A bibliometric analysis using VOSviewer of publications on COVID-19

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Background: As a global pandemic, COVID-19 has aroused great concern in the last few months and a growing number of related researches have been published. Therefore, a bibliometric analysis of these publications may provide a direction of hot topics and future research trends.

Methods: The global literatures about COVID-19 published between 2019 and 2020 were scanned in the Web of Science collection database. "COVID-19" "Novel Coronavirus" "2019-nCoV" and "SARS-CoV-2" were used as the keywords to reach the relevant publications. VOSviewer was applied to perform the bibliometric analysis of these articles.

Results: Totally 3,626 publications on the topic of COVID-19 were identified and "COVID-19" with a total link strength of 2,649 appeared as the most frequent keyword, which had a strong link to "pneumonia" and "epidemiology". The mean citation count of the top 100 most cited articles was 96 (range, 26–883). Most of them were descriptive studies and concentrated on the clinical features. The highest-ranking journal was British medical journal with 211 publications and the most cited journal was Lancet with 2,485 citation counts. Eleven articles written by Christian Drosten from Berlin Institute of Virology have been cited for 389 times and 40 articles from Chinese Academy of Sciences have been cited for 1,597 times which are the most cited author and organization. The number of collaborators with China is 44 and the total link strength is 487. The main partners of China are USA, England and Germany. The published literatures have focused on three topics: disease management, clinical features and pathogenesis.

Conclusions: The current growth trends predict a large increase in the number of global publications on COVID-19. China made the most outstanding contribution within this important field. Disease treatment, spike protein and vaccine may be hotspots in the future.

Keywords: Bibliometric analysis; novel coronavirus; coronavirus disease 2019 (COVID-19); SARS-CoV-2; trends

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Introduction

As a new acute infectious disease, coronavirus disease 2019 (COVID-19) was first reported in December 2019 in Wuhan, then spread to all the provinces of China and now has become a global pandemic (1). By 20th May 2020, a total of 4,735,622 patients were confirmed in over 200 countries, including 307,537 death cases (2), which resulted in a great public concern. Thus, a series of descriptive researches about the clinical features of COVID-19 have been published by Chinese scholars at the end of 2019. With a deeper understanding of the pathophysiology, more studies focused on antiviral treatment and immune regulation were performed as well as those concentrated on pathology of the disease and vaccine research. In mid-May of this year, more than ten thousand articles have been published and many countries with pandemic have gained a lot of experience from them.

Bibliometrics is a statistical method which could quantitative analysis the research papers concerned about one special topic via mathematical ways (3). It could also access the quality of the studies, analysis the key areas of researches and predict the direction of future studies. The Web of Science (WOS) online database includes almost all the important research papers which also provides built-in analysis tools to produce representative figures. What is more, the search results from WOS could be exported to a software for further analysis like VOSviewer.

However, no bibliometric analysis of publications on COVID-19 has been published till now. As the COVID-19 pandemic has not been fully under control and more knowledge should be obtained from these reference, bibliometric analysis of it is in critical need. Therefore, our study was performed timely to provide a broad understanding of COVID-19 and future research directions.

Methods

The global literatures about COVID-19 published between 2019 to 2020 were scanned in the WOS collection database. The search terms applied to identify the closest matching publication included "COVID-19" or "Novel Coronavirus" or "SARS-CoV-2" or "2019-nCoV" which was used as the keyword in the title. As COVID-19 was first found in Wuhan and a fairly large number of the research papers were written in Chinese, language was not limited during the process of retrieval.

The information for the documents that meet the requirements contained year of publication, language, journal, title, author, affiliation, keywords, document type, abstract and counts of citation which were exported into CSV format. The date of the retrieval was 20th May 2020. VOSviewer (version 1.6.10) was used to analyze the Co-authorship, Co-occurrence, Citation, Bibliographic coupling, Co-citation and themes. Two standard weight attributes are applied which are defined as "Links attribute" and "Total link strength attribute" (4).

Results

Bibliometric analysis of publication output

Totally 15,805 publications on the topic of COVID-19 were identified in WOS database between 2019 and 2020 which included 10,601 (67.1%) original research articles, 1,189 (7.5%) review articles, 2,296 (14.5%) editorials and 1,719 other forms of publications including letters, case reports, etc. Among them, 15,619 (98.8%) papers were published in 2020 (till 20th May) and the other 186 were published in December 2019. Almost all the publications (14,609, 92.4%) were written in English, followed by 623 Chinese publications and 11,575 (73.2%) papers were open access. In all the published papers, 3,626 could be indexed in the WOS core database.

Bibliometric analysis of the keywords

Keywords provided by authors of the paper and occurred for more than 5 times in the WOS core database were enrolled in the final analysis. Of the 4,532 keywords, 344 met the threshold. The keywords that appeared most were "COVID-19" (total link strength 2,649) and "coronavirus" (total link strength 2,024) which had a strong link to "pneumonia" and "epidemiology". As comparisons of COVID-19, SARS and MERS were another two keywords and the total link strength of each were more than 300 (*Figure 1A*). A word cloud was also created to show the frequency of the keywords which occurred for more than 10 times. It was indicated that "COVID-19" was the most frequent followed by "pneumonia", "outbreak" and "infection" (*Figure 1B*).

Bibliometric analysis of the citations and publications

The top 100 most cited articles in the field of COVID-19 were listed in *Table S1*. Most of them were clinical studies
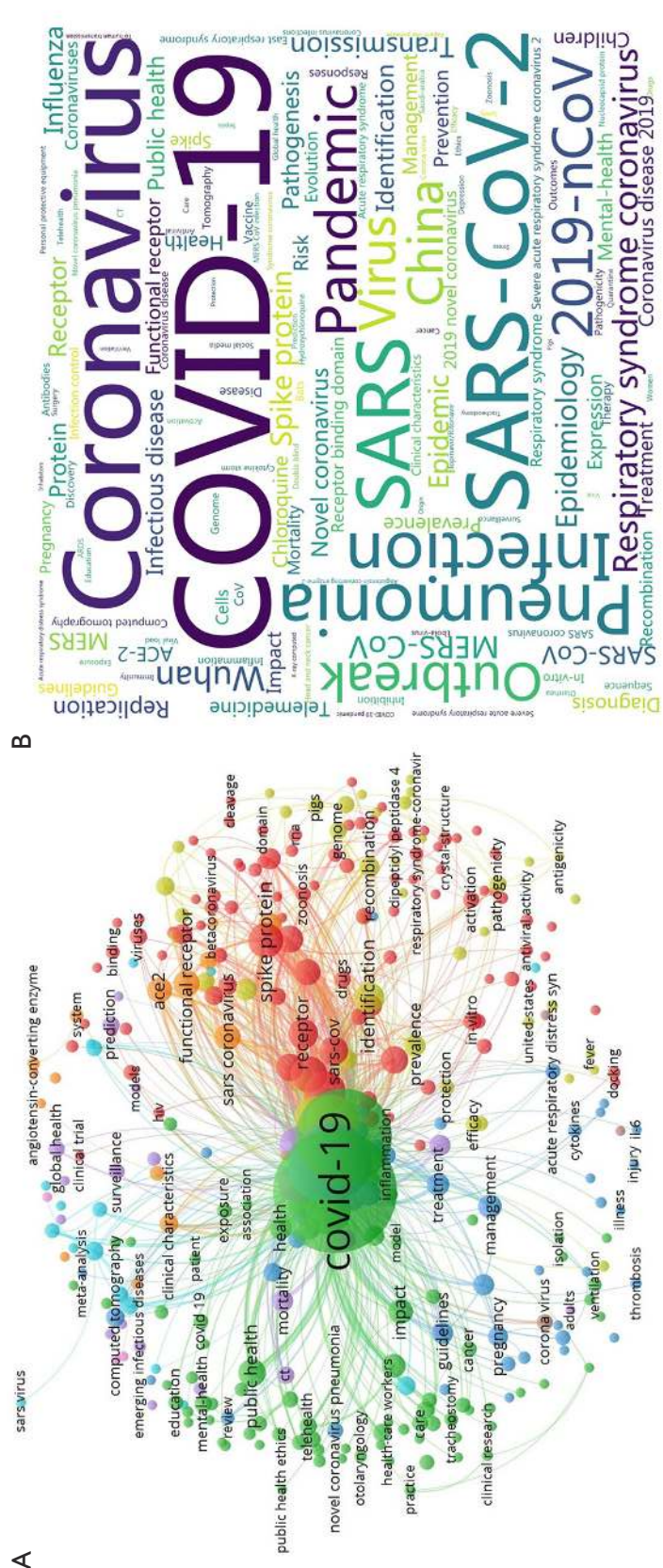
Figure 1 Bibliometric analysis of the keywords in publications of COVID-19. (A) Co-occurrence of keywords. The size of nodes indicates the frequency of occurrence. The curves between the nodes represents their co-occurrence in the same publication. The shorter the distance between two nodes, the larger the number of co-occurrence of the two keywords. (B) Word cloud. 137 keywords which occurred for more than 10 times were enrolled. The font size represents the frequency of occurrence. Keywords such as "Coronavirus", "COVID-19" and "epidemiology" occurred most common. "Prediction" and "Isolation" are rare.

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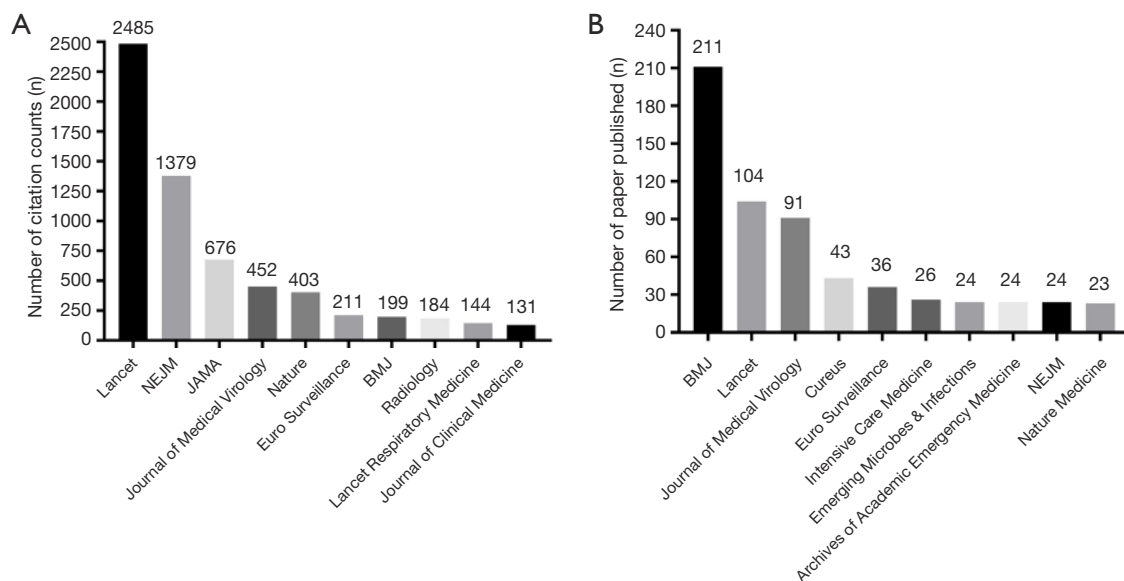Yu et al. A bibliometric analysis of COVID-19

Figure 2 The top ten most active journals. (A) The top ten journals with most-cited articles in the field of COVID-19; (B) the top ten journals with most published articles in the field of COVID-19.

including descriptive studies, case series and case report, the others were research articles which mainly focused on viral genomes and disease transmission. The mean citation count of the top 100 most cited articles was 96 (range, 26–883). All of the papers were published in 2020, and 54 of them were written by Chinese scholars. Thirteen articles were published on the special columns for COVID-19 of the *Lancet*.

Nine hundred and nineteen journals have published papers about COVID-19 and 141 of them have published more than 5 articles. In total, 606 papers were published in the top ten active journal which accounted for 16.7% of the publications in the WOS core database. The highest-ranking journal was *British Medical Journal* (*BMJ*), with 211 publications and an impact factor (IF) of 27.604. The most cited journal was the *Lancet*, with 2,485 citation counts and IF of 59.102 (*Figure 2*).

The top ten most active countries, organizations and authors of COVID-19 publications are listed in *Table 1*. Eleven articles written by Christian Drosten from Berlin Institute of Virology have been cited for 389 times and 40 articles from Chinese Academy of Sciences have been cited for 1,597 times which are the most cited author and organization. Eight hundred and thirty-eight papers from China have been cited for 7,273 times and the total link strength is 8,162 (*Figure 3*).

Bibliometric analysis of the co-authorship

Totally 6,219 authors have participated in the publication of the COVID-19 papers. Among them, Andrei R. Akhmetzhanov from Hokkaido University of Japan has 7 papers which mostly focus on the transmission of COVID-19. The main collaborators with him are Natalie M. Linton and Hiroshi Nishiura from Japan Science and Technology Agency. The total link strength is 49.

Through the domestic and international literature search, it is revealed that 2,037 organizations have published the related papers and 140 of them have over 5 publications.

Huazhong University of Science and Technology has published 90 related papers with 1,268 citations. The main partner of the organization is Wuhan University and most of the researches mainly concentrate on the clinical features of COVID-19. Hongkong University is another important partner with a long-term study on the transmission of diseases.

The number of collaborators with China is 44 and the total link strength is 487 with 838 publications. The main partners of China are USA, England and Germany. Almost as remarkably, the total link strength of Saudi Arabia is 85 and the country cooperates with other 25 countries in the topic of sharing the experience of MERS treatment (*Figure 4*).

Table 1 The top ten most active countries, organizations and authors of COVID-19 publications

Subject	Number of publications	Count of citations
Countries		
China	838	7,273
USA	705	2,102
England	295	910
Italy	282	462
Canada	130	363
Germany	129	617
India	128	79
Australia	114	508
France	87	242
Switzerland	86	174
Organizations		
Huazhong University of Science and Technology	90	1,268
Wuhan University	64	1,507
Hongkong University	56	1,161
Zhejiang University	47	195
Fudan University	45	363
Capital Medical University	43	1,496
Chinese Academy of Sciences	40	1,597
Chinese University of Hongkong	40	232
Harvard Medical School	37	38
University of Toronto	36	128
Authors		
Elisabeth Mahase	32	27
Gareth Iacobucci	21	5
Abi Rimmer	19	5
Viroj Wiwanitkit	15	9
Christian Drosten	11	389
Jiang Shibo	10	52
Ziad A. Memish	9	115
Alimuddin Zumla	8	114
Edward C. Holmes	8	139
Yang Yang	8	92

Bibliometric analysis of the bibliographic coupling and co-citation

The bibliographic coupling map of documents and sources are shown in *Figure 5A,B*. Seven clusters were obtained from the analysis. Cluster 1 includes 67 items and the research area is clinical features (shown in blue). The representative paper was published in the Lancet in January 2020 by Huang Chaolin. Cluster 7 only has one item which discuss the influence of hypertension and diabetes mellitus on COVID-19 (shown in orange).

Eight clusters of the cited references were obtained by bibliometric analysis. The top three clusters represent the research fields of clinical feature, diseases transmission and treatment which are shown in the colour of red, green and blue. The two biggest clusters of cited sources include 79 and 58 items, respectively. The representative journals are the *Lancet* and *Journal of Virology (Figure 5C,D)*.

Bibliometric analysis of themes and trend topics

As indicated in *Figure 6A*, three themes of COVID-19 studies were found. The blue cluster involved clinical trials investigating COVID-19 diagnosis and clinical features. The green cluster involved clinical trials investigating management and emergency preparedness. The red cluster involved clinical trials investigating risk factors and pathogenesis. *Figure 6B* demonstrates the network map of the trend topics according to the keywords used from December 2019 to April 2020. Indicator shows the current publications from purple to yellow. More studies focused on vaccine, disease treatment and spike protein have been published recently.

Discussion

From our current study, 3,626 publications about COVID-19 indexed in WOS core database were analyzed. The published literatures include the following three aspects: disease management, clinical characteristics and pathogenesis. As the most frequent keyword, "COVID-19" has a strong link to "pneumonia" and "epidemiology". China made the most outstanding contribution within this important field. Disease treatment, spike protein and vaccine may be hotspots in the future.

The COVID-19 epidemic continues to spread around the world till now and the new cases reported outside China
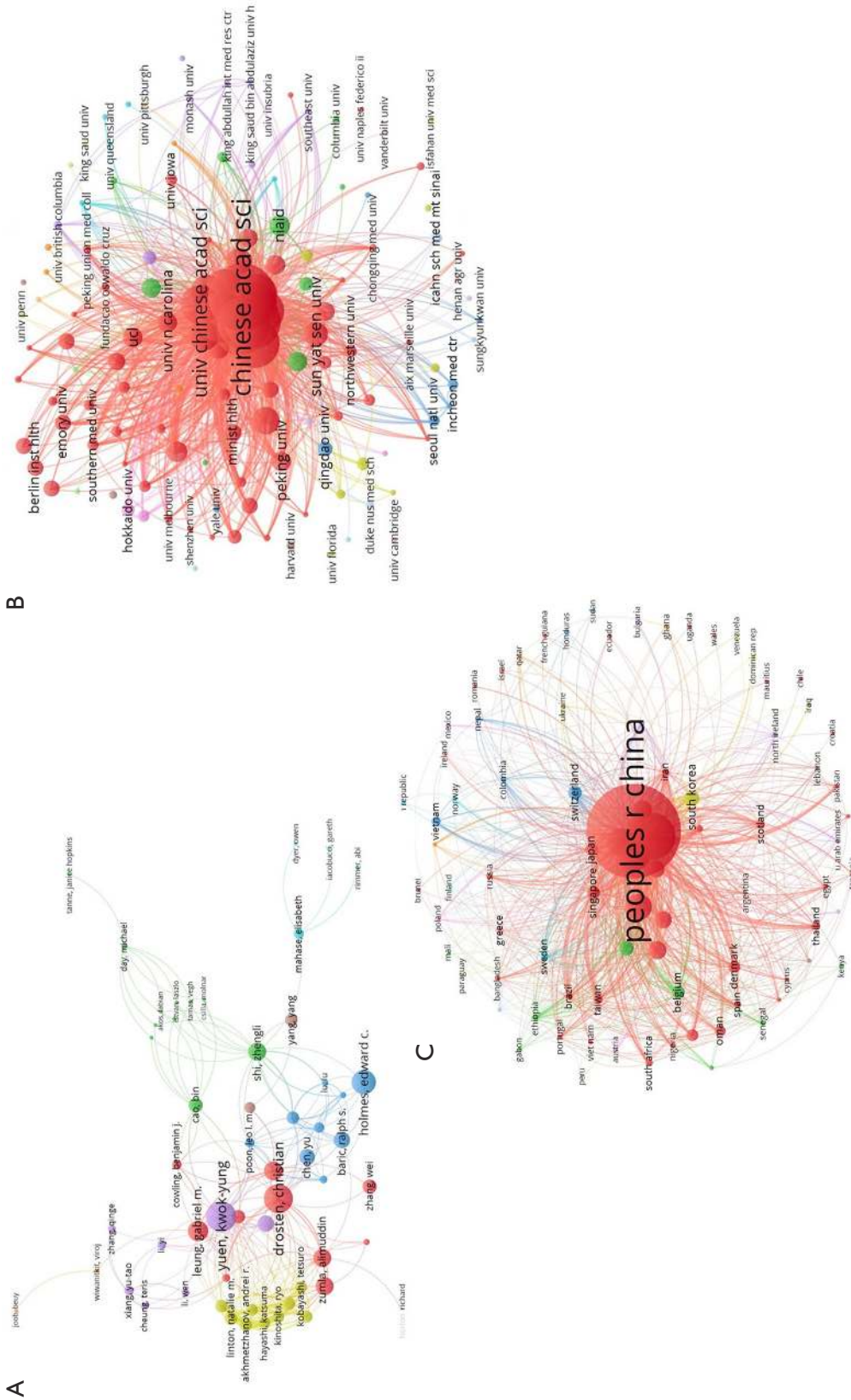
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Figure 3 Bibliometric analysis of the citations. (A) The citations of authors. Eight clusters were shown in different colours. Yuen Kwok-Yung in the purple cluster is the most cited author (191 times); (B) the citations of organizations. Chinese Academy of Sciences in red cluster is the most cited organization (1,036 times); (C) the citations of countries. Different colours indicate different clusters and the size of circles indicates the counts of citations.
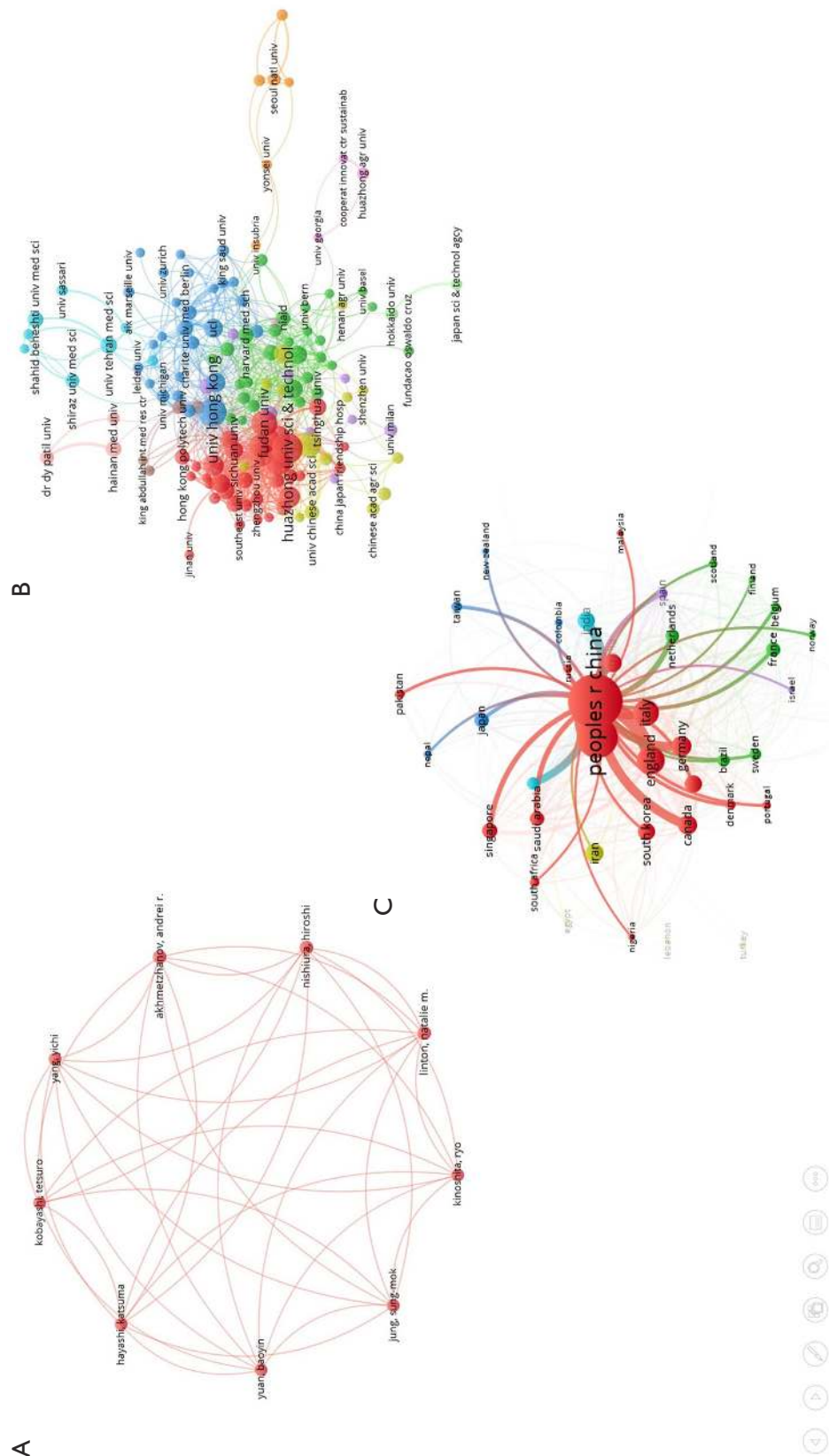
Figure 4 Bibliometric analysis of the co-authorship. (A) The co-authorship map of authors which indicates the authors that cooperate in the field of COVID-19 transmission; (B) the co-authorship map of organizations. Huazhong University of Science and Technology has published 51 related papers and cooperates with other 27 institutions; (C) the co-authorship map of countries. The number of collaborators with China is 44 and the total link strength is 290. Different colours indicate different clusters and the size of circles indicates the number of publications. The thickness of the lines represents the link strength of the countries.

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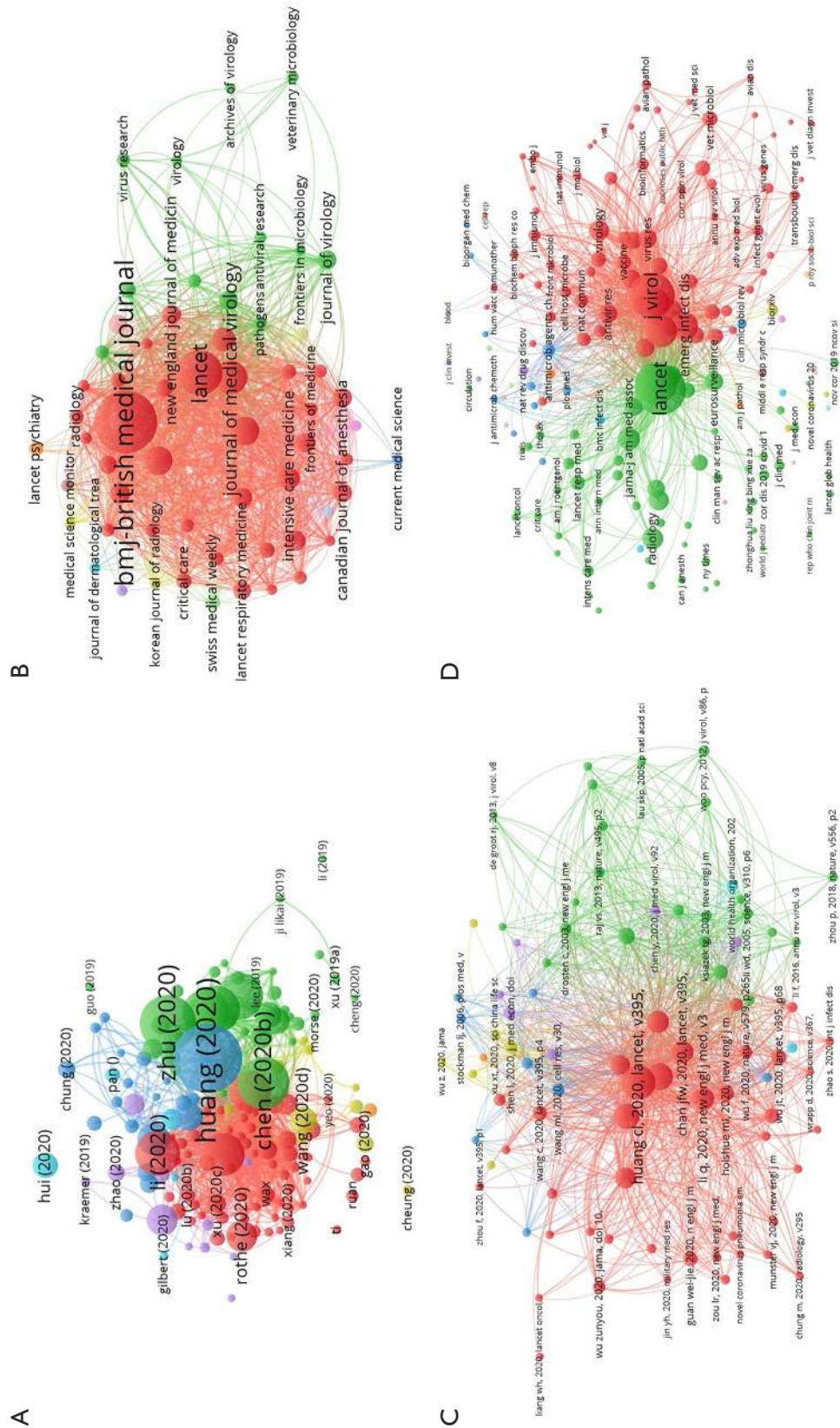**Figure 5** Bibliometric analysis of the bibliographic coupling and co-citation. (A) Bibliographic coupling of documents; (B) bibliographic coupling of sources; (C) co-citation of documents; (D) co-citation of sources. Different colour indicates different research areas. The size of the circles represents the counts of co-citations. The distance between the two circles indicates their correlation.

Figure 6 Bibliometric analysis of themes. (A) Distribution of the themes. Three clusters are shown in the map. The red cluster indicates risk factors and pathogenesis. The blue cluster involved clinical trials investigating COVID-19 diagnosis and clinical features. The green cluster represents COVID-19 management and emergency preparedness. (B) Network map of the trend topics according to the keywords used from December 2019 to April 2020. Indicator shows the current publications from purple to yellow. More studies focused on vaccine, drug treatment and spike protein have been published recently. The size of the circles represents the frequency of appearance as the keywords. The distance between the two circles indicates their correlation.

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have already exceeded the number of total confirmed cases in Wuhan. The current situation in Europe and America is still very worrisome. To fight against the pandemic, academia joined this "battlefield" as soon as possible to provide recommendations and suggestions to treat the disease. Medical journals with high impact such as the *BMJ*, *Lancet* and the *New England Journal of Medicine* have also opened special columns for COVID-19 (5), which have an advantage in the number of papers published.

COVID-19 is caused by SARS-CoV-2 and like other emerging diseases, the initial focus is often at the clinical characteristics and transmission (6). Thus, as the most commonly used keywords, "COVID-19" and "novel coronavirus" have a strong link to "clinical features" and "epidemiology". Many articles about the comparison of SARS and MERS were published in order to provide lessons for treatment due to limited knowledge could be obtained at the early stage of the disease (7), and many articles concentrated on clinical features were also most cited (8-10). One of the most important articles was published in 24th January 2020, which demonstrated the clinical characteristics and management of the disease (11). At the same day, person-to-person transmission of COVID-19 in hospital and family settings was verified in another family cluster study which has been cited for more than 300 times till now (12).

As the pandemic was first reported in Wuhan, Chinese scholars wrote almost all the articles published in 2019. With the in-depth study of the disease, more clinical studies were performed in Wuhan and other provinces of China (13). Studies of antiviral therapy like Chloroquine (14), Remdesivir (15), Arbidol (16) and Lopinavir-Ritonavir (17) have been published. However, because of the difference in the severity of the patients and the limited sample size, the results are still controversial (18). Effective drug treatment must be one of the research priorities in the future. As far as vaccines are concerned, monoclonal antibody therapy is still a potential therapeutic intervention to the infectious diseases. Global efforts should be paid on vaccines for COVID-19 and it still has a long way to go (19).

Publications on COVID-19 were retrieved from WOS and the data was analyzed objectively and comprehensively. Nonetheless, some limitations are still inevitable. Firstly, although a large number of new research papers are added to the WOS every day, only a part of them can be indexed in the core database. Thus, most of the non-English language articles were neglected or excluded. As the COVID-19 pandemic originated from Wuhan China,

expert consensus written in Chinese might be important and helpful. Secondly, the current growth trends predict a large increase in the number of global publications on COVID-19 which leads to a fairly large number of papers were published in the preprint online database like medRxiv and they were not enrolled in our study.

Conclusions

With the spread of the pandemic, more and more academic papers have been published. It is particularly important to evaluate the quality of such a great number of research papers and obtain valuable information. Scientific and medical research plays a vital role in understanding COVID-19, as well as helping to find solutions to contain its transmission. Effective drug therapy and vaccine research are still future directions.

Acknowledgments

Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/atm-20-4235). YY serves as an unpaid section editor of *Annals of Translational Medicine* from Oct 2019 to Sep 2020. The other authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Table S1 The top 100 most cited articles in the field of COVID-19

Rank	Title	Journal	Article type	Country of the corresponding author	Publication date	Citations
1	Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China	*Lancet*	Prospective observational study	China	2020/1/24	883
2	A Novel Coronavirus from Patients with Pneumonia in China, 2019	*New England Journal of Medicine*	Case series	China	2020/1/24	528
3	Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study	*Lancet*	Retrospective study	China	2020/1/30	501
4	Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China	*JAMA*	Retrospective study	China	2020/2/7	494
5	Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia	*New England Journal of Medicine*	Retrospective study	China	2020/1/29	360
6	A pneumonia outbreak associated with a new coronavirus of probable bat origin	*Nature*	Research article	China	2020/2/3	351
7	A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster	*Lancet*	Family cluster study	China	2020/1/24	331
8	Clinical Characteristics of Coronavirus Disease 2019 in China	*New England Journal of Medicine*	Retrospective study	China	2020/2/28	316
9	Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding	*Lancet*	Research article	China	2020/1/29	284
10	First Case of 2019 Novel Coronavirus in the United States	*New England Journal of Medicine*	Case reports	USA	2020/1/31	218
11	Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention	*JAMA*	Descriptive report	China	2020/2/24	212
12	Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study	*Lancet*	Retrospective Cohort Study	China	2020/3/11	198
13	Remdesivir and chloroquine effectively inhibit the recently emerged novel coronavirus (2019-nCoV) in vitro	*Cell Research*	Research article	China	2020/2/4	169
14	Transmission of 2019-nCoV Infection from an Asymptomatic Contact in Germany	*New England Journal of Medicine*	Case reports	Germany	2020/1/31	167
15	Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study	*Lancet*	Modelling Study	Hong Kong China	2020/1/31	139
16	A new coronavirus associated with human respiratory disease in China	*Nature*	Case reports	China	2020/2/3	137
17	A novel coronavirus outbreak of global health concern	*Lancet*	Comment	China	2020/1/24	136
18	SARS-CoV-2 Viral Load in Upper Respiratory Specimens of Infected Patients	*New England Journal of Medicine*	Correspondence	China	2020/2/19	126
19	Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1	*New England Journal of Medicine*	Comparative study	USA	2020/3/17	125
20	Pathological findings of COVID-19 associated with acute respiratory distress syndrome	*Lancet Respiratory Medicine*	Case series	China	2020/2/18	111
21	The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health - The latest 2019 novel coronavirus outbreak in Wuhan, China	*International Journal of Infectious Diseases*	Editorial	Hong Kong China	2020/1/14	103
22	Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records	*Lancet*	Retrospective study	China	2020/2/12	102
23	Cancer patients in SARS-CoV-2 infection: a nationwide analysis in China	*Lancet Oncology*	Nationwide Analysis	China	2020/2/14	99
24	Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study	*Lancet Respiratory Medicine*	Observational Study	China	2020/2/24	92
25	Breakthrough: Chloroquine phosphate has shown apparent efficacy in treatment of COVID-19 associated pneumonia in clinical studies	*BioScience Trends*	Letter	China	2020/2/19	92
26	Cryo-EM structure of the 2019-nCoV spike in the prefusion conformation	*Science*	Research article	USA	2020/2/19	91
27	Detection of 2019 novel coronavirus (2019-nCoV) by real-time RT-PCR	*Eurosurveillance*	Research article	Belgium	2020/1/23	90
28	SARS-CoV-2 Cell Entry Depends on ACE2 and TMPRSS2 and Is Blocked by a Clinically Proven Protease Inhibitor	*Cell*	Research article	Germany	2020/3/5	88
29	Receptor Recognition by the Novel Coronavirus from Wuhan: an Analysis Based on Decade-Long Structural Studies of SARS Coronavirus	*Journal of Virology*	Research article	USA	2020/3/17	79
30	Clinical evidence does not support corticosteroid treatment for 2019-nCoV lung injury	*Lancet*	Editorial	Scotland	2020/2/15	77
31	Genomic characterization of the 2019 novel human-pathogenic coronavirus isolated from a patient with atypical pneumonia after visiting Wuhan	*Emerging Microbes & Infections*	Research article	China	2020/1/28	76
32	CT Imaging Features of 2019 Novel Coronavirus (2019-nCoV)	*Radiology*	Case series	China	2020/2/4	73
33	Presumed Asymptomatic Carrier Transmission of COVID-19	*JAMA*	Case series	China	2020/2/21	69
34	COVID-19: consider cytokine storm syndromes and immunosuppression	*Lancet*	Comment	England	2020/3/16	68
35	Emerging coronaviruses: Genome structure, replication, and pathogenesis	*Journal of Medical Virology*	Review	China	2020/2/7	68
36	Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents	*The Journal of Hospital Infection*	Review	Germany	2020/2/6	67
37	Importation and Human-to-Human Transmission of a Novel Coronavirus in Vietnam	*New England Journal of Medicine*	Case Reports	Vietnam	2020/1/28	66
38	Evolution of the novel coronavirus from the ongoing Wuhan outbreak and modeling of its spike protein for risk of human transmission	*Science China Life Sciences*	Research article	China	2020/2/21	66
39	Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges	*International Journal of Antimicrobial Agents*	Review	Taiwan China	2020/2/17	65
40	Clinical findings in a group of patients infected with the 2019 novel coronavirus (SARS-Cov-2) outside of Wuhan, China: retrospective case series	*BMJ*	Case series	China	2020/2/19	62
41	Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study	*Lancet Infectious Diseases*	Descriptive Study	China	2020/2/24	59
42	A rapid advice guideline for the diagnosis and treatment of 2019 novel coronavirus (2019-nCoV) infected pneumonia (standard version)	*Military Medical Research*	Practice Guideline	China	2020/2/6	57
43	Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: A data-driven analysis in the early phase of the outbreak	*International Journal of Infectious Diseases*	Data-driven analysis	Hong Kong China	2020/1/30	55
44	A Novel Coronavirus Emerging in China - Key Questions for Impact Assessment	*New England Journal of Medicine*	Perspective	Netherlands	2020/1/24	55
45	Emerging 2019 Novel Coronavirus (2019-nCoV) Pneumonia	*Radiology*	Descriptive report	China	2020/2/6	54
46	Cross-species transmission of the newly identified coronavirus 2019-nCoV	*Journal of Medical Virology*	Research article	China	2020/1/21	53
47	Clinical analysis of 10 neonates born to mothers with 2019-nCoV pneumonia	*Translational Pediatrics*	Case series	China	2020/2/10	50
48	Initial CT findings and temporal changes in patients with the novel coronavirus pneumonia (2019-nCoV): a study of 63 patients in Wuhan, China	*European Radiology*	Case series	China	2020/2/13	48
49	Are patients with hypertension and diabetes mellitus at increased risk for COVID-19 infection?	*Lancet Respiratory Medicine*	Comment	Switzerland	2020/3/11	47
50	Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed	*Lancet. Psychiatry*	Comment	Macao China	2020/2/4	47
51	Clinical predictors of mortality due to COVID-19 based on an analysis of data of 150 patients from Wuhan, China	*Intensive Care Medicine*	Descriptive report	China	2020/3/3	46
52	Updated understanding of the outbreak of 2019 novel coronavirus (2019-nCoV) in Wuhan, China	*Journal of Medical Virology*	Descriptive report	China	2020/2/12	46
53	Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients	*Canadian Journal of Anaesthesia*	Practical recommendations	England	2020/2/12	46
54	2019-nCoV transmission through the ocular surface must not be ignored	*Lancet*	Comment	China	2020/2/6	45
55	Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia	*Journal of Thrombosis and Haemostasis*	Descriptive report	China	2020/3/13	44
56	COVID-19 and Italy: what next?	*Lancet*	Review	Italy	2020/3/13	44
57	The species Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2	*Nature Microbiology*	Consensus Statement	Germany	2020/3/2	43
58	The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak - an update on the status	*Military Medical Research*	Review	China	2020/3/13	43
59	Incubation period of 2019 novel coronavirus (2019-nCoV) infections among travellers from Wuhan, China, 20-28 January 2020	*Eurosurveillance*	Descriptive report	Netherlands	2020/2/6	43
60	Pattern of early human-to-human transmission of Wuhan 2019 novel coronavirus (2019-nCoV), December 2019 to January 2020	*Eurosurveillance*	Research article	Switzerland	2020/1/25	42
61	COVID-19 and the cardiovascular system	*Nature Reviews Cardiology*	Comment	China	2020/5/17	41
62	Return of the Coronavirus: 2019-nCoV	*Viruses*	Comment	USA	2020/1/24	41
63	The Incubation Period of Coronavirus Disease 2019 (COVID-19) From Publicly Reported Confirmed Cases: Estimation and Application	*Annals of Internal Medicine*	Descriptive report	Germany	2020/3/10	39
64	Air, Surface Environmental, and Personal Protective Equipment Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) From a Symptomatic Patient	*JAMA*	Research article	Singapore	2020/3/4	39
65	Therapeutic options for the 2019 novel coronavirus (2019-nCoV)	*Nature Reviews Drug Discovery*	Comment	Belgium	2020/2/10	39
66	Drug treatment options for the 2019-new coronavirus (2019-nCoV)	*BioScience Trends*	Comment	China	2020/1/28	38
67	Substantial undocumented infection facilitates the rapid dissemination of novel coronavirus (SARS-CoV-2)	*Science*	Research article	USA	2020/3/16	37
68	Virtually Perfect? Telemedicine for Covid-19	*New England Journal of Medicine*	Perspective	USA	2020/3/11	37
69	Another Decade, Another Coronavirus	*New England Journal of Medicine*	Editorial	Iowa	2020/1/24	37
70	An interactive web-based dashboard to track COVID-19 in real time	*Lancet Infectious Diseases*	Descriptive report	USA	2020/2/19	36
71	Hydroxychloroquine, a less toxic derivative of chloroquine, is effective in inhibiting SARS-CoV-2 infection in vitro	*Cell discovery*	Research article	China	2020/3/18	36
72	CT Imaging of the 2019 Novel Coronavirus (2019-nCoV) Pneumonia	*Radiology*	Case Reports	China	2020/1/31	35
73	World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19)	*International Journal of Surgery*	Review	England	2020/2/26	34
74	Case of the Index Patient Who Caused Tertiary Transmission of Coronavirus Disease 2019 in Korea: the Application of Lopinavir/Ritonavir for the Treatment of COVID-19 Pneumonia Monitored by Quantitative RT-PCR	*Journal of Korean Medical Science*	Case Reports	Korea	2020/2/17	34
75	Baricitinib as potential treatment for 2019-nCoV acute respiratory disease	*Lancet*	Correspondence	England	2020/2/4	34
76	Structure, Function, and Antigenicity of the SARS-CoV-2 Spike Glycoprotein	*Cell*	Research article	USA	2020/3/9	33
77	Functional assessment of cell entry and receptor usage for SARS-CoV-2 and other lineage B betacoronaviruses	*Nature Microbiology*	Research article	USA	2020/2/24	33
78	Novel Coronavirus Infection in Hospitalized Infants Under 1 Year of Age in China	*JAMA*	Retrospective study	China	2020/2/14	32
79	Structural basis for the recognition of SARS-CoV-2 by full-length human ACE2	*Science*	Research article	China	2020/3/4	32
80	Coronavirus envelope protein: current knowledge	*Virology Journal*	Review	South Africa	2020/2/27	32
81	Evaluation of coronavirus in tears and conjunctival secretions of patients with SARS-CoV-2 infection	*Journal of Medical Virology*	Research article	China	2020/3/12	31
82	SARS-CoV-2 Infection in Children	*New England Journal of Medicine*	Descriptive report	Hong Kong China	2020/3/18	31
83	Feasibility of controlling COVID-19 outbreaks by isolation of cases and contacts	*Lancet Global Health*	Research article	England	2020/2/28	31
84	Clinical and biochemical indexes from 2019-nCoV infected patients linked to viral loads and lung injury	*Science China Life Sciences*	Research article	China	2020/2/9	31
85	Estimating the asymptomatic proportion of coronavirus disease 2019 (COVID-19) cases on board the Diamond Princess cruise ship, Yokohama, Japan, 2020	*Eurosurveillance*	Descriptive report	Japan	2020/3/12	30
86	Genome Composition and Divergence of the Novel Coronavirus (2019-nCoV) Originating in China	*Cell Host & Microbe*	Research article	China	2020/2/7	30
87	The COVID-19 epidemic	*Tropical Medicine & International Health*	Editorial	Germany	2020/2/16	30
88	The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak	*Journal of Autoimmunity*	Review	USA	2020/2/26	29
89	Epidemiologic and Clinical Characteristics of Novel Coronavirus Infections Involving 13 Patients Outside Wuhan, China	*JAMA*	Case series	China	2020/2/7	29
90	Prevalence and impact of cardiovascular metabolic diseases on COVID-19 in China	*Clinical Research in Cardiology*	Review	China	2020/3/11	28
91	Potential interventions for novel coronavirus in China: A systematic review	*Journal of Medical Virology*	Systematic review	China	2020/3/3	28
92	Identification of a novel coronavirus causing severe pneumonia in human: a descriptive study	*Chinese Medical Journal*	Descriptive study	China	2020/2/11	27
93	Chest CT Findings in 2019 Novel Coronavirus (2019-nCoV) Infections from Wuhan, China: Key Points for the Radiologist	*Radiology*	Editorial	USA	2020/2/4	27
94	Surviving Sepsis Campaign: guidelines on the management of critically ill adults with Coronavirus Disease 2019 (COVID-19)	*Intensive Care Medicine*	Practice Guideline	England	2020/3/28	27
95	Coronavirus Disease 2019 (COVID-19): Emerging and Future Challenges for Dental and Oral Medicine	*Journal of Dental Research*	Practice management	China	2020/3/12	27
96	Stepping up infection control measures in ophthalmology during the novel coronavirus outbreak: an experience from Hong Kong	*Graefe's Archive for Clinical and Experimental Ophthalmology*	Comment	Hong Kong China	2020/3/3	27
97	High expression of ACE2 receptor of 2019-nCoV on the epithelial cells of oral mucosa	*International Journal of Oral Science*	Research article	China	2020/2/24	27
98	The First Case of 2019 Novel Coronavirus Pneumonia Imported into Korea from Wuhan, China: Implication for Infection Prevention and Control Measures	*Journal of Korean Medical Science*	Case Reports	Korea	2020/2/2	27
99	Clinical characteristics of novel coronavirus cases in tertiary hospitals in Hubei Province	*Chinese Medical Journal*	Retrospective study	China	2020/1/29	26
100	Pulmonary Pathology of Early-Phase 2019 Novel Coronavirus (COVID-19) Pneumonia in Two Patients With Lung Cancer	*Journal of Thoracic Oncology*	Case Reports	China	2020/2/28	26