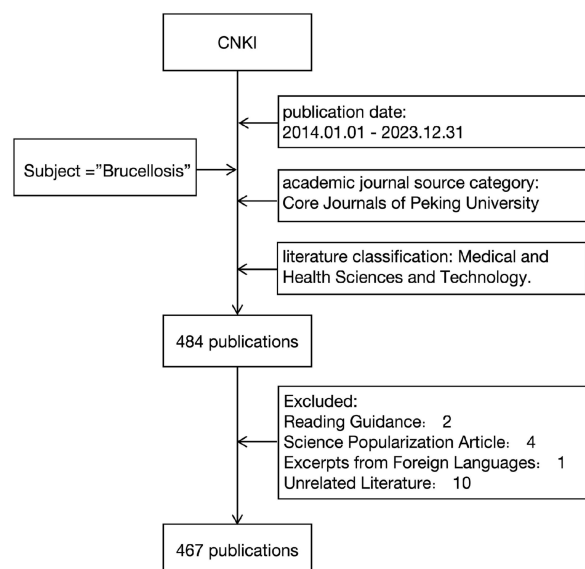
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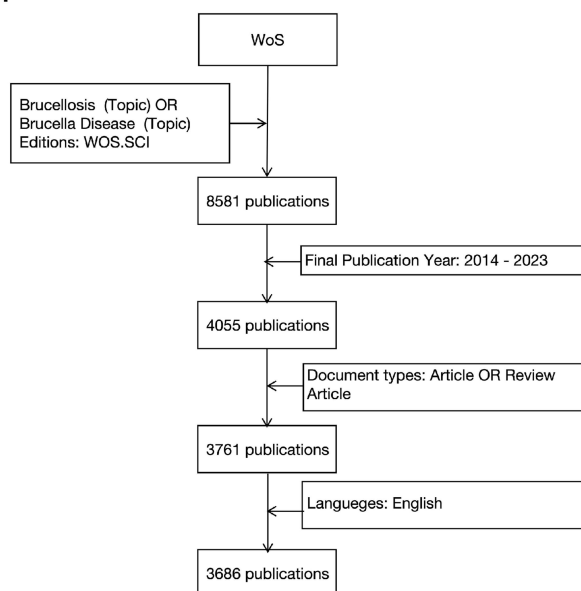
C.

Figure 1 (**A**) Data collection procedure in CNKI. (**B**) Data collection procedure in WoS. (**C**) Annual distribution of the publications of Brucellosis research literature from 2014 to 2023.

in the number of references authored by Chinese researchers. Countries with high centrality, indicating frequent international collaboration, included Sudan, Kenya, the Democratic Republic of the Congo, the United Arab Emirates, Lithuania, and Afghanistan.

Keyword Co-Occurrence and Clustering Analysis

The Chinese keyword co-occurrence network (Figure 5A) consists of 204 nodes and 371 links, with a network density of 0.0121. Table 3 lists the top 10 keywords in brucellosis research based on publication volume and centrality. In addition

Figure 2 Analysis of author collaboration network of Brucellosis research. (**A**) CNKI. (**B**) WoS.

Table 1 Top 10 Authors of Brucellosis Research Publications and Centrality

Ranking	CNKI				WoS			
	Author	Frequency	Author	Centrality	Author	Frequency	Author	Centrality
1	Xu, Liqing	11	Jiang, Hai	0.02	Neubauer, Heinrich	52	Wareth, Gamal	0.06
2	Ma, Li	11	Cui, Buyun	0.02	Melzer, Falk	47	Neubauer, Heinrich	0.05
3	Yang, Xuxin	11	Liu, Zhiguo	0.02	Kim, Suk	39	Melzer, Falk	0.05
4	Xue, Hongmei	10	Ren, Lingling	0.02	Godfroid, Jacques	31	Al dahouk, Sascha	0.05
5	Jiang, Hai	9	Xu, Liqing	0.01	Chen, Chuangfu	30	Bett, Bernard	0.04
6	Cui, Buyun	8	Ma, li	0.01	Cattle	27	Brangsch, Hanka	0.04
7	Hu, Guiying	7	Xue, Hongmei	0.01	Dadar, Maryam	26	Nthiwa, Daniel	0.04
8	Tian, Guang	7	An, Cuihong	0.01	Jiang, Hai	25	Godfroid, Jacques	0.03
9	Liu, Zhiguo	7	Tian, Guozhong	0.01	Zhang, Hui	24	Dadar, Maryam	0.03
10	An, Zhihong	7	Zhao, Hongyan	0.01	Reyes, alisha wehdnesday bernardo	22	Alamian, Saeed	0.03

to the primary search term "Brucellosis" and "Brucella", the most frequently appearing keywords include "Epidemiology", "Clinical Features", "Spondylitis", "Analysis", "Surveillance", and "Serology". These high-frequency keywords highlight key areas of focus in the field. Furthermore, in Table 5, keywords such as "Multilocus Variable-number Tandem-repeat Analysis", "Epidemiology", and "Animal Model" exhibit high centrality, suggesting their role as bridging concepts that connect different research themes.

The English keyword co-occurrence network, as can be seen from Figure 5B author keywords and publisher-provided keywords (also called Keyword Plus), comprising 352 nodes and 2,779 links, with a network density of 0.0069. As shown in Table 3, the most frequently occurring keywords are "infection", "abortus", "diagnosis", "melitensis", and "risk factors". In Table 5, the keywords with the highest centrality are "protection", "abortus infection", "outer membrane protein", "immunization", and "polymorphism".

Keyword Clustering Analysis

As illustrated in Figure 6, the CNKI keyword clustering view is divided into 13 distinct clusters, with a modularity value (Q) of 0.8524, indicating well-defined clustering structures, and an average silhouette value (S) of 0.985, suggesting high consistency and reliability of the clusters. The clustering labels are as follows: #0 Brucellosis, #1 Brucella, #2 Spondylitis, #3 Mechanism, #4 Risk Factors, #5 Epidemiology, #6 Seasonality, #7 Efficacy, #8 Analysis, #9 Vaccine, #10 Fever of Unknown Origin, #11 Genotype, and #12 Rifampin.

For the WoS keywords, 16 clusters were identified, with a Q value of 0.8412 and an S value of 0.9494, reflecting a similarly robust and reliable clustering outcome. The clustering labels include: #0 Protein, #1 Immune Response, #2 Brazil, #3 Brucella suis biovar 2, #4 One Health, #5 Brucella melitensis, #6 PCR, #7 Risk Factor, #8 Brucella canis, #9 Expression, #10 Public Health, #11 Identification, #12 Children, #13 Bovine Brucellosis, #14 Brucella abortus, and #15 Management.

In the timeline mapping of keywords (Figure 7), beyond the primary search term cluster, like Brucellosis, the Chinese keyword clusters related to *Brucella*, Spondylitis, Mechanism, Risk Factors, Epidemiology, and Efficacy have been consistently prominent over the past decade. Similarly, for the English keywords, the clusters related to Immune Response, *Brucella suis biovar 2*, PCR, and Public Health have remained focal areas of interest throughout the same period.

Keyword Burst Analysis

The keyword burst map of CNKI citations depicted in Figure 8A highlights the 15 most prominent keywords based on their burst intensity. Among these, "magnetic resonance imaging" shows the strongest occurrence burst, with a notable
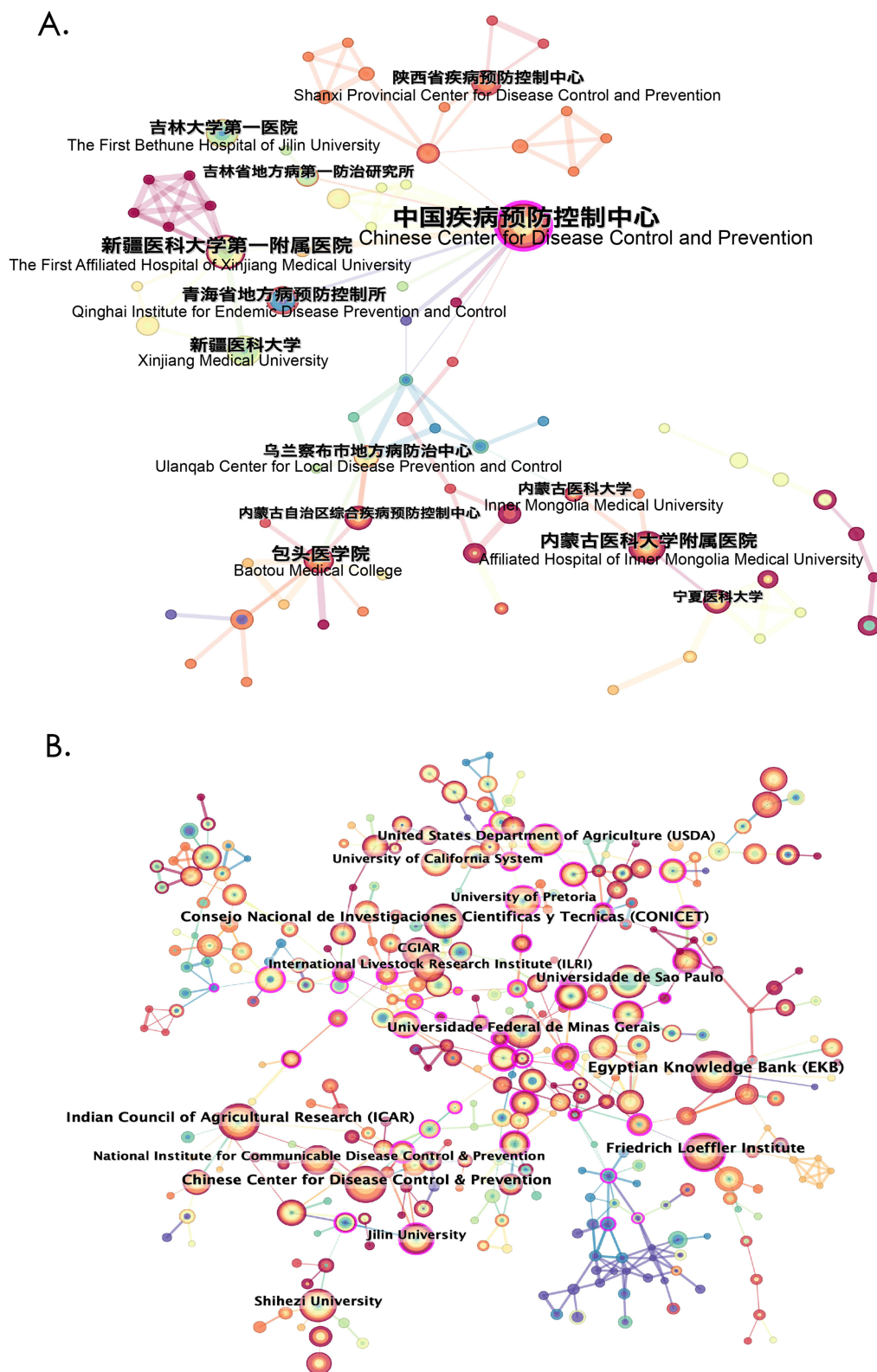
Figure 3 Analysis of Institution collaboration network of Brucellosis research. (**A**) CNKI. (**B**) WoS.

Table 2 Top 10 Institutions of Brucellosis Research Publications and Centrality in CNKI

Ranking	Institution	Frequency	Institution	Centrality
1	Chinese Center for Disease Control and Prevention	33	Chinese Center for Disease Control and Prevention	0.11
2	The First Affiliated Hospital of Xinjiang Medical University	14	Inner Mongolia Agricultural University	0.07
3	Baotou Medical College	12	Ulanqab Center for Local Disease Prevention and Control	0.05
4	Affiliated Hospital of Inner Mongolia Medical University	11	Sichuan Provincial Center for Disease Control and Prevention	0.05
5	The First Bethune Hospital of Jilin University	10	Baotou Medical College	0.04
6	Xinjiang Medical University	10	Academy of Military Medical Sciences	0.04
7	Qinghai Institute for Endemic Disease Prevention and Control	9	The First Affiliated Hospital of Xinjiang Medical University	0.03
8	Shanxi Provincial Center for Disease Control and Prevention	8	Affiliated Hospital of Inner Mongolia Medical University	0.03
9	Ulanqab Center for Local Disease Prevention and Control	8	Inner Mongolia Medical University	0.03
10	Inner Mongolia Medical University	7	Ningxia Medical University	0.02

Table 3 Top 10 Institutions of Brucellosis Research Publications and Centrality in WoS

Ranking	Institution	Frequency	Institution	Centrality
1	EKB	107	CHU de Nimes	1.00
2	Chinese Center for Disease Control & Prevention	84	Universite de Montpellier	0.46
3	ICAR	81	China institute of Veterinary Drug Control	0.34
4	Friedrich Loeffler Institute	79	Antalya Training & Research Hospital	0.34
5	CONICET	78	CIRAD	0.31
6	Universidade Federal de Minas Gerais	68	Ankara Ataturk Training & Research Hospital	0.30
7	Shihezi University	64	IZSAM Giuseppe Caporale	0.28
8	Universidade de Sao Paulo	64	China Animal Health & Epidemiology Center	0.28
9	USDA	57	Benha University	0.27
10	Jilin University	54	University of Georgia	0.27

Abbreviations: EKB, Egyptian Knowledge Bank; ICAR, Indian council of Agricultural Research; CONICET, Consejo Nacional de Investigaciones Cientificas y Tecnicas; USDA, United States Department of Agriculture; CHU de Nimes, Centre Hospitalier Universitaire de Nîmes; CIRAD, Centre de coopération internationale en recherche agronomique pour le développement; IZSAM, Istituto zooprofilattico sperimentale dell'Abruzzo e del Molise.

peak between 2017 and 2019. The burst of keywords can be broadly categorized into three distinct stages: (1) 2014–2017: During this period, keywords such as "epidemic", "infection", and "monitoring" burst, focusing on disease prevalence and analytical methods. Keywords like "serology" and "tube agglutination test" are associated with diagnostic techniques. (2) 2018–2020: This stage saw the burst of keywords including "arthritis", "magnetic resonance imaging", and "detection", which are related to complications and diagnostic assessment of brucellosis. Additionally, "retrospective study" became prominent, reflecting commonly employed research methodologies. (3) 2021–2023: Recent years have highlighted keywords such as "basic reproduction number", "spatial autocorrelation", and "outbreak", which pertain to epidemiological patterns. Keywords like "immunity" and "multilocus variable-number tandem repeat analysis" have burst, indicating a focus on understanding disease mechanisms.

Figure 8B presents 25 English keywords that have occurrence burst over the past decade, with "epidemiological situation" exhibiting the strongest burst between 2014 and 2016. The emergence of English keywords can also be categorized into three distinct stages: (1) 2014–2017: During this period, keywords such as "vaccines", "Mycobacterium bovis", "complications", "bovine tuberculosis", "mice", "features", "epidemiological situation", and "manifestations" burst. These terms encompass detailed descriptions of zoonotic diseases, clinical and epidemiological characteristics, as
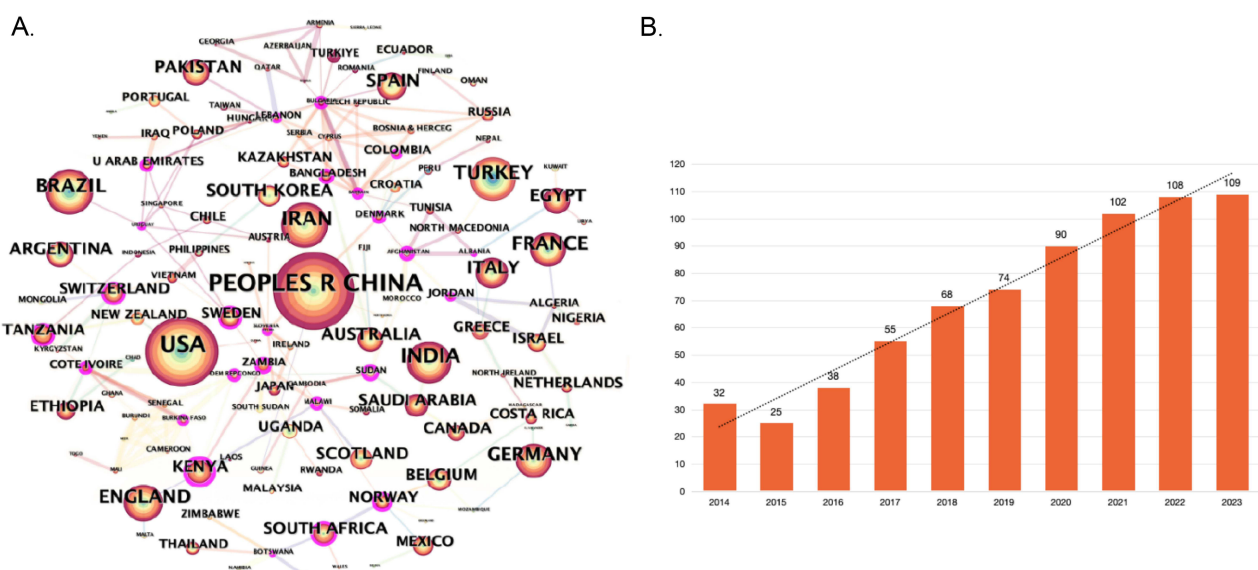
A.

B.

Figure 4 (**A**) Analysis of country collaboration network of Brucellosis research. (**B**) The quantity of references on brucellosis authored by Chinese researchers in WoS.

well as studies on mechanisms and vaccines. (2) 2017–2020: Keywords like "brucellosis model", "evolution", "intracellular survival", "Inner Mongolia", "system", "United States", "outer membrane proteins", "Toxoplasma gondii", "ruminants", and "T cells" gained prominence. These terms are primarily associated with research on disease mechanisms and the development of epidemiological models. (2) 2020–2023: The most recent period saw the burst of keywords such as "public health", "case report", "health", "dogs", "survival", and "China". The appearance of "dogs" indicates a growing focus on canine brucellosis, while "China" reflects an increase in research on brucellosis within the country. This stage underscores the impact of brucellosis on public health and the development of preventive health strategies.

Analysis of Cited References

Table 6 presents the top five cited references based on citation frequency. The highest-ranked citation is an article published in BMC Public Health, titled "Brucellosis Remains a Neglected Disease in the Developing World: A Call for Interdisciplinary Action." This article emphasizes the urgent need for public policies aimed at mitigating the socioeconomic impact of brucellosis on both human and animal populations. The second and fourth most cited references address different aspects of brucellosis: one focuses on diagnostic methods and management strategies, while the other explores the pathogenesis of the disease. Additionally, one of the top five references discusses the evolution of

Table 4 Top 10 Countries or Regions of Brucellosis Research Publications and Centrality

Ranking	Country	Frequency	Centrality	Country	Centrality
1	China	702	0.03	Sudan	0.58
2	USA	619	0.03	Kenya	0.45
3	Iran	270	0.03	Congo	0.41
4	India	253	0.00	United Arab Emirates	0.39
5	Brazil	243	0.00	Lithuania	0.37
6	Turkey	239	0.00	Afghanistan	0.35
7	England	184	0.03	Australia	0.29
8	Germany	163	0.03	Botswana	0.25
9	France	157	0.00	Sweden	0.24
10	Italy	133	0.00	Lebanon	0.24

Figure 5 Co-occurrence of keywords for Brucellosis research. (**A**) CNKI. (**B**) WoS.
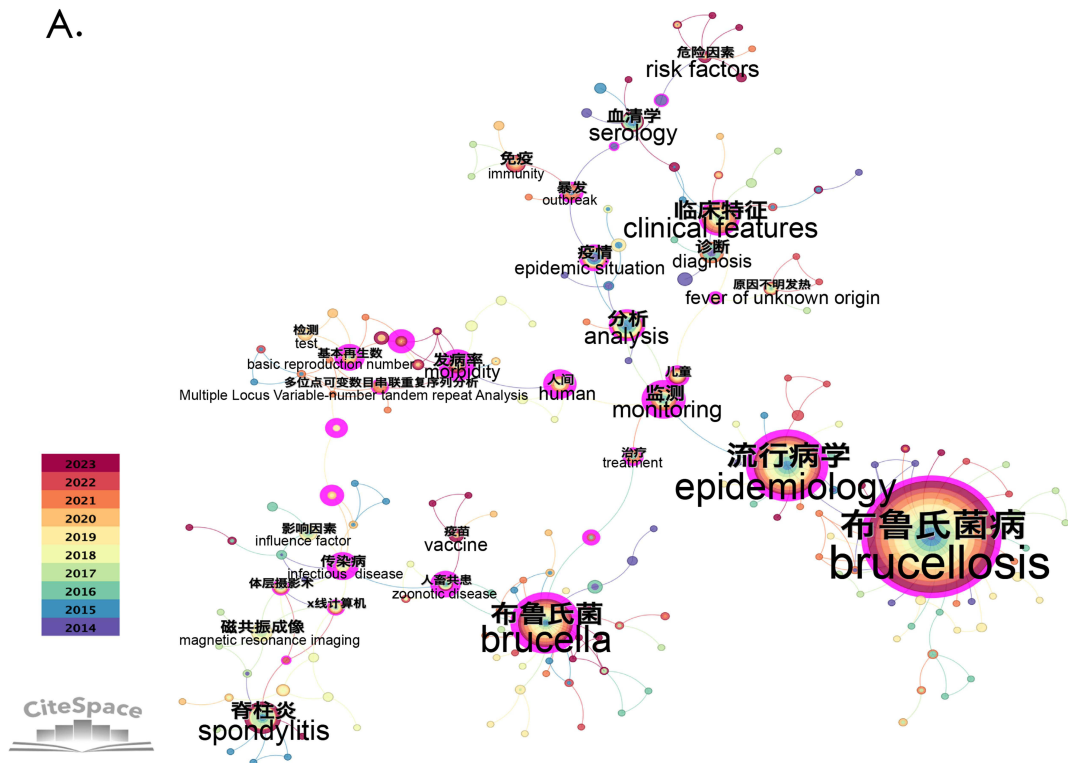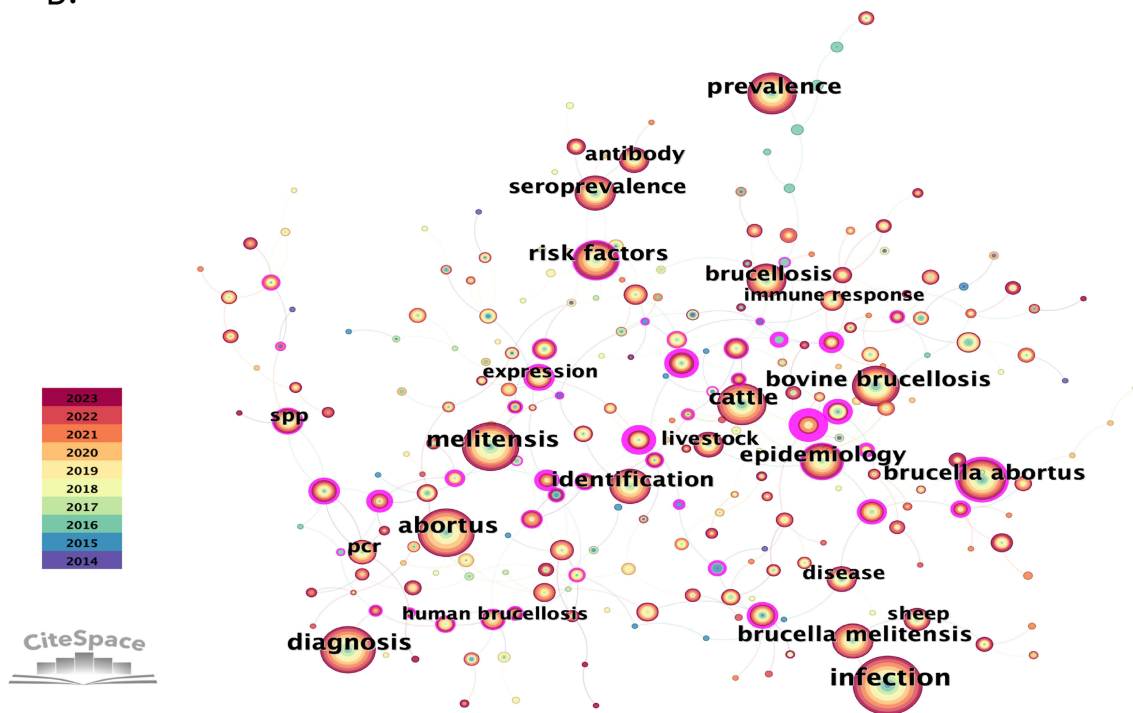
Table 5 Top 10 Keywords by Publications and Centrality

Ranking	CNKI				WoS			
	Keyword	Frequency	Keyword	Centrality	Keyword	Frequency	Keyword	Centrality
1	Brucellosis	314	Brucella	0.98	Infection	586	Protection	0.65
2	Epidemiology	102	Multilocus variable-number tandem-repeat analysis	0.83	Abortus	445	Abortus infection	0.38
3	Brucella	65	Brucellosis	0.77	Diagnosis	434	Outer membrane protein	0.29
4	Clinical features	33	Epidemiology	0.76	Melitensis	425	Immunization	0.26
5	Spondylitis	24	Animal model	0.36	Risk factors	355	Polymorphism	0.26
6	Analysis	20	Vaccine	0.35	Cattle	325	United States	0.24
7	Monitoring	17	Diagnosis	0.31	Prevalence	317	Risk factor	0.23
8	Serology	13	Zoonotic disease	0.31	Bovine brucellosis	296	Ifn gamma	0.21
9	Diagnosis	12	Morbidity	0.24	Brucella abortus	293	Linked immunosorbent assay	0.20
10	Epidemic situation	11	Spondylitis	0.18	Identification	262	Association	0.19

epidemiological characteristics of brucellosis in China. The fifth reference, featured in Clinical Microbiology Reviews, a leading journal with an impact factor of 19, concentrates on laboratory diagnosis of brucellosis. This reference highlights the importance of accurate diagnostic techniques in the effective management of the disease.

Analysis of Cited Journals

Table 7 lists the top 10 co-cited journals. Veterinary Microbiology ranks first with 1,812 citations, indicating it is among the most frequently cited journals in the field. It is followed by PLoS One, Journal of Clinical Microbiology, Emerging Infectious Diseases, and Preventive Veterinary Medicine. The journal Infection and Immunity has the highest centrality score (0.73), reflecting its significant influence and connectivity within the network of cited journals. Notably, Lancet Infectious Diseases, ranked 7th, has the highest impact factor (36.4), underscoring its prominence and authority in the field.

Discussion

The CNKI database is the largest repository of academic papers in China, with Chinese core journals representing a subset of high-impact, rigorously selected publications that set the standard for academic excellence across various disciplines. On the global stage, the Science Citation Index Expanded (SCI-Expanded) forms the core of the WoS database, encompassing high-quality literature from thousands of scientific and technical journals worldwide. It provides comprehensive citation data, which is crucial for tracking citation patterns, evaluating scientific output, and analyzing research trends. Together, these resources are indispensable tools for assessing the academic impact and evolution of brucellosis research.

This study presents a comprehensive quantitative review of brucellosis-related publications from the CNKI and WoS databases, spanning the years 2014 to 2023. The objective was to assess the current research landscape, identify prevalent themes, and pinpoint emerging trends in the field of brucellosis research. A total of 476 references from CNKI and 3,686 references from WoS were analyzed.

Analysis of Publication Trends

The analysis of publication trends reveals a notable difference between the CNKI and WoS databases. The number of brucellosis-related papers in the CNKI database is relatively low and has been declining over the years. In contrast, publications in the WoS database have shown a consistent annual increase, with Chinese authors contributing
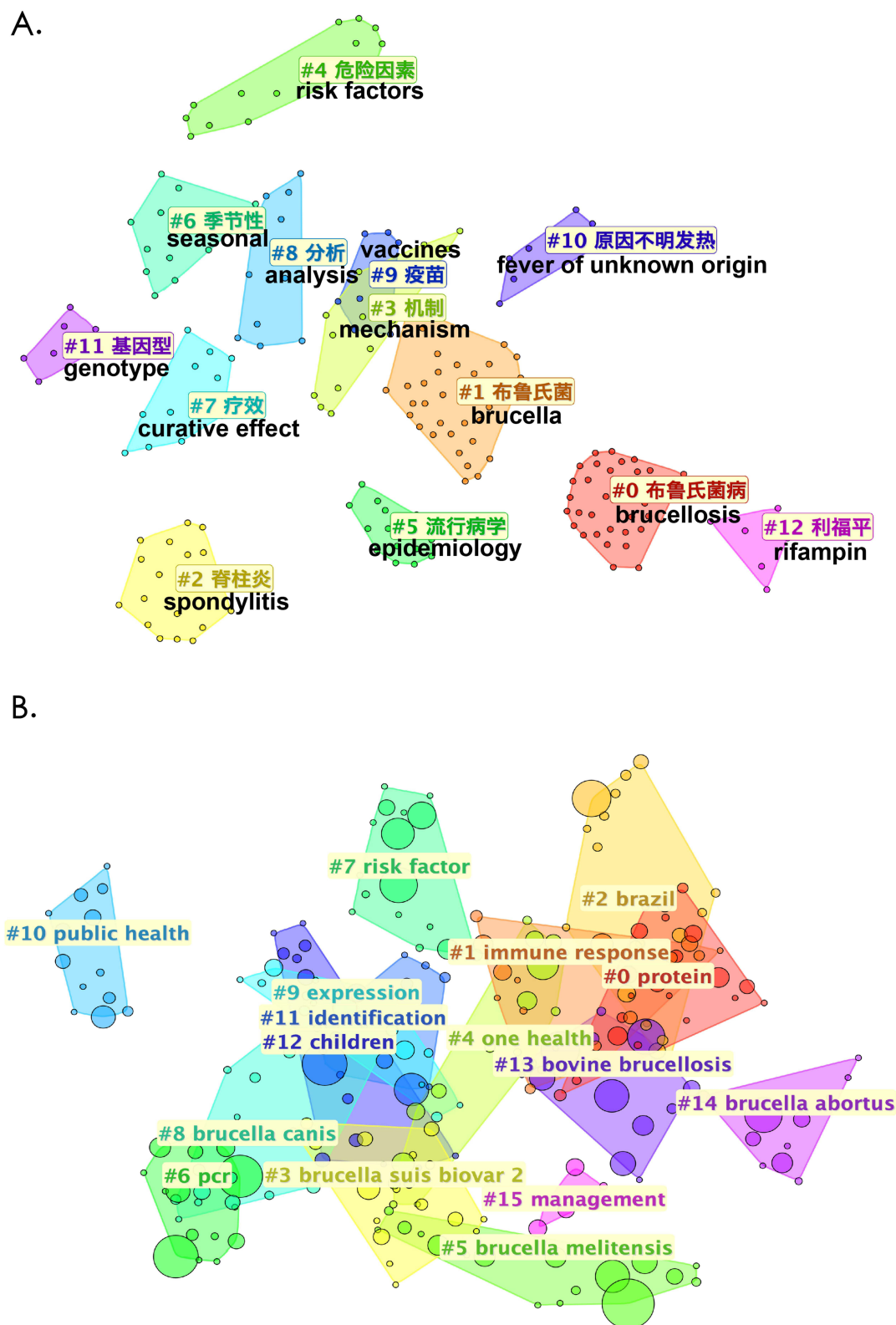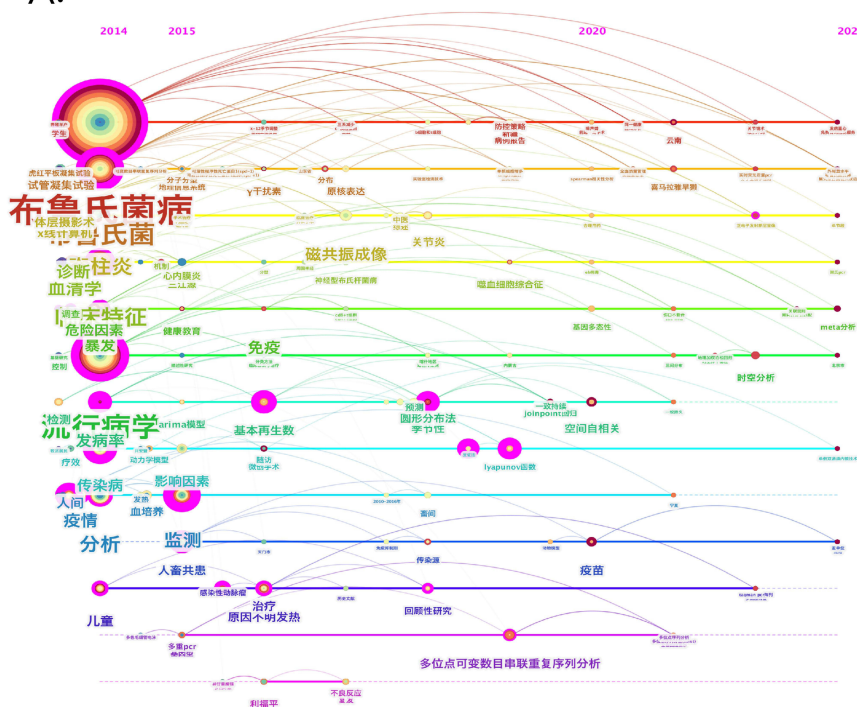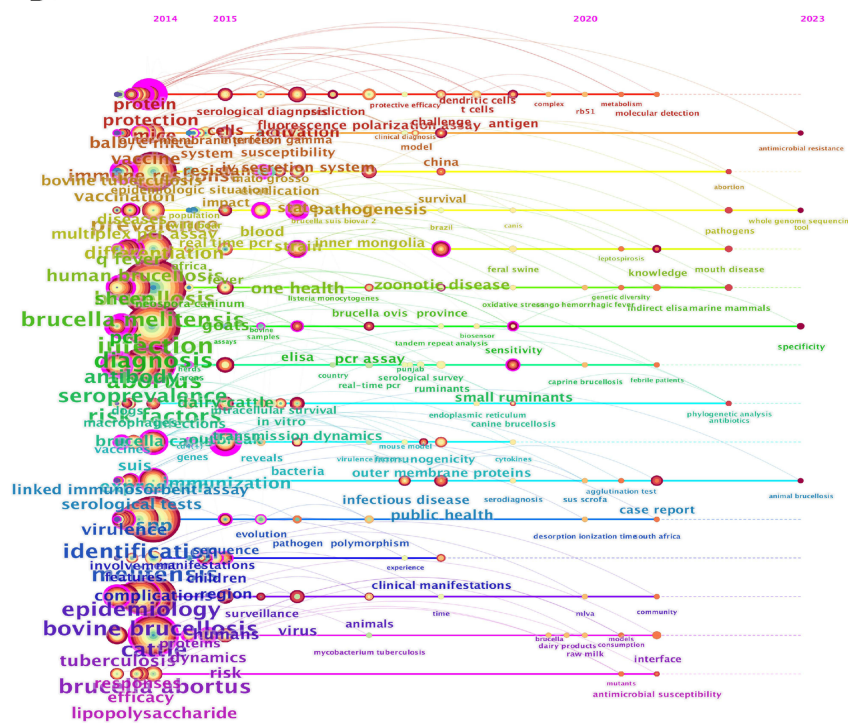
Figure 6 Clustering map of keywords for Brucellosis research. (**A**) CNKI. (**B**) WoS.

Figure 7 Timeline mapping of keywords for Brucellosis research. (**A**) CNKI. (**B**) WoS.

A.

Keywords	Year	Strength	Begin	End	2014 – 2023
疫情 epidemic situation	2014	2.4	2014	2015	
血清学 serology	2014	2.12	2014	2017	
试管凝集试验 tube agglutination test	2014	1.5	2014	2016	
感染 infection	2014	1.41	2014	2015	
分析 analysis	2014	2.1	2015	2016	
监测 monitoring	2015	1.53	2015	2016	
磁共振成像 magnetic resonance imaging	2017	3.93	2017	2019	
关节炎 arthritis	2018	1.64	2018	2020	
回顾性研究 retrospective study	2018	1.23	2018	2020	
检测 test	2014	1.86	2019	2020	
基本再生数 basic reproduction number	2016	1.32	2019	2021	
免疫 immunity	2016	1.4	2020	2023	
空间自相关 spatial autocorrelation	2020	1.29	2020	2023	
暴发 outbreak	2014	1.95	2021	2023	
多位点可变数目串联重复序列分析 multilocus variable-number tandem repeat analysis	2019	1.82	2021	2023	

B.

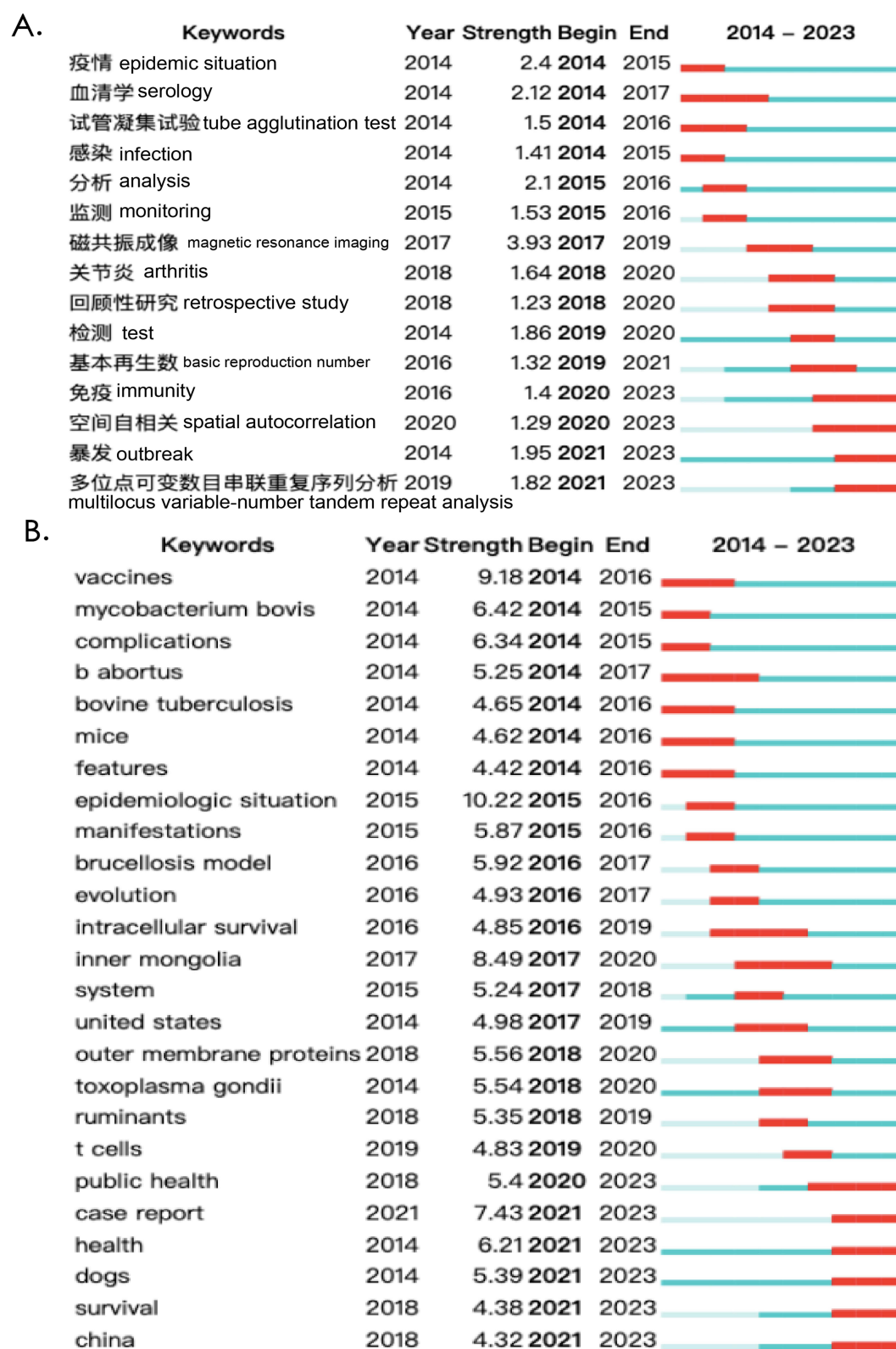| Keywords	Year	Strength	Begin	End	2014 – 2023
vaccines	2014	9.18	2014	2016	
mycobacterium bovis	2014	6.42	2014	2015	
complications	2014	6.34	2014	2015	
b abortus	2014	5.25	2014	2017	
bovine tuberculosis	2014	4.65	2014	2016	
mice	2014	4.62	2014	2016	
features	2014	4.42	2014	2016	
epidemiologic situation	2015	10.22	2015	2016	
manifestations	2015	5.87	2015	2016	
brucellosis model	2016	5.92	2016	2017	
evolution	2016	4.93	2016	2017	
intracellular survival	2016	4.85	2016	2019	
inner mongolia	2017	8.49	2017	2020	
system	2015	5.24	2017	2018	
united states	2014	4.98	2017	2019	
outer membrane proteins	2018	5.56	2018	2020	
toxoplasma gondii	2014	5.54	2018	2020	
ruminants	2018	5.35	2018	2019	
t cells	2019	4.83	2019	2020	
public health	2018	5.4	2020	2023	
case report	2021	7.43	2021	2023	
health	2014	6.21	2021	2023	
dogs	2014	5.39	2021	2023	
survival	2018	4.38	2021	2023	
china	2018	4.32	2021	2023	

Figure 8 Keywords with the strongest citation bursts of Brucellosis research. (**A**) CNKI. (**B**) WoS.

Table 6 The Top 5 Cited References in WoS

Ranking	Author	Journal	Year	Times Cited	Journal
1	Frank KA[10]	Brucellosis remains a neglected disease in the developing world: a call for interdisciplinary action	2018	161	BMC Public Health
2	Paul de Figueiredo[11]	Pathogenesis and Immunobiology of Brucellosis: Review of Brucella–Host Interactions	2015	109	The American Journal of Pathology
3	Shengjie Lai[12]	Changing Epidemiology of Human Brucellosis, China, 1955–2014	2017	99	Emerging Infectious Disease
4	M. Ducrotoy[13]	Brucellosis in Sub-Saharan Africa: Current challenges for management, diagnosis and control	2017	90	Acta Tropica
5	Pablo Yagupsky[14]	Laboratory Diagnosis of Human Brucellosis	2020	80	Clinical Microbiology Review

Table 7 The Top 10 Co-Cited Journals

Ranking	Journal	Times cited	Centrality	IF (2023)
1	Veterinary Microbiology	1812	0.14	2.4
2	PLoS One	1780	0.17	2.9
3	Journal of Clinical Microbiology	1137	0.01	6.1
4	Emerging Infectious Diseases	1127	0.00	7.2
5	Preventive Veterinary Medicine	1103	0.12	2.2
6	Revue Scientifique et Technique-Office International Des Epizooties	1078	0.01	1.9
7	Lancet Infectious Diseases	1060	0.01	36.4
8	PLoS Neglected Tropical Diseases	1004	0.01	3.4
9	Infection and Immunity	947	0.73	2.9
10	Clinical Infectious Diseases	768	0.01	8.2

significantly to this growth. This trend indicates that China's focus on brucellosis aligns with global research trends and has not diminished. Since 2020, the number of reported human brucellosis cases in China has been increasing, accompanied by significant geographical expansion. Historically concentrated in northern regions, brucellosis has now spread to southern provinces, largely due to the increased movement of people, animals, and animal products from endemic regions.[15] As a result, brucellosis remains a critical public health concern in China that demands continued attention.[16]

National and Institutional Collaboration

In terms of publication quantity, analysis of the WoS database shows that China leads globally in brucellosis research, followed by the United States, Iran, India, Brazil, and other countries. However, the top 10 countries by publication volume demonstrate low centrality (less than 0.1), suggesting a preference for conducting research independently. In contrast, countries with higher centrality, such as Sudan, Kenya, the Democratic Republic of the Congo, and the United Arab Emirates, are primarily situated in West Asia and Africa. This indicates that while brucellosis is a critical global health issue, disparities in research resources and capabilities result in countries like China, the US, and India generating substantial scientific output independently. Conversely, less developed regions often rely on international collaboration to access external resources and support, which is crucial for addressing their urgent health challenges.[17] International collaboration is therefore essential in global public health, particularly for resource-limited countries. Such collaboration not only helps these countries tackle major health threats but also promotes the exchange and advancement of scientific knowledge on a global scale.[18]

From an institutional perspective, authors of papers in the CNKI database are predominantly affiliated with the Chinese Center for Disease Control and Prevention (CDC). Key research institutions are located in livestock-dense provinces such as Inner Mongolia, Xinjiang, and Shaanxi. These institutions often have stable internal research teams, but there is limited collaboration between institutions. In the WoS database, the Egyptian Knowledge Bank (EKB) leads

in publication volume, with the top 10 institutions mainly comprising agricultural research centers, universities, and government departments, including three from China. CHU de Nîmes, a medical institution in Nîmes, France, has the highest centrality, reflecting its significant role in integrating healthcare, education, and research within the French public health system. Similar to national trends, the top 10 institutions by publication volume exhibit low centrality, indicating limited collaboration with other institutions.

Author Collaboration

In the CNKI literature, key researchers from the Qinghai Provincial Institute for Endemic Disease Prevention and Control, such as Liqing Xu, Li Ma, Xuxin Yang, and Hongmei Xue, have each published over 10 papers in the past decade. This group represents the largest author collaboration network within CNKI, primarily focusing on the epidemiological analysis of human and animal brucellosis in Qinghai Province, China, and the identification and study of *Brucella* strains.[19,20] For instance, they have utilized multilocus variable-number tandem-repeat analysis (MLVA) to compare the genetic characteristics of B. melitensis and B. abortus isolated from humans and animals. Their findings suggest that MLVA typing can be a crucial method for enhancing brucellosis monitoring and control strategies.[21]

In the WoS literature, Heinrich Neubauer from the Friedrich Loeffler Institute in Germany stands out as the most prolific author. Neubauer has made significant contributions to the study of brucellosis, particularly in the areas of epidemiology, diagnosis, and control, and has been involved in numerous international collaborations. His work is highly cited, establishing him as a leading figure in the global academic community focused on brucellosis and related infectious diseases. Along with collaborators like Falk Melzer, Jacques Godfroid, and Maryam Dadar, Neubauer forms the largest author collaboration group in WoS. However, similar to their CNKI counterparts, this group's centrality is relatively low, indicating limited collaboration with researchers outside their immediate network.

Cited Researchers and Leading Journals

In the WoS database, the most frequently cited reference is "Brucellosis Remains a Neglected Disease in the Developing World: A Call for Interdisciplinary Action" by Katherine A. Franc et al.[10] This seminal work highlights the substantial burden that brucellosis places on human healthcare systems and its detrimental impact on economic growth at individual, community, and national levels, particularly in developing regions. The authors advocate for the implementation of public policies designed to mitigate the socioeconomic effects of brucellosis on both human and animal populations. They emphasize the need for an interdisciplinary and collaborative "One Health" approach, which includes public education, the establishment of robust disease surveillance and reporting systems in both veterinary and medical fields, and targeted control campaigns for livestock and wildlife species.[22]

Among the journals publishing brucellosis research, Veterinary Microbiology, published by Elsevier, stands out as the most prolific, particularly within the fields of agroforestry and veterinary medicine.[23] Lancet Infectious Diseases holds the highest impact factor (36.4) among the top 10 journals in this domain, underscoring its influence in disseminating high-impact research.[24] The diversity of leading journals, spanning veterinary medicine, clinical medicine, pathogenic microbiology, and agroforestry, reflects the multidisciplinary nature of brucellosis research. Addressing the global challenges posed by this disease requires enhanced collaboration across these varied disciplines, ensuring a systematic and comprehensive response.

Research Hotspots and Trends of Epidemiology, Clinical Features, and Diagnostic Methods

Analysis of keyword co-occurrence, clustering, timeline maps, and burst trends reveals that research on brucellosis has consistently focused on its epidemiology, clinical features, and diagnostic methods across both CNKI and WoS literature.

The disease's spread is closely linked to animal husbandry, with individuals involved in cattle and sheep herding, slaughtering, and meat or dairy processing identified as high-risk.[25] Spatial autocorrelation is key in understanding brucellosis epidemiology, as it identifies clustering patterns and geographic factors influencing disease distribution. This analysis is essential for pinpointing high and low incidence areas, guiding prevention strategies, and optimizing resource

allocation.[15] The rise in brucellosis cases in non-pastoral areas, linked to raw meat handling and unsterilized dairy consumption, underscores the need for improved training for practitioners, strict quarantine measures, and better oversight of dairy production to manage the disease's spread beyond traditional pastoral regions.[26,27] *Brucella spondylitis*, affecting 2% to 53% of brucellosis patients, presents with fever and localized spinal pain. If untreated, it can become chronic, severely impacting quality of life and work. The disease often recurs and leads to complications. Despite its increasing prevalence, standardized diagnosis and treatment protocols are lacking due to limited research and variable clinical practices.[7,28] While isolating *Brucella* bacteria remains the gold standard for diagnosis, its complexity and time demands lead to reliance on serological tests.[14] Multilocus variable-number tandem-repeat analysis (MLVA) has emerged as a valuable tool, providing high-resolution differentiation of *Brucella* strains and aiding in epidemiological investigations. MLVA helps trace infections, analyze transmission routes, and manage outbreaks, enhancing disease management and prevention.[29,30] Recent research has increasingly focused on developing vaccines to reduce *Brucella* infections in livestock, highlighting the critical need to address this zoonotic disease at its source.[31,32]

Research Hotspots and Trends in Mechanism Research

Keyword analysis of WoS literature highlights a greater emphasis on the mechanisms of brucellosis compared to CNKI. The pathogenesis of brucellosis involves *Brucella* disrupting both innate and adaptive immune responses, leading to disease progression. Key factors in this process include outer membrane proteins (OMPs) and lipopolysaccharides (LPS). OMPs are crucial for *Brucella's* interaction with host cells, facilitating its invasion and survival.[33] LPS helps *Brucella* evade immune detection by interfering with complement activation and neutrophil function. *Brucella's* immune evasion strategy also involves modulating the IFN-gamma signaling pathway. Genetic variations in this pathway can affect the host's immune response, potentially leading to drug resistance and chronic infection.[34]

Research Hotspots and Trends in Public Health Management

As brucellosis transmission becomes more complex and crosses borders, public health research has shifted toward integrated prevention and control strategies. The WHO's "One Health" initiative emphasizes the interconnection between human, animal, and environmental health, promoting global collaboration to address brucellosis.[22] Significant advancements include improved surveillance and reporting systems for early detection and rapid response in endemic areas. Strategies to reduce human infection risks involve livestock vaccination, strict food safety measures, and enhanced public health education. Nevertheless, challenges remain, especially in resource-limited regions where sector coordination and resource access are insufficient. Future efforts should focus on optimizing global collaboration and strengthening policy implementation under the One Health framework to more effectively manage brucellosis.[35,36]

Limitations

This study has several limitations. Firstly, due to the inherent constraints of the CNKI database, it is not possible to analyze co-cited authors, references, and journals within this platform, potentially leading to an incomplete analysis. Secondly, although the study focuses on high-quality Chinese core journals within CNKI, some invalid keywords, such as "analysis", which lack clear directionality, were identified. This issue may be linked to the keyword selection habits of Chinese authors and could affect the reliability of the conclusions drawn. Lastly, the study only considered literature published in English from the WoS database, which may limit the comprehensiveness of the data and the generalizability of the findings.

Conclusion

An analysis of publication trends from 2014 to 2023 revealed distinct trajectories between the two databases: brucellosis-related studies in CNKI showed a declining trend, whereas those indexed in WoS exhibited steady growth. Notably, the substantial contribution of Chinese authors to WoS publications indicates continued research engagement and investment in brucellosis studies in China. Literature analysis identifies key research hotspots, including epidemiology, clinical manifestations and complications, and diagnostic methods. Meanwhile, WoS publications have placed greater emphasis

on disease mechanisms and public health interventions. Effectively addressing brucellosis requires interdisciplinary, cross-sectoral, and international collaboration to formulate and execute comprehensive strategies to curb its transmission.

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Disclosure

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