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Growth Analysis of Global Scientific Research on Covid-19 Pandemic: A Scientometrics Analysis

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Abstract

The purpose of present study is to evaluate the growth of scientific literature pertaining to Coronavirus disease 2019(Covid-19). In sum 1630 document published during 01 January 2020 to 6 April, 2020. Publication data were retrieved from SCOPUS databases using key terms and detailed analysis were made to understand the publication trends, authorship and collaborative pattern, country-wise distribution, core journal and most leading institutes. Study found that 82.88% (1351) of the research documents published on open-access platform which signify the rapid communication of research finding among global scientific communities. 'BMJ Clinical Research Ed' found to be most productive journal with 114(6.99%) research articles. China & USA dominates in the publishing research output of 515(31.60%) and 308(18.90%) respectively. There has been an unparalleled growth in the number of publications across the globe on COVID-19 since January 2020.

Keywords: Coronavirus, Covid-19, Pandemic, Scientometric analysis, Publication pattern

Introduction

Recent outbreak of epidemic Coronavirus disease (COVID-2019) created an unparallel situation across the globe and tremendously impacted social and health distress. The covid-19 pandemic is the biggest threat for entire world. World Health Organization (WHO) was informed of a cluster of cases of pneumonia of unknown cause in Wuhan, China, in late December 2019 and later it has confirmed of coronavirus disease (COVID-19) by the Chinese authorities. COVID-19 is caused by a novel, enveloped single-stranded RNA virus, Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) probably originated from bats. As on 06/04/2020 around 12,10,000 cases of COVID-19 have been reported and nearly 67,000 deaths occurred worldwide. Many countries across world have restricted their border and declared lockdown to maintain social distance which can slow down the spread of the virus. This particular study focuses on

analyzing the growth of scientific literature, publication trends, authorship and collaborative patterns, keywords, country-wise distribution, leading institutes and journal producing maximum research documents. This study is useful for identifying and understanding the growth of scientific literature in this field and evolving of this domain of research around the globe.

Literature Reviewed

Sa'ed H. Zyoud, 2016 studies indicated that MERS-CoV related literature has grown to be more extensive and global over the past four years. The USA has the highest contribution in terms of research published in the field of MERS-CoV research. Hossain, 2020 identified the Current Status of Global Research on COVID-19 and suggested that there is massive progress of research in different areas of knowledge. Studies on the COVID-19 during the first 30 days suggested that diagnosis and effective preventive and therapeutic measures were the fields in which more research is still needed (Gori, Boetto & Fantini, 2020). Chahrour, Mohamad, 2020 recommended that Observational studies and therapeutic trials about COVID-19 are essential for developing new treatment options. The research volume of emerging infectious diseases is very high after an outbreak and drops drastically upon the containment of the disease (Kagan, Moran-Gilad & Fire, 2020). Study conducted by Bonilla-Aldana et al., 2020 has identified 109 entries reported between February 29, 2000, and January 22, 2020, through ProMED and found that a total of 966 cases with death of 188 cases reported. Study suggested that an overall case fatality rate (CFR) of 19.5%. Of 70 cases for which the gender was reported, 47 (67.1%) were male. China was the most leading county in terms of number of cases reported ; followed by United Arab Emirates, and Saudi Arabia, with reports from other countries, including imported cases in Europe and North America at the time of this study .Further, China accounted for the highest proportion of published research (44 papers, 40.48%), followed by the United States (21 documents, 19.32%), and Canada (7 articles, 6.44%) (Rafiei Nasab & Rahim, 2020).

Data and Methodology

In total, 1630 research documents were retrieved from Scopus database using the below search query and further these records were analyzed to get the inference. We have considered the published literature data during 01 January 2020 to 06 April, 2020 for this analysis which were indexed in Scopus. Various scientometrics parameters and statistical techniques have been used for further analysis. VOSviewer data visualization tool is used to create the co-author network.

Search Query: ((TITLE-ABS-KEY(Covid-19) OR TITLE-ABS-KEY(Coronavirus)) AND (LIMIT-TO (PUBYEAR,2020)))

The objectives of this study

The present study aims to analyze the world's scientific publications on Coronavirus disease 2019 (Covid-19) research using various scientometrics indicators. The major objectives are i) To analyze the research effort among different countries ii) To determine the influential institutions globally iii) To analyze authorship pattern iv) To identify most publishing journals, prominent researcher and key papers.

Data Analysis and Result Discussion

1. Categorization of Research Document

From the study, it has been found that the maximum 746(45.77%) of research documents were published in the form of 'Article' followed by 'Letter' with 251(15.40%) and 240(14.72%) of the total documents published as 'Note' and 196(12.02) as 'Editorial'. Significant portion of 136(8.34%) documents communicated as 'Review'. The detailed categories of document types are given in the Table 1.

Table 1 Categorization of published document

Document Type	No of Document	%TP
Article	746	45.77
Letter	251	15.40
Note	240	14.72
Editorial	196	12.02
Review	136	8.34
Short Survey	26	1.60
Erratum	20	1.23
Book Chapter	13	0.80
Data Paper	2	0.12

2. Distribution of research findings in major subjects

The distributions of various subjects are represented in Figure 1. The data shows that the major portion of the research documents are published in the domain of Medicine (76.32%) followed

by Immunology and Microbiology (18.28%), and Biochemistry, Genetics and Molecular Biology subject domains (9.51%).

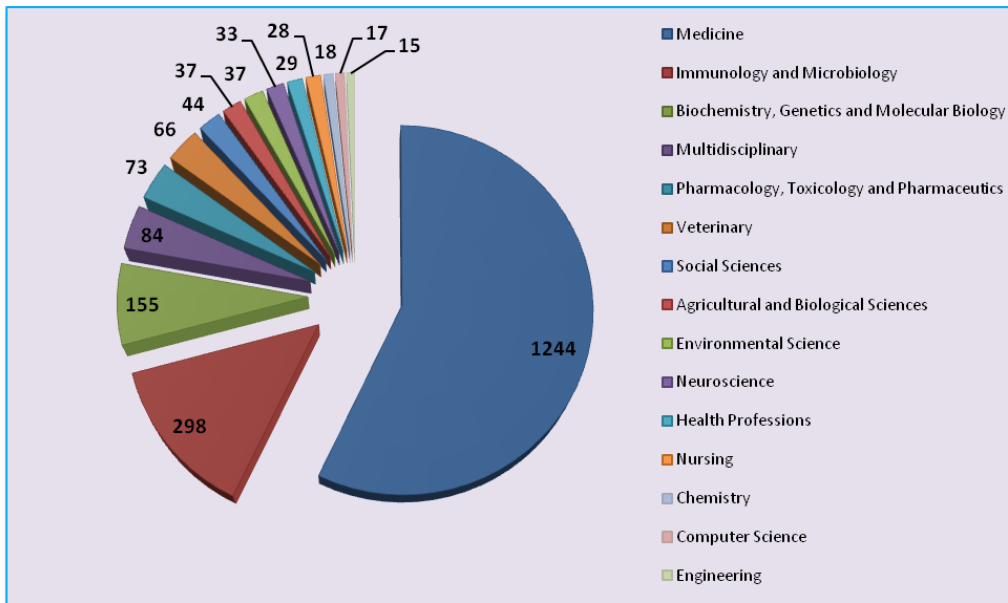


Figure 1 shows the top 15 subject-wise distribution of sample data.

3. Leading Countries in producing maximum Covid-19 research

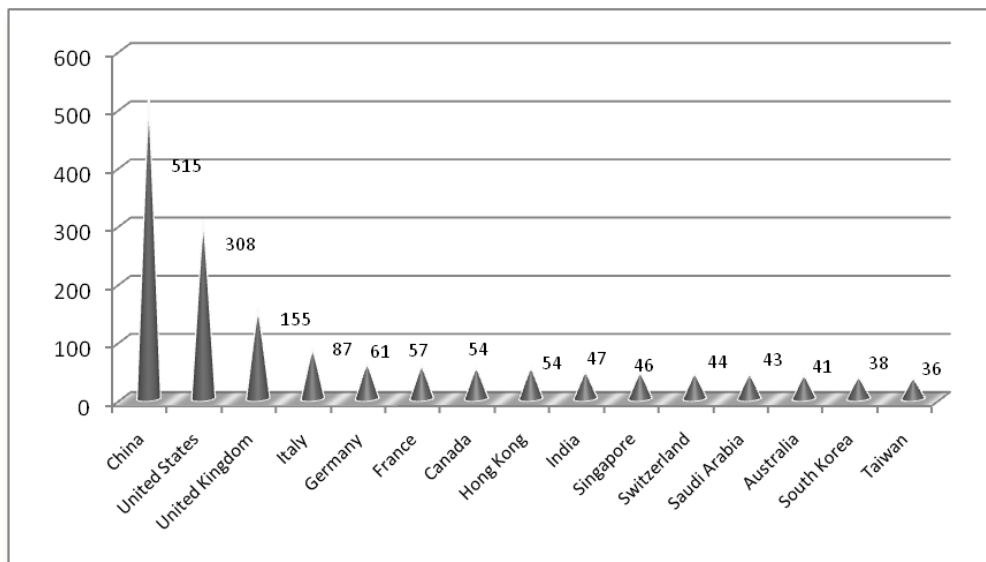


Figure 2 represent the top 15 countries producing maximum research publication

The analysis reveals that China has published highest research publications 515(31.60%) followed by USA 308(18.90%) and UK 155(9.51%). Countries like Italy, Germany, France, Canada, Hong Kong and India are actively doing research on Covid-19 producing significant

number of publications in this area of research. The total research output in Covid-19 originated in 85 countries. Top 15 countries in term of number of maximum publication are shown in Figure 2.

4. Influential Institutions Analysis

From the data analysis It has been found that University of Hong Kong has produces highest number research paper (3.58%) followed by Chinese Academy of Sciences (2.14%) and Chinese University of Hong Kong (1.84%) of global publications.

Table 2 Top 20 Influential institutions & their publications

Institution	No. of Paper
The University of Hong Kong	43
Chinese Academy of Sciences	40
Huazhong University of Science and Technology	37
Tongji Medical College	36
Wuhan University	28
London School of Hygiene & Tropical Medicine	28
The University of Hong Kong Li Ka Shing Faculty of Medicine	27
Chinese Academy of Medical Sciences & Peking Union Medical College	27
School of Medicine, University of Pittsburgh	27
Capital Medical University	26
Chinese University of Hong Kong	25
Fudan University	25
National University of Singapore	24
Ministry of Education China	23
Zhejiang University	23
University College London	21
University of Oxford	21
Zhejiang University School of Medicine	21
Zhongnan Hospital of Wuhan University	20
University of Toronto	18

5. Core Journals

It has been observed that ‘BMJ Clinical Research Ed’ published maximum research documents 114(6.99%) followed by ‘ The Lancet’ covering around 81(4.97%) papers and ‘Journal of Medical Virology’ of 56(3.44%) articles. It is observed that significant portion of research finding are communicated in highly impacted journal such as ‘Nature’ 45(2.76%) and ‘JAMA Journal of The American Medical Association’ 41(2.52) & Science 26(1.60%). The data reveals

that top 15 journals have produced 599(36.75%) of highly cited articles. BMJ, Lancet Infectious Diseases, Euro Surveillance, Travel Medicine and Infectious Disease, Journal of Infection and Viruses are also other leading journals communicating significant proportion of Covid-19 research work. The Lancet has highest impact factor of 59.102 with 81 research papers. Overall, it has been observed that Covid-19 publications are communicated in high impact factor journals. The 15 core journals and publication details are shown in Figure 3.

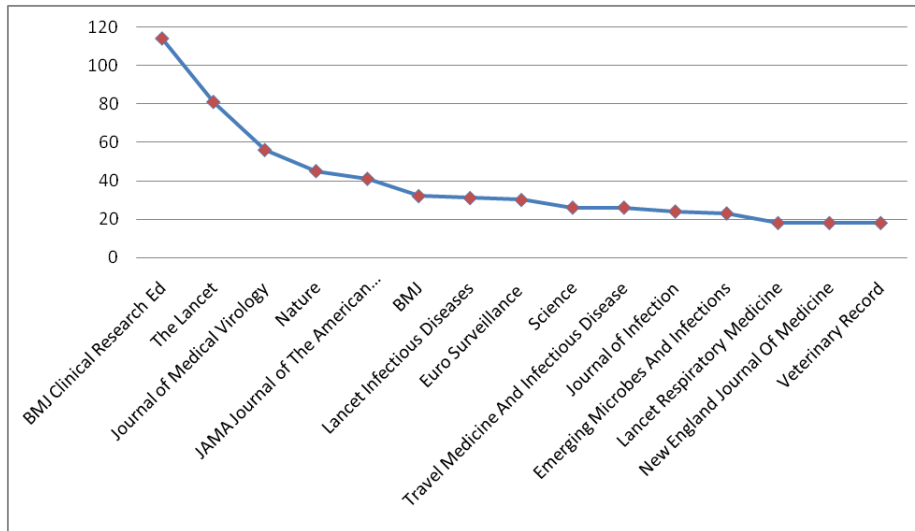


Figure 3 shows the top 15 Influential Journal

6. Prominent contributors in Covid-19 research

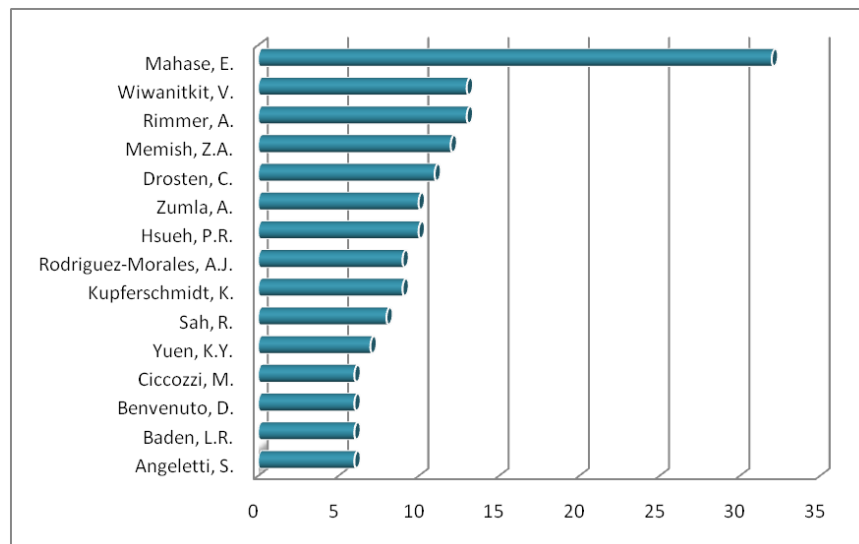


Figure 4 shows the top 15 leading contributors

Data reveals that Elisabeth Mahase, publishes the maximum number of publications (32) and became the most prolific contributor in this domain of research. Rimmer, A. Wiwanitkit, V.

Memish, Z.A. Drosten, C. Hsueh, P.R. and Zumla, A. are other prominent author producing significant number of research publications. The scientific productivity in terms of publications of the top 15 contributors varied from 6 to 32.

7. Authorship pattern & Co-author network visualization

7.1 Authorship pattern

Authorship patterns of the published documents in the year 2020 is depicted in Table 3. The maximum number of collaborators found is 133 and a total number of authors who have contributed were 1630. It is observed that highest numbers of research documents are contributed by single author 443(27.18%) where as remaining 1187 (72.82%) documents are published by joint authors.

Table 3 Single author vs Multi authors publications

Authors	Single	Double	Three	Four	Five	Six	Seven	Eight	Nine	Ten	More than Ten
No of Publication	443	218	189	147	137	92	65	81	32	36	190
%TP	27.18	13.37	11.60	9.02	8.40	5.64	3.99	4.97	1.96	2.21	11.66

7.2 Co-author network

Visualizations of co-authorship networks were created using VOSviewer data visualizing tool to have better understanding of links between co-authors. The trend showing the increase with the nodes representing the authors and the edges representing a co-authorship. While the size of nodes presents their relative frequency in a network structure, the width of links illustrates the strength of the relationship between each pair. Figure 5 represent the link between co-authors.

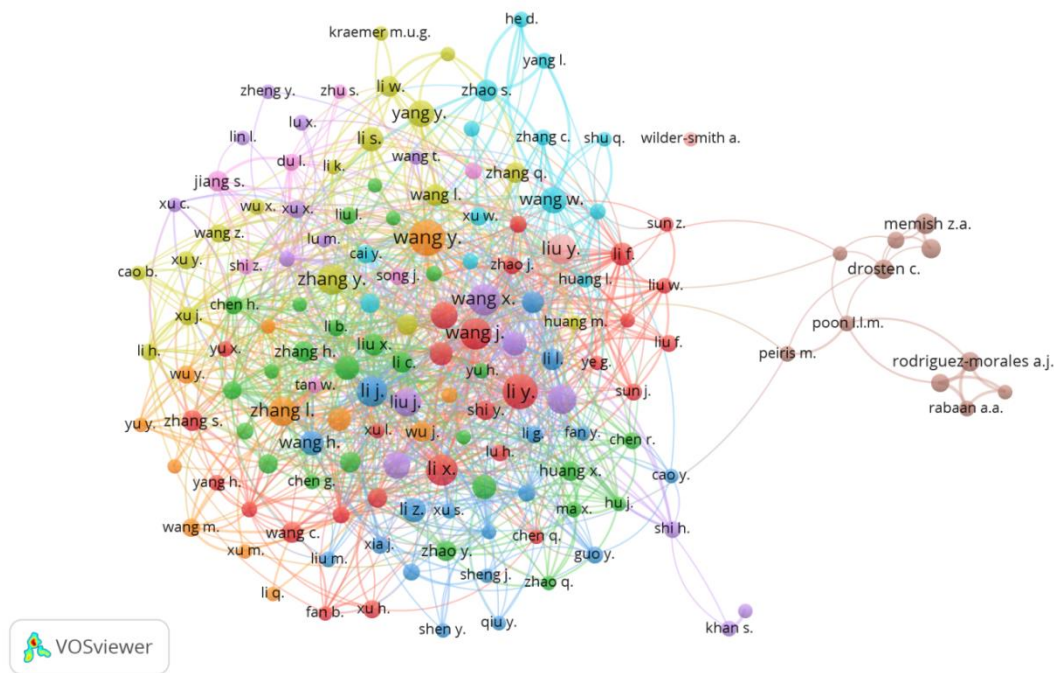


Figure 5 shows the network visualization of co-authors

8. Keyword Analysis

Top 50 key words and their frequency of occurrence pertaining to Covid-19 has listed in Table 4. A higher occurrence of these keywords clearly indicates the information about current research trends on Covid-19 disease.

Table 4 List of Key term & their occurrence

Keyword	Occurrence	Keyword	Occurrence
Human	685	Virology	115
Coronavirus Infection	601	Infection Control	113
Humans	411	2019-nCoV	91
COVID-19	409	Middle East Respiratory Syndrome Coronavirus	91
Coronavirus Infections	399	Fever	85
Virus Pneumonia	369	World Health Organization	84
Pneumonia, Viral	341	Pathogenicity	80
China	318	Disease Transmission	79
Epidemic	315	Genetics	79
Nonhuman	309	Travel	74
Betacoronavirus	305	Isolation And Purification	72
Severe Acute Respiratory Syndrome Coronavirus 2	293	Global Health	71
Coronavirinae	263	Coughing	70
Coronavirus	263	Quarantine	70
Coronavirus Disease 2019	246	Animal	69

SARS Coronavirus	186	Disease Severity	68
2019 Novel Coronavirus	171	Middle Aged	63
Virus Transmission	142	Middle East Respiratory Syndrome	63
Disease Outbreaks	139	Virus Genome	63
Public Health	137	Epidemiology	61
Severe Acute Respiratory Syndrome	131	Health Care Personnel	59
Female	124	Phylogeny	59
Pandemic	122	Infection Prevention	58
Pneumonia	121	Pandemics	58
SARS-CoV-2	118	Mortality	57

9. Top Funding agency/Sponsors

Top 15 funding/sponsor agencies have shown in the figure 6. It has been found that maximum publications were produced with support from National Natural Science Foundation of China. National Institutes of Health, National Institute of Allergy and Infectious Diseases, Chinese Academy of Sciences are other prominent agency which provides support for the advancement of the Coronavirus and Covid-19 research.

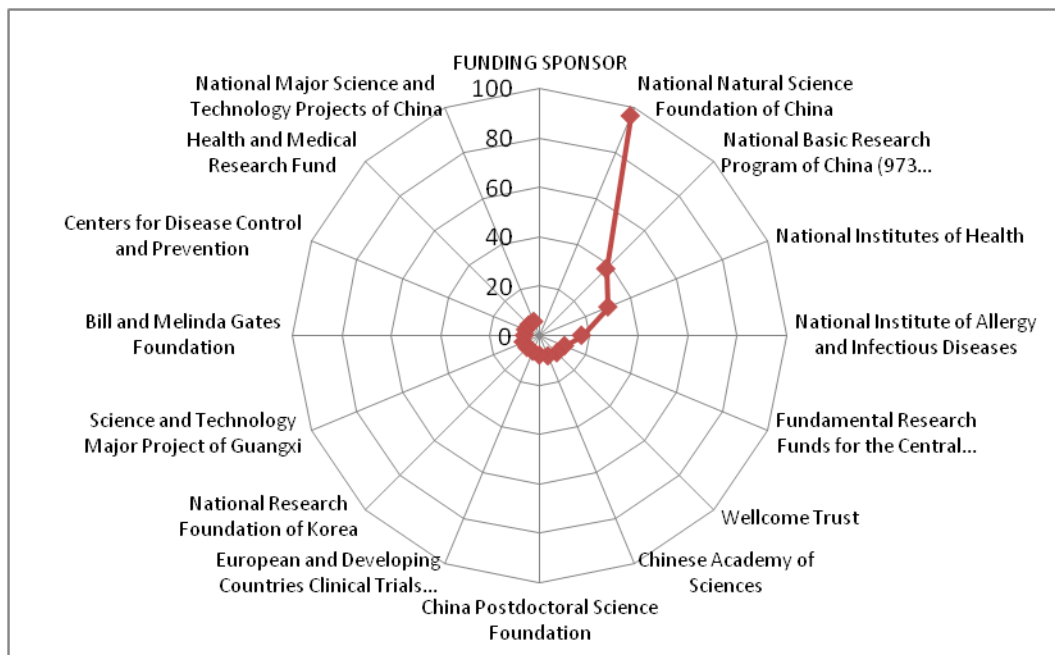


Figure 6 represents the top 15 funding agencies in the studied domain

10. Key research papers based on most citations

Top 15 most cited papers were listed in Table 5. It has been observed that the highest cited article was published in 2003 by Huang C., and his coauthors in 'The Lancet' journal. It has been

observed that the most-cited articles were mainly published in high impact factor journals such as New England Journal of Medicine, JAMA - Journal of the American Medical Association, and Nature.

Table 5 List of Top 15 key paper based on maximum citations

SI No.	Authors	Source title	Title	Cited by
KP1	Huang C., etal.	The Lancet	Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China	315
KP2	Zhu N., etal.	New England Journal of Medicine	A novel coronavirus from patients with pneumonia in China, 2019	219
KP3	Li Q., etal.	New England journal of medicine	Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia	189
KP4	Chen N., etal.	The Lancet	Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study	173
KP5	Chan J.F.-W., etal.	The Lancet	A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster	153
KP6	Wang D., etal.	JAMA - Journal of the American Medical Association	Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China	151
KP7	Zhou P., etal.	Nature	A pneumonia outbreak associated with a new coronavirus of probable bat origin	128
KP8	Lu R., etal.	The Lancet	Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding	120
KP9	Holshue M.L.,etal.	New England Journal of Medicine	First case of 2019 novel coronavirus in the United States	82
KP10	Rothe C., etal.	New England Journal of Medicine	Transmission of 2019-NCOV infection from an asymptomatic contact in Germany	72
KP11	Wang C., etal.	The Lancet	A novel coronavirus outbreak of global health concern	68
KP12	Wu J.T., etal.	The Lancet	Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study	62
KP13	Hui D.S.,etal.	International Journal of Infectious Diseases	The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health – The latest 2019 novel coronavirus outbreak in Wuhan, China	54
KP14	Wu Z., etal.	JAMA - Journal of the American Medical Association	Characteristics of and Important Lessons from the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72314 Cases from the Chinese Center for Disease Control and Prevention	52
KP15	Wu F., etal.	Nature	A new coronavirus associated with human respiratory disease in China	46

Conclusions

The widespread of COVID-19 epidemic disease has created major challenges and raised serious public health issues to the international community. It has prompted a demand for global scientific communities to carry out specific research that could better characterize the clinical and pathogens of this viral disease. We, therefore, attempted to the study of the literature growth in Covid-19 research using various scientometrics indicators, which will be largely support the scientific communities in finding potential collaborator and identifying valuable research

patterns from publications and developments in the field of Coronavirus disease 2019 (Covid-19). The result shows that the China and USA dominates in the research output. In conclusion, there is exponential rise in the number of research publications on COVID-19 since the outbreak of the epidemic and many researchers in several regions of the world are working to containment the spread of Covid-19 infectious diseases.

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