International Journal of Information Science and Management
Vol. 21, No. 2, 2023, 141-156
DOI: https://doi.org/10.22034/ijism.2023.1977573.0 / DOR: https://dorl.net/dor/20.1001.1.20088302.2023.21.2.9.1

Original Research

Global Visualization of Research Outburst Up-To 2nd Wave of Covid-19 On WoS Literature: A Scientometric Preview

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Received: 13 September 2021
Accepted: 08 December 2021

Abstract

Scientometric study on covid-19 has taken place to highlight the latest trend and situation of literature on covid-19. After the outbreak from Wuhan city, Coronavirus spread worldwide, destroying health, mobility, livelihood and socio-economic management. To make a qualitative and quantitative investigation this scientometric study is eventuated. Thousands of research outputs are increasing in this epidemic situation. During 18 months (2019 December-2021 May) WOS database indexed 1234 literature on covid-19 and related topics. Most of the publishers dropped their paywall and made it open access for more communication. A string was created with a time to exact all secondary bibliographic data. A .txt file has been downloaded from the WOS database for visualisation and mapping. Some statistical formulas are adequate to calculate the annual growth rate (AGR), author productivity, and collaborative coefficient (CC). WOS viewers, MS Excel, and QGIS software are also used for data representation. The outcome results are the direction of the literature growth map continuously upward. In the top 10 journals and authors, 'Medicine' and 'Wang J' ranked top. Author collaboration was maximum (0.997), but more collaboration was required. China, India and the USA contributed the most with relevant research output. Covid-19 is near all subject disciplines, where medical science, environmental science, engineering and social science are gathered. It is hoped that this type of research outcome will help the government and society manage and develop future strategies to prevent such natural disasters.

Keywords: Scientometric Study, Covid-19, Sars-Cov-2, Natural Disaster, Collaborative Co-Efficient, Collaborative Network, Quantitative-Visual Analysis, Lotka's Law, Web of Science.

Introduction

Coronavirus will be an obstacle, and mortality is realizing how helpless we are. It affects our daily life and livelihood (Ahmad & Batcha, 2020). Coronavirus appeared in the mid-1960s. According to the Centres for disease control and prevention (CDC) there are 7 types of Coronavirus available (NCIRD, 2020). Covid-19 is one of the latest and most dangerous one (Radha, 2020). This virus first appeared in Wuhan city of China at the end of 2019; it spread worldwide. This virus was introduced as Novel Coronavirus, then CRG (International

Committee of Coronavirus Study group) renamed as SARS-COV-2 and is known as Covid-19 declared by WHO in 2019 (WHO, Naming the Coronavirus disease (COVID-19), 2019). It is a RNA-familiar virus, spread by droplets or direct contact human to humans (Ahmad & Batcha, 2020). In the last two years, a lot of scholarly literature has been gathered online. Google can retrieve 5,01,00,00,000 information sources within 1.61 seconds, Google scholar can hit more than 215900 topics on Coronavirus (Kalra, Kaur, Ichhpujani, Chahal, & Kumar, 2021). However MeSH, SCOPUS, and Web of Science (WoS) databases are indexing lots of literature per day (Pal, 2021). In this research work, a scientometrics study is conducted to help the covid warriors to find the solutions to problems (Atlasi, Chakoli, Ramezani, Tabatabaei-Malazy & Larijani, 2021).

Why need scientometric study on Covid-19 literature?

In January, 2020, a public health emergency was declared by WHO for the decrease of Coronavirus (Jasarevic, Lindmeier, & Chaib, Statement on the first meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel Coronavirus (2019-nCoV), 2020). According to the World Health Organization (WHO), 169597415 have confirmed cases. 3530582 have died, and 1546316352 vaccine doses were administered all over the world (27 May 2021), and 1.3 million health workers sacrificed their life; in a report of IMA (Centre, 2020), India lost 1372 health workers up to the second wave of spreading, and NIH reported that above 151 doctors died in Italy during the pandemic war (Onder, 2020). These active cases have been gradually increasing daily, and the health, socio-economics, and mobility systems have collapsed (Homolak, Kodvanj, & Virag, 2020). Organizations, agencies, experts, and the scholarly community are involved in finding the hidden solution to drugs, vaccines and medicines. The second wave Covid 19 is more dangerous than the previous; (Surulinathi, Arputha, Srinivasaragavan, & Jayasuriya, 2020). Their mutation is changing their characters and becoming more powerful daily.

Scientometrics research is an output of qualitative and quantitative literature. (Surulinathi, Arputha Sahaya, Prasanna, & T, 2020) "Scientometric is a scientific discipline which performs productive measurement of scientific activity and reveals its objective quantitative regularities" by Haiturn2 (Balasubramanian & Ayaba, 2018). Scientists, and doctors are desperately finding research output from where they can evaluate and digest the trend of research (Şenel & Topa, 2021). A few literature were conducted in the previous decade, but during 2020-21 a huge amount of scholarly literature has emerged on this burning topic (Patil, 2020). SCOPUS, WoS etc. databases have published thousands of publications. In this study, the WoS database has been selected as literature resource.

Literature Review

An exponential growth in literature found on Covid-19 during these two years. Previous literatures are evidence of the trend, and from these literatures, researchers can find the next gap for evaluation (Santra, Majhi, & Bhowmick, 2021).

Atlasi, Chakoli, Ramezani, Tabatabaei-Malazy and Larijani (2021) analysed the scientific efforts of researchers and organizations on Covid-19 situations. This paper was based on endocrinology. To evaluate the article, more efforts and effective management were needed. Surulinathi, Arputha Sahaya, Prasanna, & Jayasuriya (2020) studied Covid-19grug and medicines during 2020-21, with 313411 documents retrieved on Covid-19 drugs and medicine.

Only 8 titles have more than 1000 citations and were published in high-impact journals. These articles or literature helped to discover Covid-19 vaccine at the end of 2020. He made an author study on Covid-19 vaccine. This article received only 97 articles from the WOS database (Surulinathi, Arputha, Srinivasaragavan, & Jayasuriya, 2020) but also literature was also highly cited and mostly distributed. Krishnamurly carried out a scientometric study on the recent trend of Coronavirus. All data were mapped as the author's productivity and country-wise distribution on WOS literature (Bhalachandra, 2020). This paper selected mainly medicine, virology, and virus-related literature. Radha (2020) elaborated in his research work on Coronavirus. He arranged WOS data from 2018-2020, mainly on China and Wuhan University publications. Farooq, Rehman, Ashiq, Siddique and Ahmad (2021) represented a bibliographic review of her paper on Covid-19. The main focus of this paper was the most cited and impactful literature and its distribution. Hong Kong, China, England had the maximum cited journals. In a scientometric study on Covid-19 by Azam Malik, Butta & Bashirc (2020), a visual representation was mapped in the last decades. Among 28846 literature, 53% were common publications, and 8% of documents suffered from a lack of global efforts. Authors' co-operation, and author networking were found among only developed countries. Besides this literature, Kalra et al. (2021) researched Covid-19 and ophthalmology. Different databases were selected as sources. Basic information and future expectation were mentioned in this article. Homolak et al. (2020) identified a barrier in academic information patterns due to Covid-19. This article was based on velocity, availability, scientific collection, significance and problems regarding information of open science. Farooq et al. (2021) Examined 6694 bibliographic data on Scopus on Covid-19 to represent the bibliographic analysis of the disease Covid-19 during 2019-20. This article presented the outbreak of Coronavirus and the exponential growth of medical science literature. Ahmad and Batcha (2020) focused on global research output on Covid-19. They analysed only citations of literature during 2011-20. According to this article, the maximum number of articles were published in 2019. Most of the publications were from the USA and preferred the English language. Palit (2020) highlighted the paywall and open access literature on Covid-19 in the dimensions database during 2019. He found that leading institutions were in China, but most cited journals belonged to England and the USA. Medical-related literature from Iran has been produced by Okhovoti and Arshadi (2021). This paper aimed to represent research, its impact on Iran, and how to help the medical department rescue itself. Quantitative detection and biological evaluation were the main mottoes of this paper. G. Colavizza, Costas, Traag, Van Eck, Van Leeuwen and Waltman (2021) unfold a scientific chapter on CORD-19. During the analysis he visited different databases and gathered literature on CORD-19, which was almost coverage of research on COvid-19. CORD-19 focuses on a few defined areas. Grammes (2020) and his co-authors found a huge gap between different databases in the literature on Covid-19. Searching, indexing, popularity, scopes, and such limitations are also found in databases. Pal (2021) carried out a study on the knowledge outburst of global literature on Covid-19. Characters of Coronavirus, growth of literature, global presentation, collaboration, visualized co-authorship occurrences, and arranged influenced contribution in showcases were the main outcome of this paper.

So, most of the literature focuses only on authorship, global distribution and growth of literature, but this paper differs from the above literature. The aims and objectives make it unique from other publications.

Objectives

This paper showcases scientific information on Coronavirus. Through this scientometric study, a visual map and global orientation of the research output of covid-19 can be provided to researchers to find the gap. Otherwise, the researchers' work has been conducted to fulfil the following objectives:

1. To enumerate the growth of the bibliometric profile of covid 19 in WoS literature.
2. To study the profile contribution of authors, degree of collaboration and collaborative co-efficient index of authors.
3. To identify the most dynamic, favourite journal in WoS.
4. To reveal the most productive authors and literature.
5. To map the contribution of researchers' output globally.
6. To observe the accuracy of the author's productivity with Lotka's Law.
7. To determine the extent of subject categories.

Materials and Methods

This research paper is adequate for mapping and analysing the gigantic output of global research on covid -19 during 2019-21 in the WoS database (Web of Science, n.d.). In this study, the WoS database was accepted for its advanced search facility, standard, most precise and comprehensive information and most of the extensively used bibliographic sources (Azam Malik et al., 2020). After downloading data in excel format, data has been tabulated per objectives. The time span is very short (2019-21), so data has been divided month-wise. A .txt file has been downloaded from the WoS database for visualisation and mapping. Some statistical formulas are adequate to calculate the annual growth rate (AGR), author productivity, and collaborative coefficient (CC). VOSviewers (Van Eck, 2020), MS Excel, and QGIS, the software also used for data representation. Listed all data are secondary data that came through some string of search queries as follows:

TITLE-ABS-KEY (Covid-19) OR TITLE-ABS-KEY (Coronavirus) OR TITLE-ABS-KEY (SARS-COV-2)) AND (LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2021)

(Data harvest on 24th May, 2021)

Results

Articles, book chapters, letters, and Reviews have been taken through the database, but conference proceedings, newspaper clips, patents interview, and technical reports are absent (Colavizza, et al., 2021). Only 2019-21 time-span has been taken for this study, except WOS database, other databases are absent.

In the WoS database, Covid-19 related literature has been indexed with different terms (Onder, 2020). According to our search string, it may have missed some terms and did not get all literature. Restrictions of this time are here. WOS does not provide month-wise data; it is restricted to year-wise time. In this holistic research, some exciting results have come out. Here the results have been divided into two sections i. Descriptive analysis ii. Visual analysis.

During this study, within 2019-21, 1234 publications were retrieved from WOS database. To measure the exponential growth of publication average growth rate (AGR) has been calculated in Table 1. In the early situation in 2020, minimum publications took place (6.33%), then gradually, this topic sucked all attention to the researchers. During April-December, 2020

and Jan-March, 2021 (87%) of publications were uploaded on covid-19. Maximum growth rate was from Jan-March, 2021. There was no item retrieved in 2019. According to WHO, 25 countries were highly infected, and the mortality rate was also high between Jan-March, 2021 and parallelly, the publication growth rate also increased.

Table 1
Trend and growth of research output

Year	Month	No.of Publication	Percentage of Publication (%)	AGR percentage	Total citation	CPP	Percentage of Citation (%)
2020	Jan-March	78	6.33		2305	29.55	4.42
	April-June	244	19.77	212.82	4641	19.02	8.87
	July-Sep	245	19.85	0.4	9918	40.48	18.95
	Oct-Dec	282	22.85	15.1	13252	46.99	25.32
2021	Jan-March	299	24.23	6.02	14742	49.30	28.17
	April-June	86	6.97	-71.23	7464	86.79	14.27

AGR= Average growth rate; CPP= Citation per paper, AGR= $\{t_2 / (t_1 - 1)\}$ x 100 (where $t_2 \approx$ Ending Value, $t_1 \approx$ Beginning value)

Figure 1 shows the AGR and growth of publications month-wise. In 2019 covid-19 was not a burning topic, but after spreading this epidemic worldwide, AGR was maximum in April-June, 2020. As April-June, 2021, all publications are not recorded, with the AGR showing -71.33.

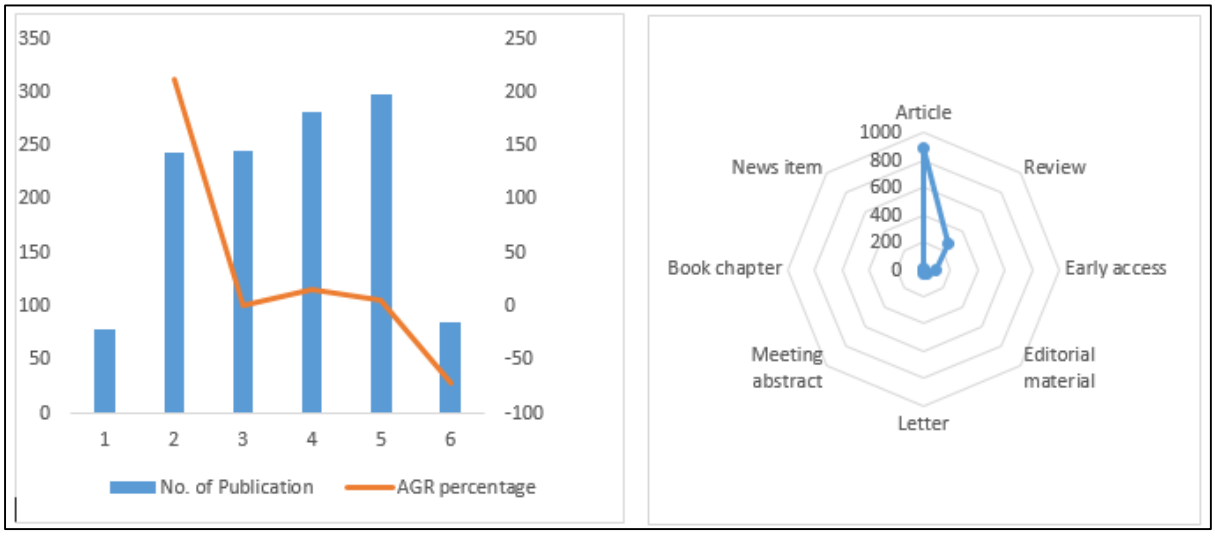

Figure 1: Distribution of trend and growth of research output

A report has come out on the types of publications. The above figure shows that 892 publications are 'research article', 258 are 'Review chapter', 88 are 'early access', 42 'editorial materials', 42 'letters' and 7 items are 'Meeting, Book chapter, news item'.

International collaboration scenario

Authorship study is critical and necessary for better communication. In applied research, collaboration and distribution are essential for a positive impact (Şenel & Topa, 2021). In this

era, different subject disciplines are merged. So, authors are also following the same way. In this pandemic, it is necessary to work together where medical science, social science, technology, and environmental science must work together to defeat Covid-19 (Kalra et al., 2021). In this study international collaboration has occurred but how much collaboration is effective and from where this trend was coming, showing in Table 2. Total 6594 authors contributed with this holistic work in 1234 publications. Author collaboration was almost equal in every month of 2020-21. Especially in April-June, 2020.

Table 2
Distribution of Authorship pattern and Degree of Collaboration

Author Productivity	Average pub/ author	0.21	0.28	0.19	0.17	0.17	0.02
	No. of Publication	78	244	245	282	299	86
Degree of Collaboration	Degree of collaboration	0.976	0.98	0.987	0.987	0.988	0.997
	(N1+N2)	376	859	1235	1600	1708	3308
	Multiple author (N2)	367	842	1220	1580	1689	3299
	Single author (N1)	9	17	15	20	19	9
Distribution by Authorship Pattern	10>	2	3	5	4	6	4
	10	1	9	7	12	15	4
	9	3	10	12	16	19	4
	8	6	13	31	28	31	13
	7	4	16	19	12	19	8
	6	6	14	20	33	42	12
	5	11	11	23	31	29	15
	4	16	25	22	41	43	17
	3	9	22	39	47	35	16
	2	8	29	39	33	33	24
	1	9	17	15	20	19	9
Month		Jan-March	April-June	July-Sep	Oct-Dec	Jan-March	April-June
Year		2020				2021	

At least the authors created a maximum publication (0.28), showing the degree of collaboration (DoC), where 0.98 DoC occurred. Otherwise, more or less every time, author collaboration was maximum in between 0.976 to 0.997 (April-June, 2021 has a maximum).

Author Collaboration index

To measure and judge the proportion of author collaboration relation, a coefficient correlation (CC) index is calculated.

[{(f1)1+ (f2)2+ (f3)3+ (f4)4+…. (fk)k} / N]
= [{(9) + (8)2+ (9)3+ (16)4+(11)5+(24)6} / 78]
= [{9 + 16+ 27 +64 +55+ 144} /78]
= [315 / 78]
= 4.03 (in Jan-March 2020, as such, others are calculated)

(Where f1≈ single author, f2≈ Two authors, f3≈ Three authors, fk≈ k number of the author (s), N≈ Total number of publications in that year)

During April-June, 2021 CC value was a maximum (38.46) and April-June, 2020, a minimum (3.52), as discussed in previous Table 2. CC value was gradually increasing day by day. June 2020 to March 2021 CC value was static, but a huge breakthrough was shown in April-June, 2021 (Table 3).

Table 3

Collaborative co-efficient index measurement

Year	Month	Number of Article	Total Authors	1	2	3	4	5	6 ≥	CCI
2020	Jan-March	78	376	9	8	9	16	11	24	4.03
	April-June	244	859	17	29	22	25	11	65	3.52
	July-Sep	245	1235	15	39	39	22	23	97	5.04
	Oct-Dec	282	1600	20	33	47	41	31	107	5.67
2021	Jan-March	299	1708	19	33	35	43	29	131	5.71
	April-June	86	3308	9	24	16	17	15	44	38.46

CCI= Coefficient correlation index

Most productive authors and core-journals

This area covered productive authors. 'Wang, J.' was the most productive author from the hotspot of covid-19, china. He eventuated 10 publications. Next most creative authors were 'Kumar, A' and 'Kumar, S', from India, with 8 publications. Other bottoms 7 authors have contained at least 6 publications. But it is not enough for an author. Every productive author has to look for further research on covid-19 and related work.

Table 4

Distribution of top 10 productive authors and core-journals

Core-Journals				Productive author	
Journal name	**No.**of publication	Total citation	H-Index	Author name	No. of Publication
Medicine	25	580	148	Wang, J.	10
International journal of environmental research and public health	20	887	113	Kumar, A.	8
Journal of biomolecular structure & dynamics	20	1028	69	Kumar,S.	8
Medical hypotheses	20	550	87	Shah, K.	7
Plos one	18	560	332	Chen, H.	7
Pakistan journal of medical sciences	15	323	30	Hu, Y.	7
Chaos solitons & fractals	14	480	139	Li, J.	7

Core-Journals				Productive author	
Journal name	**No.**of publication	Total citation	H-Index	Author name	No. of Publication
Science of the total environment	11	508	244	Liu, Y.	7
Scientific reports	11	478	213	Wang, Y.	7
European review for medical and pharmacological sciences	10	372	63	Kumar, V.	6

Covid-19 is now the most common and burning topic in 'medical science' and 'environmental science' (Atlasi et al., 2021). Among top 10 productive journals (Figure 2), medicinal and environmental journals are mash-ups to each other. Maximum number of articles on covid-19 has published in 'Medicine' journal (25), 'International journal of environmental research and public health' and 'Journal of biomolecular structure & dynamics' covered 20 publications, 'PLoS One' contained 18 records, From 'Pakistan journal of medical sciences' got 15 items, 'Chaos solitons & fractals' covered 14 and other 3 journals digested 11, 11 and 10 publications. Though 'Medicine; journal contained most publications, the most cited journal was 'Journal of biomolecular structure & dynamics' but according to H-Index 'Plos One' (332) is far better than other journals. This variation can occur for frequency of publication, better publication flexibility.

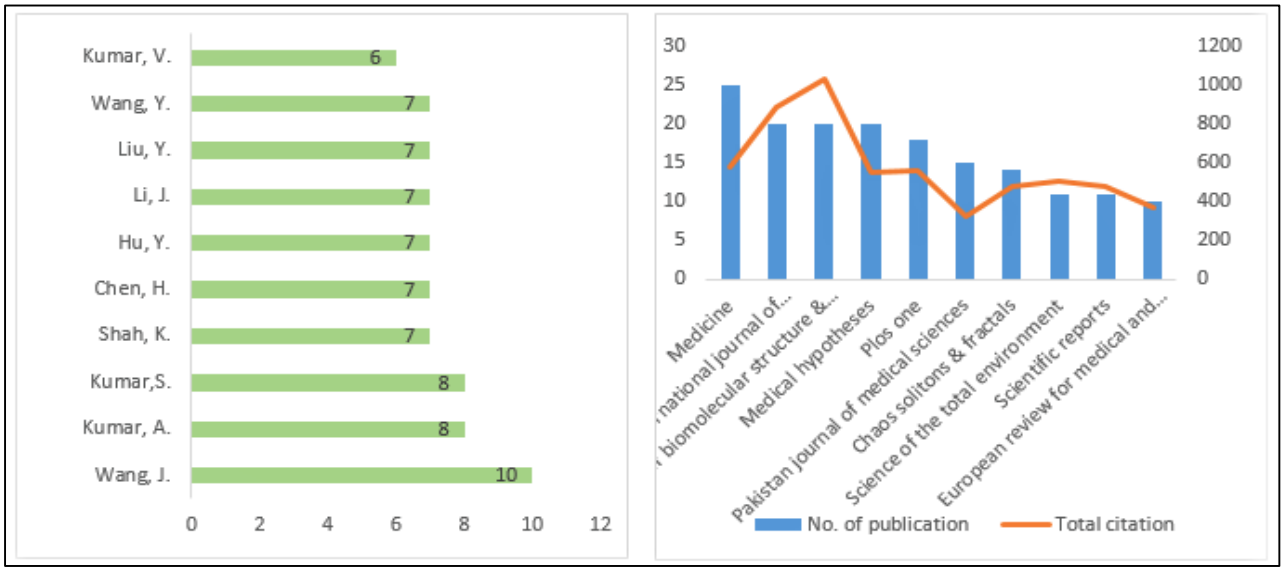

Figure 2: Showing top 10 productive authors and core-journals

Table 5
Top 10 clustered cited articles

Title of the Articles	Source title	Cited Reference Count	IF
Response to the Novel Corona Virus (COVID-19) Pandemic Across Africa: Successes, Challenges, and Implications for the Future	Frontiers in pharmacology	496	4.4
The neuropsychiatric manifestations of COVID-19: Interactions with psychiatric illness and pharmacological treatment	Biomedicine & pharmacotherapy	380	4.545
IL-6 in inflammation, autoimmunity and cancer	International immunology	377	3.403
Nanotechnology-based antiviral therapeutics	Drug delivery and translational research	339	2.98
A comprehensive review of imaging findings in COVID-19-status in early 2021	European journal of nuclear medicine and molecular imaging	306	7.277
The find of COVID-19 vaccine: Challenges and opportunities	Journal of infection and public health	306	2.447
Approaching Coronavirus disease 2019: Mechanisms of action of repurposed drugs with potential activity against SARS-CoV-2	Biochemical pharmacology	261	5.009
Electrochemical diagnostics of infectious viral diseases: Trends and challenges	Biosensors & bioelectronics	244	10.257
Therapeutic opportunities of edible antiviral plants for COVID-19	Molecular and cellular biochemistry	228	2.057
Intensive Care Unit-Acquired Weakness: Not Just Another Muscle Atrophying Condition	International journal of molecular sciences	227	4.556

IF= Impact Factor

Covid-19 has now become a well-known multidisciplinary topic (Table 6). Most of the subject fields covered this topic. DDC's first and second summaries are undertaken to make a report on subject coverage. Covid-19 impacted ‘Medicine, Health and Biology’ (52.46%). Among 1234, 27% of title covered more than one subject. ‘Social science, social problem’ (15%), ‘Engineering, Technology’, ‘Computer science, Library science’, ‘Arts, Psychology’, ‘Religion and Travel’ have also been covered by covid-19.

Table 6
Mother subject disciplinary covers covid-19

DDC First summary [class number]	DDC second summary [class number]	No. of Publication	Average publication (%)
Technology [600]	Medicine & Health [610]	926	52.46
Science [500]	Biology [570]	236	13.37
Social Science [300]	Social problems & services; associations [360]	186	10.53
Science [500]	Physics [530]	72	4.07
Computer science, information & general works [000]	Computer science, Information [000]	58	3.28
Technology [600]	Engineering & allied operations [620]	56	3.17
Science [500]	Chemistry & allied sciences [540]	56	3.17
Science [500]	Mathematics [510]	39	2.2
Social Science [300]	Social sciences (communities) [307]	33	1.86
Philosophy and Psychology [100]	Psychology [150]	21	1.11
Social Science [300]	Economics [330]	19	1.07
Technology [600]	Technology [600]	18	1.01
Science [500]	Earth sciences [550]	16	0.9
Social Science [300]	Education [370]	10	0.5
Science [500]	Plants [580]	9	0.5
Technology [600]	Agriculture & related technologies [630]	3	0.2
Arts and Recreation [700[	The arts; fine & Decorative arts(Organization and Management) [706]	3	0.2
History and Geography [900]	Geography and Travel [910]	2	0.2
Religion [200]	Religion [200]	2	0.2

Global prolific situation

Covid-19 strike globally during 2019-21. Every developed, developing and underdeveloped country suffered due to this pandemic situation. Thousands of research works have come out from different countries (Azam Malik et al., 2020). Total 127 countries contributed their research works in the WOS database on Coronavirus globally. Most of the publications belong from China (23.14%), then India (204) and the USA (201) contributed their maximum effort. Germany, Pakistan, Italy, and Iran are small countries also provided their research outcome to prevent covid-19 (Figure 3).

Figure 3: Contribution of research works globally

Accuracy of author productivity with Lotka's Law

Tables 1 and 2 discussed the author's contribution and productivity. In Table 4, we discussed the frequency of publication but how to prove that this frequency of publication is enough for productivity (Santra et al., 2021). So, to measure the fitness, Lotka's law (Nicholls, 1989) has been adequate through the Kolmogorov-Smirnov test (K-S test) hypotheses test method.

Observe proportion (OP): (observed number/total observed of particular)

A Cumulative observed proportion value (COP) table has been created.

Expected proportion (EP): (1 / total no. of activities)

A Cumulative expected proportion value (CEP) table has been created.

D-Max value: ($|O-E|$)

Table 7 was created based on the frequency of publication, and the result has come out. Table value at 95% confidence level equals $1.36\sqrt{89} = 0.72$. So, the hypothesis is rejected as D-Max value 0.09 where 0.72 is the table value. Only the publishing frequency of 2021 Jan-March satisfied the Lotka's law.

Table 7

D-Max calculation for Lotka's law test

OP	COP	EP	CEP	D=($\|O-E\|$)
0.11	0.11	0.16	0.16	0.05
0.19	0.30	0.16	0.33	0.03
0.17	0.47	0.16	0.49	0.02
0.22	0.69	0.16	0.66	0.03
0.21	0.90	0.16	0.83	0.09
0.10	1	0.16	1	0

Discussion

Few publications have been used as a reference to combat Corona Virus challenges for a few decades, and WoS is the most common and valuable data source for health and other expert personnel.

At the start of the pandemic on January 2020, only 78 contributions were taken to the WOS database, but day by day growth of disaster and publications were competing. From April 2020 to March 2021, a tremendous contribution can be found worldwide. Most relevant and popular publications can also be found in-between this era.

More than half of the articles were authored by more than one author or correspondence author. The number of articles was expected to be riches, but it was not. On the other hand, single authorised articles are not recognised as much as multiple authorised articles. Last two years' degree of collaboration was almost the same, but the author's productivity was far good in the earlier stages of the pandemic. During this research, it was observed that most of the articles covered in the English language, most relevant publications are close access, and authors faced funding-related difficulties. Those were the barriers to disseminating relevant documents. Most productive author "Wang J" from China, also wrote 10 articles I English Language, which was suitable for global access but not for grassroots-level people.

Figure 4: Co-author network mapping

"Symbolic payment for an intellectual debt" was told by H. Small (2004). Number of citations is not enough to judge a research work as co-citation; self-citation has manipulated and beguiled the exact importance. But citation count is the only way to find quality research work (Homolak et al., 2020). Nowadays covid-19 is a hot topic on the internet, and thousands of research works have been published in different databases (Balasubramanian & Ayaba, 2018). The number of citations and publication quality depends on the Impact factor (IF). Such measurement tools help to choose weightage works.

$$IF = \frac{\text{No. of current year citations published in previous two years}}{\text{No. of cited articles published in previous same two years}}$$

According to Table 5, the most cited article was 'Response to the Novel Coronavirus

(COVID-19) Pandemic across Africa: Successes, Challenges, and Implications for the Future' published in 'Frontiers in pharmacology'. The next most highly cited paper was Neuropsychiatric manifestations of COVID-19: Interactions with psychiatric illness and pharmacological treatment' from 'Biomedicine & pharmacotherapy' publisher but the most Impactful journal 'Biosensors & bioelectronics' (10.257) has contained a title 'Electrochemical diagnostics of infectious viral diseases: Trends and challenges' with minimum citation (244). So it can be concluded that the Impact Factor cannot influence the number of citations in such a situation. The quality of publication depends on qualitative (H-Index, G-Index, Impact Factor etc.) and quantitative tools. According to results, the most cited journal was 'Frontiers in pharmacology' (496) but the highest Impact factor carried was 'Biosensors & bioelectronics' (10.257) journal.

Covid-19 created a pandemic worldwide; social, economic, educational, and mobility systems collapsed for this dangerous virus. But most productive creation comes from the Medicinal or Health section, only 15% of total publication covered by social science and social problems, but there are minimum publications in technology, Arts, Psychology and religious aspects.

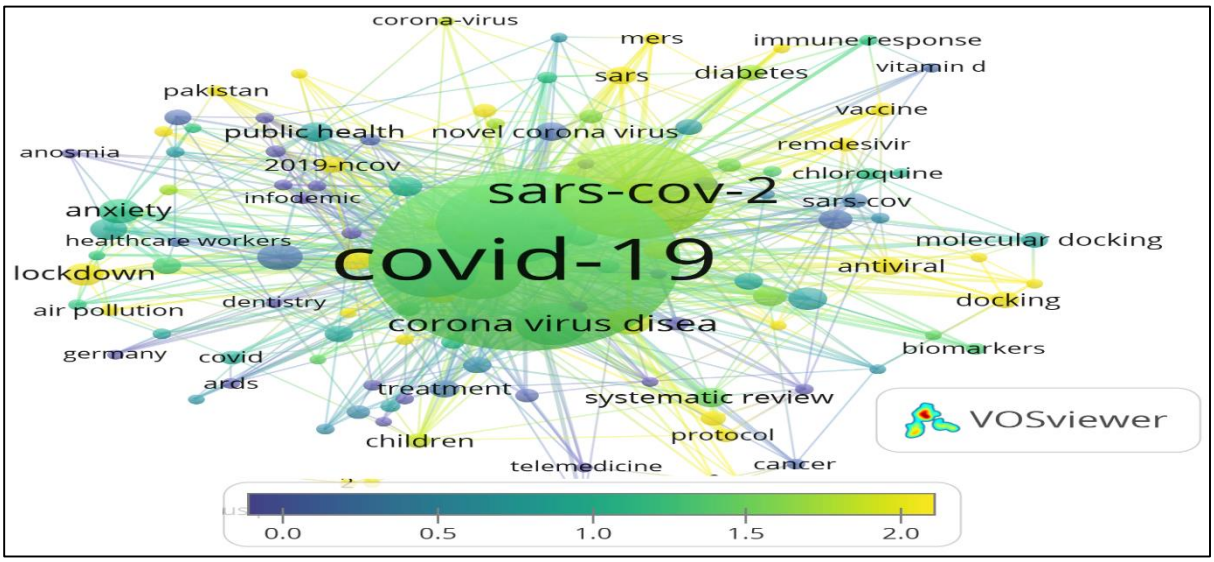

Figure 5: Isolated keywords focused in the WOS database

Keyword index and author index helps to isolate the same research works and easily view the most focused area. VOSviewer tool can easily map the indexed keywords retrieved from the WOS database (Van Eck, 2020). And most common and focused areas are Covid-19, SARS-COV-2, Coronavirus disease, Lock down, etc (Figure 5). Finding results has proven enormous work on Covid-19 and is also helpful for a comprehensive global search strategy.

Total of 195 countries, 127 contributed their valuable publication to the WoS database worldwide. China was the most productive county, covering 23.14% of total publications. Other main contributing countries were the United States of America and India, with about 18% published from those two countries. Then United Kingdom, Saudi Arabian Country, European Countries, Pakistan, Australia, South Africa, Korea, and Japan also contributed from their respective regions. A magical result came out, 68.17% of publications contributed by the top 10 countries in the prolific global scenario.

This article was prepared on the basis of reliability of WoS database, which could be a major drawback. Rapidly changing data may affect the results. Here few aspects and limited technologies were negotiated, and exhaustive research can open new branches for future study.

Conclusion

This holistic study aims to determine the status of growth of literature, most productive authors and core journals, international authors collaboration, a trend of the subject disciplinary cluster, highly populated keywords, prolific global situation and mash-up with co-author network on covid-19 related literature. It was a summarised version of research on covid-19 with a microscopic evaluation. This study explores the overview outcome of literature on covid-19. Within 18 months, 1234 documents have been indexed in the WOS database, which is still expanding its area. WHO inducts some guidelines for self-protection. Consequently, researchers are also serving their research and practice for social welfare. Finding disclosed that the growth of publication was always up-wards. In 2019 there was no indexed literature, but a peak appeared after March 2020 to now. International collaboration, citation, organization collaboration had also been observed. A strong recommendation for the authors is to create more collaborative, impactful, relevant and productive research on Covid-19. An encouraging trend can be found in this study; the epidemic spread worldwide, but the most contributing countries are China, India and USA. Medical science, Environmental science, Engineering, and Social science subjects are mash-up together.

Coronaviruses mutate every day and change their characters. Scientists and medical science make vaccines, but sometimes vaccine doses are not working. Many countries suffer due to the unavailability of vaccines, and incredibly underdeveloped, developing and most populated countries. Scientist communities are fighting hard to combat this RNA virus and provide vaccines to people worldwide. Above all, finding results may help to create future strategies and help to find the path to slay Coronavirus. We hope such productive creations will help the government and society to prevent such natural disasters. At the end, it is suggested that this trend of research will be helpful for further research design, and an Altmetric study is also required on covid-19 situation.

References

Ahmad, M. & Batcha, M. (2020). Identifying and Mapping the Global Research Output on Coronavirus Disease: A Scientometric Study. *Library Philosophy and Practice (e-journal)*, 4125. Retrieved from https://digitalcommons.unl.edu/libphilprac/4125

Atlasi, R., Noroozi Chakoli, A., Ramezani, A., Tabatabaei-Malazy, O. & Larijani, B. (2021). Scientometric analyzing the output of researchers and organizations on COVID-19 for better conducting the scientific efforts: with a glance to endocrinology. Journal of diabetes and metabolic disorders, 20(1), 107-118. https://doi.org/10.1007/s40200-020-00718-7

Azam Malik, A., Butta, N. S. & Bashirc, M. A. (2020). A scientometric analysis on Coronaviruses research (1900-2020): Time for a continuous, cooperative and global approach. *Journal of Infection and Public Health,* 14(2021), 311-319. https://doi.org/10.1016/j.jiph.2020.12.008

Balasubramanian, K. & ayaba, R. (2018). Scientometric study of indian journal of chemical technology. *Library Philosophy and and practice (e-journal), 2004*. Retrieved from http://digitalcommons.unl.edu/libphilprac/2004

Centre, I. S. (2020). Publishes List of 382 Doctors Who Died Due to COVID-19. New Delhi, New Delhi, India: Indian Medical Association. Retrieved from https://scroll.in/latest/973322/Coronavirusima ima-says-382-doctors-have-died-accuses-centre-of-being-indifferent-abandoning-them

Colavizza, G., Costas, R., Traag, V. A., Van Eck, N. J., Van Leeuwen, T. & Waltman, L. (2021). A scientometric overview of CORD-19. *Plose One,* 16(1), 1-18. https://doi.org/10.1371/journal.

Şenel, E., & Topal, F. E. (2021). Holistic analysis of Coronavirus Literature: A scientometric study of the globalpublications relevant to SARS-CoV-2 (COVID-19), MERS-CoV (MERS) and SARS-CoV (SARS). *Disaster medicine and public health preparedness*, 15(6), e12–e19. https://doi.org/10.1017/dmp.2020.300

Farooq, R. K., Ashiq, M., Siddique, N., Rehman, S. U. & Adil, H. M. (2021). A bibliometric review of highly cited and hot papers on Coronavirus and COVID 19. *Library Philosophy and Practice (e-journal),*5238. Retrieved from https://digitalcommons.unl.edu/libphilprac/5238

Farooq, R. K., Rehman, S. U., Ashiq, M., Siddique, N. & Ahmad, S. (2021). Bibliometric analysis of Coronavirus disease (COVID-19) literature published in Web of Science 2019–2020. *Journal of Family & Community Medicine,* 28(1), 1-7. https://doi.org/10.4103/jfcm.JFCM_332_20

Grammes, N., Millenaar, D., Fehlmann, T., Kern, F., Böhm, M., Mahfoud, F. & Keller, A. (2020). Research output and international cooperation among countries during the COVID-19 pandemic: Scientometric analysis. *Journal of medical Internet research,* 22(12), e24514. https://doi.org/10.2196/24514

Homolak, J., Kodvanj, I. & Virag, D. (2020). Preliminary analysis of COVID-19 academic information patterns: A call for open science in the times of closed borders. *Scientometrics*, 124(3), 2687-2701. https://doi.org/10.1007/s11192-020-03587-2

Jasarevic, T., Lindmeier, C. & Chaib, F. (2020). *Statement on the first meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel Coronavirus (2019-nCoV).* Geneva: World Health Organization. Retrieved from https://www.who.int/news/item/23-01-2020-statement-on-the-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-Coronavirus-(2019-ncov)

Kalra, G., Kaur, R., Ichhpujani, P., Chahal, R. & Kumar, S. (2021). COVID-19 and ophthalmology: A scientometric analysis. *Indian Journal of Ophthalmology,* 69(5), 1234-1240. DOI:10.4103/ijo.IJO_3284_20

Bhalachandra, S. (2020). Scientometrics analysis of recent trends in Global Corona virus Research. *Research Square*, 1-13. https://doi.org/10.21203/rs.3.rs-43995/v1

NCIRD. (2020). *Division of Viral Diseases.* National Center for Immunization and Respiratory Diseases.

Nicholls, P. T. (1989). Bibliometric Modeling Processes and the Empirical Validity of Lotka's Law. *Journal of the American Society for Information Science,* 40(6), 379-385. https://doi.org/10.1002/(SICI)1097-4571(198911)40:6<379::AIDASI1>3.0.CO;2-Q.

Onder, G. R. (2020). Case-fatality rate and characteristics of patients dying in relation to COVID-19 in Italy. *Jama,* 323(18), 1775-1806.

Pal, J. K. (2021). Visualizing the knowledge outburst in global research on COVID-19. *Scientometrics*, 126, 4173-4193. https://doi.org/10.1007/s11192-021-03912-3

Patil, S. (2020). A scientometric analysis of global covid-19 research based on dimensions database. *SSRN*. Retrieved from https://ssrn.com/abstract=3631795

Radha, L. (2020). Coronavirus: A scientometric study with special reference to Web of Science. *International Journal of Arts, Science and Humanities*, 8(1), 212-217. https://doi.org/10.34293/sijash.v8i1.2818

Santra, P. P., Majhi, D. & Bhowmick, A. (2021). Indian research output on scientometric literature as indexed in Scopus: A scientometric exploration. *Library Philosophy and Practice (e-journal)*, 5497. Retrieved from https://digitalcommons.unl.edu/libphilprac/5497

Small, H. G. (2004). On the shoulders of Robert Merton: towards a normative theory of citation. *Scientometric*, 60(1), 71-79. https://doi.org/10.1023/B:SCIE.0000027310.68393.bc

Surulinathi, M., Arputha Sahaya, R. Y., Prasanna, k. N. & Jayasuriya,T. (2020). Highly cited works on Covid-19 vaccine: A scientometric mapping of publications. *Library Philosophy and Practice (e-journal)*, 4782. Retrieved from https://digitalcommons.unl.edu/libphilprac/4782

Surulinathi, M., Arputha, S. R., Srinivasaragavan, S. & Jayasuriya, T. (2020). Research output on Covid-19/Coronavirus Vaccine: A scientometric study. *Library Philosophy and Practice (e-journal*, 4781. Retrieved from https://digitalcommons.unl.edu/libphilprac/4781

Van Eck, N. W. (2020, June 2). Manual for VOSviewer version 1.6.15. *Manual for VOSviewer*. Retrieved from https://www.vosviewer.com/download/f-33r2.pdf

Web of Science. (n.d.). *Master Journal list*. Retrieved from Clarivate.com: https://mjl.clarivate.com/home

WHO. (2019). *Naming the Coronavirus disease (COVID-19).* Geneva: World Health Organization. Retrieved from https://www.who.int/emergencies/diseases/novelCoronavirus-(covid-2019)-and-the-virus-that-causes-it.