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Bibliometrics of COVID-19 publications in first three months of 2020

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Abstract

The paper is an attempt to analyze the publications on COVID-19, an infectious disease which has been declared a pandemic by WHO. The publications during Jan-March 2020 have been selected for the study that has been indexed in Scopus database till March 31, 2020. It was found that during this span of three months, 884 documents have been published on COVID-19 in the form of articles, news, letters, notes, editorials, reviews, short surveys and erratum. These documents received a total of 2603 citations and six documents received even more than 100 citations. China has contributed maximum documents and Huazhong University of Science and Technology was the top contributor. *The Lancet* and *BMJ Clinical Research Ed* were the most preferred journals. A large number of documents had international collaborations.

Keywords: Bibliometrics, Scientometrics, Research output, COVID-19, Novel Coronavirus, SARS-CoV-2, 2019-nCoV

1. INTRODUCTION

A new infectious disease appeared at the end of year 2019 caused by a newly discovered coronavirus (SARS-CoV-2 or 2019-nCoV) which was given the name COVID-19 by WHO on Feb 11, 2020. The outbreak was identified in Wuhan, China in Dec 2019 and then spread to other parts of the world. It was declared as a Public Health Emergency of International Concern on Jan 30, 2020 and then as a pandemic on March 11, 2020 by WHO[1]. According to WHO website, on March 31, 2020 a total of 203 countries have been affected by the disease[2].

The virus is known to spread among human through contact via droplets produced by coughing or sneezing. By touching contaminated surfaces people might get infected when they touch their eyes, nose or mouth[3]. Many countries in the world have implemented travel restrictions while many others have implemented lockdown and curfews to stop the spread of the virus.

2. OBJECTIVES OF THE STUDY

The major objective of the study was to analyze the publications on COVID-19 during Jan-March 2020 from a bibliometric point of view. The specific objectives included:

- To identify the type of publications on COVID-19.
- To identify the most prolific authors publishing COVID-19 research.
- To explore the top sources for publishing research on COVID-19.
- To find out the top countries in COVID-19 research.
- To explore the top institutions conducting research on COVID-19.
- To study the keywords used by the authors.
- To explore the citation pattern and top cited publications.

3. SCOPE AND METHODOLOGY

The study is based only on the publications which have been added in Scopus database till 31st March 2020. The data was extracted from Scopus on 1st April 2020 morning. Thus, any study not included in the database till this date is likely to be missed.

For extraction of data, the Article Title-Abstract-Keyword field of the database was searched using various phrases like “COVID-19”, “COVID19”, “19 COVID”, “2019 coronavirus”, “novel coronavirus”, “2019 novel coronavirus”, “2019 novel corona virus”, “coronavirus 2019”, “corona virus 2019”, “2019 corona virus”, “2019-nCOV”, “SARS-COV-2” and "severe acute respiratory syndrome coronavirus 2".

Some of these phrases provided required results while some did not provide pertinent results. Thus, keeping in consideration the results of the above phrases, only relevant phrases were selected for search and the final query used for data extraction was formulated as below:

> *TITLE-ABS-KEY("COVID-19" OR "COVID 19" OR "2019 novel coronavirus" OR “2019 novel corona virus” OR "coronavirus 2019" OR "corona virus 2019" OR “2019-nCOV” OR "severe acute respiratory syndrome coronavirus 2" OR (“SARS-COV-2” AND 2019))*

The above query provided 885 results, out of which 1 result was from the year 2019 while 884 results were from the year 2020. The 1 document of 2019 was excluded and the remaining 884 documents were considered for the study. Since all new information on any new

topic of research is important, all types of publications like articles, editorials, short notes, etc. were included in the study. The data was analyzed with the help of MS-Excel, Bibliometrix[4] package and VOSviewer[5].

4. DATA ANALYSIS

During Jan-March 2020, a total of 884 documents have been published on COVID-19 in the form of articles, news, letters, notes, editorials, reviews, short surveys and erratum. During a short span of three months, a significant amount of documents have been published as COVID-19 being a new infectious disease and scientists are keen to study and report on this new disease which has effected almost the whole world.

The 884 documents appeared in 297 sources and received a total of 2603 citations with an average of 2.94 citations per document. These documents appeared in 297 journals and have been authored by 3098 authors having an average of 3.5 authors per document.

Table 1: Publications Summary

Total Documents	884
Sources (Journals, Books, etc.)	297
Average citations per documents	2.945
Total Number of Authors	3098
Author Appearances	4555
Authors of single-authored documents	150
Authors of multi-authored documents	2948
Single-authored documents	236
Documents per Author	0.285
Authors per Document	3.5
Co-Authors per Documents	5.15
Collaboration Index	4.55

4.1 Type of Publications

Out of the total 884 documents, 372 (42.08%) were in the form of articles and news, 146 (16.52%) letters, 142 (16.06%) notes, 122 (13.8%) notes, 74 (8.37%) reviews, 16 (1.81%) short surveys and 12 (1.36%) erratum and corrections. Among these, the articles were cited the most and received citations with an average of 4.66 citations per paper. The other document types also received considerable citations during this short span of time (table 2).

Table 2: Type of Documents

Document Type	TP	TC	ACPP
Article and News	372	1732	4.66
Letter	146	247	1.69
Note	142	310	2.18
Editorial	122	149	1.22
Review	74	145	1.96
Short Survey	16	20	1.25
Erratum and Correction	12	0	-
TOTAL	884	2603	2.94
TP= "Total Publications", TC= "Total Citations", ACPP= "Average Citation Per Publication"			

4.2 Prolific Authors

The top 10 authors are shown in table 3. E. Mahase and A. Rimmer of BMJ have contributed 14 and 10 documents respectively but since all these documents are in the form of news, so these have not been cited by others. Next most prolific authors with 8 documents each are C. Drosten of Institute of Virology, Berlin and A. Zumla of University College London. Their publications received considerable citations being 139 and 54 respectively having average citations per paper of 17.38 and 6.75. Other authors receiving significant citations were P.R. Hsueh (7 documents, 18 citations), G. Ippolito (6 documents, 50 citations) and Z.A. Memish (6 documents, 47 citations).

Table 3: Top Ten Authors

Author	Affiliation	TP	TC	ACPP
Mahase, E.	British Medical Journal, London, United Kingdom	14	0	-
Rimmer, A.	British Medical Journal, London, United Kingdom	10	0	-
Drosten, C.	Charité Universitätsmedizin Berlin Institute of Virology, Berlin, Germany	8	139	17.38
Zumla, A.	Department of Infection, Division of Infection and Immunity, University College London, United Kingdom	8	54	6.75
Hsueh, P.R.	National Taiwan University Hospital, Taipei, Taiwan	7	18	2.57
Eurosurveillance Editorial Team	European Centre for Disease Prevention and Control (ECDC), Stockholm, Sweden	6	3	0.5
Iacobucci, G.	British Medical Journal, London, United Kingdom	6	0	-
Ippolito, G.	National Institute for Infectious Diseases – Lazzaro Spallanzani – IRCCS, Rome, Italy	6	50	8.33
Kim, J.Y.	Department of Internal Medicine, Incheon Medical Center, Incheon, South Korea	6	11	1.83
Memish, Z.A.	Research and Innovation Center, King Saud Medical City, Alfaisal University, Riyadh, Saudi Arabia	6	47	7.83
TP= "Total Publications", TC= "Total Citations", ACPP= "Average Citation Per Publication"				

4.3 Top Sources for Publication

Research on COVID-19 has been published in several sources. The top 10 journals publishing such research are listed in table 4. The highest number of publications appeared in *The Lancet* (72 papers) which also received the maximum number of citations (843) with an average of 11.7 citations per paper. The next most preferred journal for COVID-19 publications was *BMJ Clinical Research Ed* with 61 publications but the citations to these publications was less as maximum among these were news items. Other prominent journals publishing such research included *Journal of Medical Virology* (43 papers), *European Communication Disease Bulletin* (25 papers), *The BMJ* (22 papers), *JAMA- Journal of the American Medical Association* (18 papers), *Nature* (18 papers), *Lancet Infectious Diseases* (16 papers), *Emerging Microbes and Infections* (15 papers) and *Travel Medicine and Infectious Diseases* (15 papers).

Table 4: Top Journals for Publication

Source	Publisher	TP	TC
Lancet	Lancet Publishing Group	72	843
BMJ Clinical Research Ed	BMJ Publishing Group	61	5
Journal of Medical Virology	John Wiley and Sons	43	168
Euro Surveillance Bulletin Europeen Sur Les Maladies Transmissibles = European Communicable Disease Bulletin	ECDC	25	68
The BMJ	BMJ Publishing Group	22	18
JAMA - Journal of the American Medical Association	American Medical Association	18	218
Nature	Nature Research	18	149
Lancet Infectious Diseases	Lancet Publishing Group	16	12
Emerging Microbes and Infections	Taylor and Francis	15	61
Travel Medicine and Infectious Disease	Elsevier	15	24
TP= "Total Publications", TC= "Total Citations"			

4.4 Top Contributing Countries

The top 10 countries publishing on COVID-19 are listed in table 5. China, where the disease originated, is the top contributing country with 312 publications which received 1789 citations with an average of 5.73 citations per paper. The next most productive country is United States with 156 publications receiving 542 citations with average of 3.47 citations per paper. This is followed by United Kingdom with 84 publications and Canada and Italy with 44

publications each. Among the top 10 countries, the ACPP was highest for China (5.73) and lowest for Singapore (0.69).

Table 5: Top Countries

Country	TP	TC	ACPP
China	312	1789	5.73
United States	156	542	3.47
United Kingdom	84	237	2.82
Canada	44	54	1.23
Italy	44	79	1.80
Hong Kong	35	185	5.29
Germany	33	167	5.06
France	30	52	1.73
Switzerland	29	50	1.72
Australia	26	149	5.73
TP= "Total Publications", TC= "Total Citations", ACPP= "Average Citation Per Publication"			

4.5 Collaborations among Top Countries

Inter and intra country collaborations are a common feature of research publications. In this study also the inter-country collaboration linkages were studied. The collaboration linkages among the top 10 contributing countries are given in table 6. Among these, the maximum collaborations (44) were found between China and United States. The next most collaborations were between United States and United Kingdom (15 collaborative papers). There were 12 collaborative publications between China and Canada. All the top 10 countries have collaborated among themselves for research purpose.

Table 6: Collaboration Linkages among Top Countries

	China	United States	United Kingdom	Canada	Italy	Hong Kong	Germany	France	Switzerland	Australia
China		44	8	12	4	11	7	4	3	8
United States	44		15	9	10	7	9	7	4	6
United Kingdom	8	15		8	10	8	11	5	6	4
Canada	12	9	8		4	2	1	1	1	3
Italy	4	10	10	4		4	6	5	3	3
Hong Kong	11	7	8	2	4		6	1	2	3
Germany	7	9	11	1	6	6		5	1	1
France	4	7	5	1	5	1	5		3	3
Switzerland	3	4	6	1	3	2	1	3		1
Australia	8	6	4	3	3	3	1	3	1	

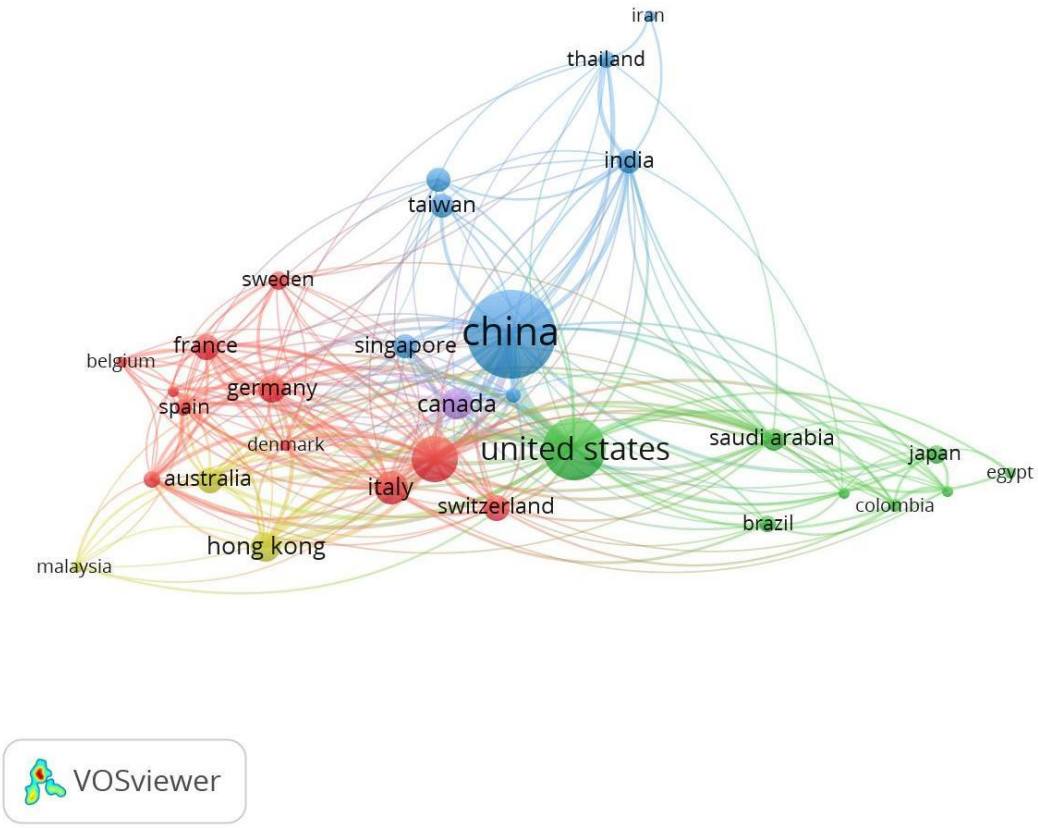

Figure 1: Country co-authorship pattern

4.6 Top Contributing Institutions

The top ten institutions contributing towards COVID-19 publications are listed in table 7. Among these top ten institutions, seven are from China and one each from Hong Kong, Canada and United Kingdom. The topmost contributors were The University of Hong Kong and Huazhong University of Science and Technology, both contributing 26 publications each. The next most contributing institutions included Tongji Medical College (24 papers), London School of Hygiene & Tropical Medicine (22 papers) and Chinese Academy of Sciences (21 papers). In terms of citations, the ACPP was highest for Chinese Academy of Sciences (28.14), followed by Capital Medical University (26.16) and Chinese Academy of Medical Sciences & Peking Union Medical College (18.65).

Table 7: Top Contributing Institution

Institution	Country	TP	TC	ACPP
The University of Hong Kong	Hong Kong	26	293	11.27
Huazhong University of Science and Technology	China	26	345	13.27
Tongji Medical College	China	24	325	13.54
London School of Hygiene & Tropical Medicine	United Kingdom	22	39	1.77
Chinese Academy of Sciences	China	21	591	28.14
Wuhan University	China	20	197	9.85
Fudan University	China	19	145	7.63
Capital Medical University	China	19	497	26.16
University of Toronto	Canada	17	34	2.00
Chinese Academy of Medical Sciences & Peking Union Medical College	China	17	317	18.65
TP= "Total Publications", TC= "Total Citations", ACPP= "Average Citation Per Publication"				

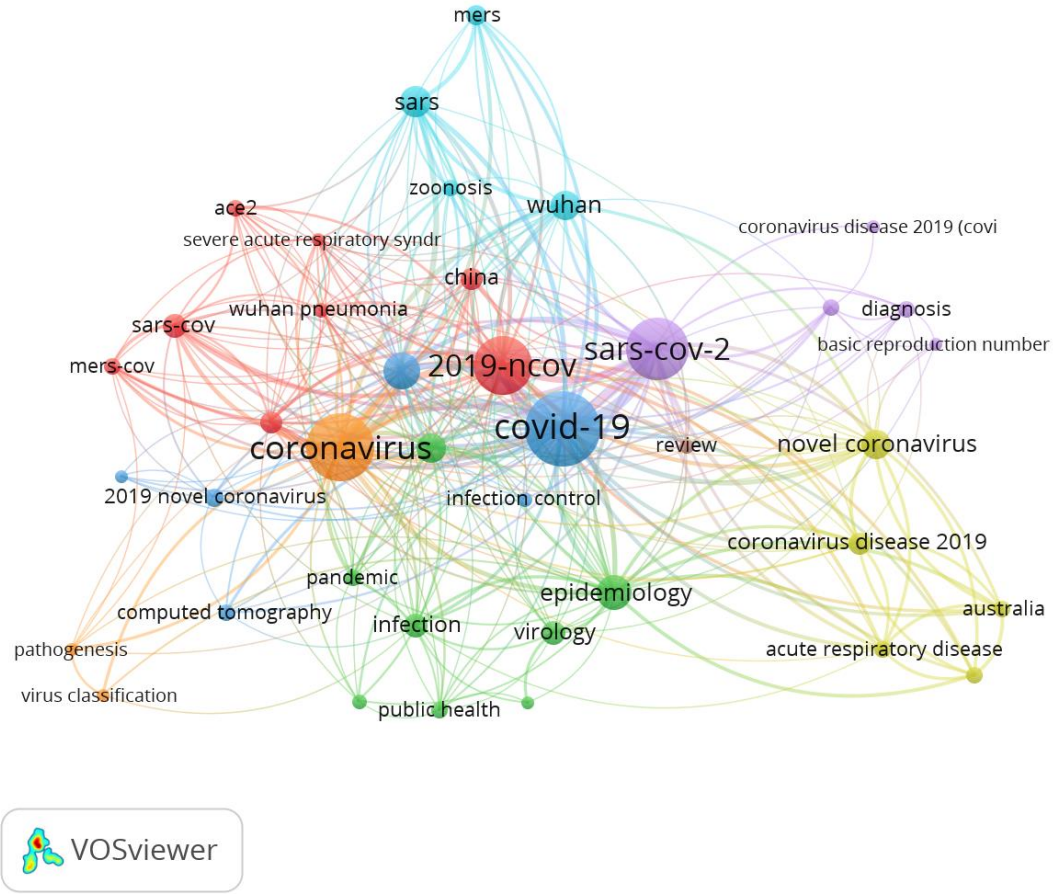

Figure 2: Author Keywords

4.7 Author Keywords

The keywords used by the authors in their publications were also explored. A graphical representation of these author keywords is shown in figure 2. The most commonly used keywords (along with their frequency of occurrences) were covid-19 (142), coronavirus (116), sars-cov-2 (96), 2019-ncov (86), pneumonia (35), epidemiology (30), sars (22), novel coronavirus (22), wuhan (22) and outbreak (22).

4.8 Citation Profile and Top Cited Publications

The 884 publications on COVID-19 received a total of 2603 citations with an average of 2.94 citations per paper. The citation profile of these publications is indicated in table 8. Out of the total publications, 276 (31.22%) have received citations while the remaining 608 (68.78%) didn't receive any citation till April 1, 2020. Among those publications which received citations, the maximum were articles (114) followed by notes (59), letters (46), editorials (30), reviews (23) and short surveys (4). The erratum and corrections were not cited by others.

There were six publications in the form of research articles which have received more than 100 citations. Five publications received citations between 51-100 out of which three were articles, one each is letter and note. 198 publications (22.39%) received upto 5 citations while 31 (3.51%) received citations between 6 to10.

The top cited ten publications are listed in table 9. Among these ten publications, five have been published in *The Lancet*, three in *New England Journal of Medicine* and one each in *Nature* and *JAMA - Journal of the American Medical Association*. The maximum number of citations (244) was received by the paper titled "Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China" by Huang, C., et al published in *The Lancet*.

Table 8: Citation Profile

No. of Citations	Article and News	Letter	Note	Editorial	Review	Short Survey	Erratum	TOTAL
>100	6	-	-	-	-	-	-	6
51-100	3	1	1	-	-	-	-	5
41-50	-	-	-	1	-	-	-	1
31-40	2	-	1	-	-	-	-	3
21-30	6	1	1	-	2	-	-	10
11-20	11	4	4	2	1	-	-	22
6-10	12	2	6	3	7	1	-	31
1-5	74	38	46	24	13	3	-	198
Zero	258	100	83	92	51	12	12	608
TOTAL	372	146	142	122	74	16	12	884

Table 9: Top Cited Publications

Authors	Title	Source Title	Citations
Huang, C., et al	Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China	The Lancet	244
Zhu, N., et al	A novel coronavirus from patients with pneumonia in China, 2019	New England Journal of Medicine	176
Chen, N., et al	Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study	The Lancet	133
Chan, J.F.-W., et al	A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster	The Lancet	133
Wang, D., et al	Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China	JAMA - Journal of the American Medical Association	110
Zhou, P., et al	A pneumonia outbreak associated with a new coronavirus of probable bat origin	Nature	103
Lu, R., et al	Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding	The Lancet	94
Holshue, M.L., et al	First case of 2019 novel coronavirus in the United States	New England Journal of Medicine	66
Rothe, C., et al	Transmission of 2019-NCOV infection from an asymptomatic contact in Germany	New England Journal of Medicine	61
Wang, C., et al	A novel coronavirus outbreak of global health concern	The Lancet	54

5. SUMMARY AND CONCLUSION

The bibliometric analysis of documents on COVID-19 published between Jan-March 2020 indicated that the scientists and academicians were quick in conducting and reporting research on this new topic as 884 publications appeared in just a span of three months. These 884 publications appeared in 297 journals receiving 2603 citations averaging 2.94 citations per publication. E. Mahase and A. Rimmer of BMJ were the top contributors while *The Lancet* and *BMJ Clinical Research Ed* were the most preferred journals for publishing research on COVID-19. The disease originated from China and it is the country which has published the maximum documents as well as citations on this newly emerged disease. Authors of many countries have collaborated in conducting research on this topic and the maximum collaborations were between China and United States. Among the top ten institutions which have published on COVID-19, seven are from China among which Huazhong University of Science and Technology is the top contributor. The research on this disease was quick to attract citations as six publication received

more than 100 citations in this short span indicating that researchers were working towards researching and reporting on this disease and trying to find possible solutions for controlling and managing this outbreak.

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