



CORONAVIRUS RESEARCH TRENDS: A BIBLIOMETRIC EVALUATION

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ABSTRACT

Corona viruses (CoVs) are a large family of viruses and are endemic in humans and animals, causing respiratory and intestinal infections. The study attempted to analyze the year wise, author's wise contribution of Corona virus research and explored about the authorship pattern. The study aims at citations per year; citations per author in the Corona virus research and calculate the trend analysis on Corona virus research. The

dataset from 2010 to 2020 was obtained from Google scholar through publish or perish. Theme words for searching were referred to MESH terms from PoP search term were as follows 'Corona viruses. It is noticed that among the study period, totally 3392 articles published in Corona virus which was indexed in Google Scholar. In the study period, highest level of articles published in 2020 was 414 articles. Total number of 12972 authors contributed to the Corona virus research. It is noticed that number of authors contributed in the year 2020 as 1651 (12.45%). In the year 2013 around 16581 highest number of citations of was received with top position of citation and 2014 received 13853 citations rated with second position on citation. 29554.5 citations per year was noticed, highest level of cites per year was noticed during 2012. It is understood that there was research on corona virus by single author to 4 authors from the major group through degree of collaboration. It is noticed that USA contributed 598 articles, placed first and that Journal of Virology published 544 articles. The study mentioned that by 2025 the solo research productivity will have 77 percent growth in the field of corona virus. The study highlighted that by 2025 that the Joint research productivity will have 80 percent growth in the field of corona virus.

KEYWORDS: Corona virus, Bibliometrics, Degree of Collaboration, Time Series Analysis.

INTRODUCTION

Viruses are always changing, and can cause a new variant, or strain, of a virus to form. A variant usually doesn't affect how the virus works. But sometimes they make it act in different ways. Corona virus is one of the common viruses that can cause infection in nose or upper throat. Most of them are not dangerous as they are present with mild symptoms and can be treated symptomatically, but it killed around 858 people from Middle East with respiratory syndrome (MERS) in 2015, this is because of its severe presentation causing respiratory failure. Undiscovered corona viruses like the Wuhan Corona virus are very dangerous because specific treatment for such viruses is not yet available and it rapidly progresses to cause multi-organ failure. This category of the virus causes harmful diseases in mammals as well as in birds. In humans, the virus causes mild respiratory infections, which in rare cases may even cause death. In animals like cows and pigs, it causes diarrhea, while in chickens it causes severe respiratory infections. You may be shocked to know that there are no vaccines currently available for the treatment of this disease. When it comes to the basic description of the virus, Corona virus comes under the sub-family Orthocoronavirinae. It has been surrounded by an envelope like a frame, which gives a definite sense of the single-stranded RNA genome. The shape of their nucleocapsid is helical. The size of corona viruses ranges from 26 to 32 kilo bases. It is the largest category of a RNA virus. In most cases, it is difficult to detect if corona virus or a different cold-causing virus is causing fever.

Early discovered in the 1960s, the name of this virus comes from the crown-like spikes that it has its surface. The word corona came from the Latin word "Crown." Corona viruses are a large group of viruses that infect animals and mammals like bats, pigs. Scientists call them zoonotic because they get a transfer from animals to humans. Scientists around the world are tracking changes in the virus that causes COVID-19 and other variants which is affecting the humankind. Corona viruses didn't just pop up recently. They're a large family of viruses that have been for a long time. Most of them can cause a variety of illnesses, from a mild cough to severe respiratory illness. The new (or "novel") corona virus that causes COVID-19 is one of the several known to infect humans. It's probably been for some time in animals. Sometimes, a virus in animals crosses over to people. As it was making people sick in 2019, the scientists named it as a novel corona virus.

Bibliometrics is a term coined by Pritchard in 1969. It is a measure used to understand the output and impact of scientific communication. Publications and Citations are the two important variables normally used in Bibliometrics. It has provided ways and means of benchmarking and evaluation of scholarly work. In recent years bibliometrics has been a growing field of interest in Library and Information Science, yielding various resultant factors in rankings and decision-making process in library management and information services to the users. For example, the citation analysis is also used as one of the methods employed in user studies. Bibliometrics – as a method and as a discipline - has received a greater deal of significance since its germination or genesis. One of the important aspects of the increasing interest in bibliometrics in the libraries as well as in academia in general is the increasing use of bibliometric indicators to evaluate research performance of faculty and researchers, “Especially in the university and government laboratories, and also by policymakers, research directors and administrators, information specialists and librarians and researchers by themselves” (Pendlebury, 2009). The objective of the assessments may be repeated by the analyses and are basic reasons for its popularity. Other reasons, for accepting bibliometrics as a measurement tool, are it being relatively inexpensive in terms of time, money and effort in its study, and provide a good data source. Scalability is one of the main advantages of bibliometrics as a tool. In other words, it can be applied from a micro level, i.e., an individual researcher or an institute, to a macro level, i.e., country or global level. Ability for comparative analyses – temporal, geographic, linguistic, biographic, etc. bibliometrics has drawn the attention of many scholars. It has been universally accepted as an ideal method for assessing the research productivity.

LITERATURE REVIEW

Felice, Francesca De & Polimeni, Antonella (2020) evaluated the research trends in corona virus disease (COVID-19). The bibliometric analysis presents the most influential references related to COVID-19 during this time and could be useful to improve understanding and management of COVID-19. **Deng Z, Chen J and Wang T (2020)** showed that research on human corona virus is dominated by SARS-CoV. Although there have been many publications, only 626 publications (4.1% of total) have more than 100 citations. The top 20 journals with most publications account for 20.6% of total publications and 41% of total citations. **Gautam, Prerna (2020)** aimed to get an idea about the direction of the flow of current research, the association of various authors with each other, the role of collaboration between several institutions and the position of India in current explosive ongoing research.

Farooq R, K.&Rehman S, U. (2020) investigated research productivity related to corona virus disease (COVID-19) pandemic using the Web of Science database and stated that the pattern of multiple author publications has outstripped that of single authors. The initial research related to the current corona virus outbreak was reported from China. The data and patterns were supposed to alter as the virus spread globally.**Neto J, F. Moura Filho E, P. EME Santos, Carvalho M, N. & Nery R, P. (2020)** aims to map international scientific production on the Novel Corona virus. As the main results of the analyses, the top journals of the theme and the most cited articles were identified. Although this research does not cover all scientific production information about the new Corona virus “COVID-19”, it was possible to search for documents of high scientific relevance so that we have an overview of the scientific production world on the subject. **Herrera-Viedma, Enrique et al (2020)** conducted a science map construction to understand the corresponding intellectual structure and main research themes. The research serves as a framework to strengthen existing research lines and develop new ones, establishing synergistic relationships that were not visible without the maps generated herein. **Fei Zhai et al (2020)** explored the distribution of research capabilities of countries, institutions, and researchers, and the hotspots and frontiers of corona virus research in the past two decades. **Mao X, Guo L, Fu P, Xiang C (2020)** investigated the global status and trends of corona virus research. The number of publications about corona virus research increased sharply in 2004 for SARS outbreak and increased again in 2012 for MERS outbreak. **Lou, J et al (2020)** stated that research on the COVID-19 still booming, new vaccine and effective medicine for COVID-19 will be expected to come out in the near future with the joint efforts of researchers worldwide. **Mukherjee, Bhaskar (2020)** attempted to understand the trends in global research in corona virus related diseases during the last seven decades. It gives hope that this well directed research across different countries will provide new pathways for understanding corona virus generated diseases including the present n-CoV which is an essential pre-requisite for developing measures to control corona virus associated disease and develop vaccination for its prevention.

Nasab, F R & Rahim, Fakher (2020) stated that growing publication on COVID-19. Most studies are published in journals with very high impact factors (IFs) and other journals are more interested in this type of research. **Shri Ram (2020)** is an attempt to trace the trends of research associated with “Corona virus” for a period of 50 years using the SCOPUS database. **Renjith. V. R & Shihab. I (2020)** conducted the study on bibliometric studies on corona virus (CoVID-19) research publications published from January to June 2020. **Zhengbo Tao**

et al (2020) aimed to quantitatively and qualitatively investigate the research trends on corona viruses using bibliometric analysis to identify new prevention strategies. The study analyses the keywords and identified 5 corona virus research hotspot clusters. **Yue Gong et al (2020)** revealed that the epidemic situation and data accessibility of different research teams have caused obvious difference in case of publications. Besides, there was an unprecedented level of close cooperation and information sharing within the global scientific community relative to previous corona virus research. Future perspectives on treatment, prevention, and control are also presented to provide fundamental references for current and future corona virus research. **Zhou, Yi and Chen, Liyu (2020)** aims to investigate the global research routine and trends of corona virus over the last twenty years based on the production, hotspots, and frontiers of published articles as well as to provide the global health system International collaborations promoted study progress, and universities and academies act as the main force in corona virus research. **Mulyono Putri, SS., Fuad, A, and Watsiq Maula, A (2020)** aimed to depict the bibliographic trend of corona virus all time and pictured the corona virus research patterns and dynamics throughout the years. The study retrieved data from Pub Med for the source. Pub med is chosen because it is the biggest freely available health and medicine electronic database. **Zyoud, Shaher H. & Zyoud, Ahed H. (2020)** discussed that bibliometric analysis and visualization mapping were utilized with the objective of revealing and evaluating the developments in knowledge on COVID-19 and its impacts based on collection of environmental sources.

Most of the previous studies conducted to analysis the mapping of the research contribution of the corona virus. It is noticed from the review of literatures, mentioning about contribution of the authorship, particularly on multiple authors contribution. Compared with developing countries, most of the research contributions on corona virus by the developed countries. Life science related journals were published more research publications on corona virus.

Objectives

1. To analyze the year wise, authors wise contribution to corona virus research.
2. To explore about the authorship pattern on corona virus research.
3. To study the citations, citations per year, citations per author in the corona virus research.
4. To analyze the degree of collaboration in corona virus research.
5. To present the highly contributed country and journals on the corona virus research.
6. To study the trend analysis on Corona virus research.

METHODOLOGY

The dataset from 2010 to 2020 was obtained from Google scholar through publish or perish. Theme words for searching were referred to MESH terms from PoP search term as 'Corona viruses. The information about publications including research orientation, institutions, and funding were ameliorated by the data in the Google Scholar. Degree of Collaboration will apply to calculate for the collaboration of the authors on the corona virus research contribution. Trend analysis will adopt to know the future research contribution on the solo and joint research contribution of corona virus.

RESULT

The table:1 presents the year wise contribution on corona virus research. It is noticed that among the study period, total 3392 articles were published on corona virus which is indexed in Google Scholar. In the study period, highest level of articles published in 2020 was 414 articles (12.21%), 11.29 % (383) articles published in 2019 and 11.08% (376) articles was published in 2013. Between 2010 to 2020, lesser number of articles are published in 2017 (222) and 2011 (157)

Table 1: Distribution of year wise in Corona virus research.

Year	No of Articles	Percentage
2010	247	7.28
2011	157	4.63
2012	238	7.02
2013	376	11.08
2014	352	10.38
2015	332	9.79
2016	307	9.05
2017	222	6.54
2018	364	10.73
2019	383	11.29
2020	414	12.21
Total	3392	100

The table:2 presents the author wise contribution on corona virus research. It is noticed that among the study period totally 12972 authors have contributed to the corona virus research. It is noticed that a greater number of authors contributed in the year 2020 as 1651 (12.45%) and 1452 authors contributed in 2019. Lesser number of authors contributed in 2012 (905 authors-6.98%).

Table 2: Authors wise contribution in Corona virus research.

Year	No of Authors	Percentage
2010	942	7.26
2011	654	5.04
2012	905	6.98
2013	1278	9.85
2014	1358	10.47
2015	1200	9.25
2016	1215	9.37
2017	960	7.4
2018	1393	10.74
2019	1452	11.19
2020	1615	12.45
Total	12972	100

The table: 3 present the year wise citations in the corona virus research. It is clear that 74685 citations were noticed during this period. In the year 2013 study period 16581 citations was received with top position.2014 received 13853 citations rated with second position on citation. Less number of citations is received in 2019 as 940.

Table 3: Year wise of Citations in Corona virus research.

Year	Citations	Percentage
2010	5984	8.01
2011	4477	5.99
2012	9000	12.05
2013	16581	22.2
2014	13853	18.55
2015	6912	9.25
2016	5160	6.91
2017	2775	3.72
2018	1768	2.37
2019	940	1.26
2020	7235	9.69
Total	74685	100

The table:4 presents the citation per year and citations per author in corona virus research. It is noticed that among the study period, 29,554.5 cites per year was noticed. Among the study period, highest level of cites per year was noticed during 2012 as 11125.48 (37.64%) and lesser level of cites per year noticed on 2011 as 497.45 (1.68%).It is noticed that totally 20708 cites per author was noticed on the study period on Corona virus research. During 2013, 4413 (21.31%) cites per author was noticed. And lesser number of cites per author was noticed during 2019 as 351 (1.69%).

Table 4: Citation per year and Citations per authors in Corona virus research.

Year	Citation Per Year	Percentage	Citations Per Author	Percentage
2010	598	2.02	1661	8.02
2011	497.45	1.68	1107	5.35
2012	11125.5	37.64	2513	12.14
2013	2368.88	8.02	4413	21.31
2014	2308.8	7.81	3642	17.59
2015	1382.4	4.68	2357	11.38
2016	1290	4.36	1474	7.12
2017	924.99	3.13	739	3.57
2018	883.5	2.99	495	2.39
2019	940	3.18	351	1.69
2020	7235	24.48	1956	9.45
Total	29554.5	100	20708	100

The table:5 presents the authorship pattern of the Corona virus research. It is noticed that most of the articles are contributed by four authors (746; 21.99%) and followed by five authors contributed 740 articles (21.82%). 573 articles contributed by single authors, 352 articles are contributed by two authors and 400 articles are contributed by three articles. It is notable that eight articles were contributed by more than nine authors.

Table 5: Authorship Pattern in Corona virus research.

Year	Single	Two	Three	Four	Five	Six	Seven	Eight	Nine	Total Authors
2010	32	31	33	52	61	31	6	1	0	942
2011	19	9	17	32	53	17	9	1	0	654
2012	42	23	25	53	59	23	8	4	1	905
2013	103	28	50	74	73	33	10	5	0	1278
2014	48	29	59	86	76	36	10	7	1	1358
2015	64	44	37	71	67	30	14	5	0	1200
2016	36	35	34	82	65	37	12	6	0	1215
2017	13	16	31	65	52	23	13	8	1	960
2018	66	37	27	83	97	29	21	2	2	1393
2019	60	42	46	100	78	31	16	8	2	1452
2020	90	58	41	48	59	53	40	24	1	1615
Total	573	352	400	746	740	343	159	71	8	12972
Percentage	16.89	10.38	11.79	21.99	21.82	10.11	4.69	2.09	0.24	

Degree of collaboration was drawn on the above table 6. The degree of collaboration is defined as the ratio of number of collaborative research papers to the total number of research papers in the discipline during certain period of time. The degree of collaboration was 0.95 to 0.97 which is evident as the number of authors in a collaborative research raised to more than

four authors; the number of publications is in increasing trend. It is understood that there was research on corona virus by single author to 4 authors' that forms the major group.

Table 6: Degree of Collaboration on Corona virus research.

Year	Single Author	Percentage	Multiple Author	Percentage	Total	Degree of Collaboration
2010	32	5.58	215	7.63	247	0.87
2011	19	3.32	138	4.90	157	0.88
2012	42	7.33	196	6.95	238	0.82
2013	103	17.98	273	9.68	376	0.73
2014	48	8.38	304	10.78	352	0.86
2015	64	11.17	268	9.51	332	0.81
2016	36	6.28	271	9.61	307	0.88
2017	13	2.27	209	7.41	222	0.94
2018	66	11.52	298	10.57	364	0.82
2019	60	10.47	323	11.46	383	0.84
2020	90	15.71	324	11.49	414	0.78
Total	573	100	2819	100	3392	0.83

The table: 7 presents the top ten countries that contributed on corona virus research. It is noticed that USA contributed 598 articles stood in first place and China took second place with the contribution on articles and Germany was placed in third position with the contribution of 341 articles. The contribution of the first author is accepted as the primary contribution to the work. Total numbers of 3392 articles were published from 48 countries. Also, 81 countries published 1–10 articles and 18 countries published 11–20 articles.

Table 7: Top ten countries highly contributed on Corona virus research.

Country	No of Articles	Percentage
USA	598	17.63
China	481	14.18
Germany	341	10.05
United Kingdom	203	5.98
England	198	5.84
Japan	186	5.48
Canada	131	3.86
South Korea	101	2.98
France	92	2.71
Saudi Arabia	55	1.62

The table: 8 presents the top ten journals this has high contribution on corona virus research. It is noticed that around 262 journals published the research contributions on the corona virus research. It is noticed that Journal of Virology published 544 articles, Virology published 469 articles and PLoS ONE journal published 432 articles.

Table 8: Top ten Journals highly contributed on Corona virus research.

Journal Name	No of Articles	Percentage
Journal of Virology	544	16.04
Virology	469	13.83
PLoS ONE	432	12.74
Emerging Infectious Diseases	397	11.70
Journal of General Virology	304	8.96
Virus Research	299	8.81
Advances in Experimental Medicine and Biology	131	3.86
Archives of Virology	101	2.98
Journal of Virological Methods	92	2.71
Veterinary Microbiology	55	1.62

Table 9

SOLO RESEARCH ON CORONAVIRUS

Straight Line equation $Y_c = a + bX$

Since $\sum x = 0$

$$a = \sum Y/N = 573/11 = 52.09$$

$$b = \sum XY/\sum x^2 = 334/110 = 3.04$$

Estimated Solo research on corona virus literature in 2025 is

$$\text{When } X = 2025 - 2020 = 5$$

$$= 52.09 + 3.04 * 5 = 67.29$$

This shows that by 2025 the solo research productivity will have 77 percent growth in the field of corona virus.

JOINT RESEARCH ON CORONAVIRUS

Straight Line equation $Y_c = a + bX$

Since $\sum x = 0$

$$a = \sum Y/N = 2819/11 = 256.28$$

$$b = \sum XY/\sum x^2 = 1430/110 = 13$$

Estimated Solo research on corona virus literature in 2025 is

$$\text{When } X = 2025 - 2020 = 5$$

$$= 256.28 + 13 * 5 = 321.28$$

This shows that by 2025 the Joint research productivity will have 80 percent growth in the field of corona virus.

Table 9: Solo & Joint Research – Time Series Analysis in Corona virus research.

Year	Single Author	Multiple Author	X	X2	Solo Research	Joint Research
2010	32	215	-5	25	-160	-1075
2011	19	138	-4	16	-76	-552
2012	42	196	-3	9	-126	-588
2013	103	273	-2	4	-206	-546
2014	48	304	-1	1	-48	-304
2015	64	268	0	0	0	0
2016	36	271	1	1	36	271
2017	13	209	2	4	26	418
2018	66	298	3	9	198	894
2019	60	323	4	16	240	1292
2020	90	324	5	25	450	1620
Total	573	2819	0	110	334	1430

DISCUSSION

It is noticed that among the study period, total 3392 articles were published on Corona virus that was indexed in Google Scholar. In the study period, it is known fact the most of the researchers concentrated on corona virus research effect more number of publications published in 2020. Scientific research requires more contribution by the multiple authors contribution in corona virus research and the citations were highly mentioned by the others based their novel ideas. It is evident that when the number of authors in a collaborative research raises more than four authors, the number of publications is in increasing trend. It is understood that there was research on corona virus by single author to 4 authors' that forms the major group based on the degree of collaboration calculation. The study mentioned that by 2025 that the solo research productivity will have 77 percent growth in the field of corona virus. The study highlighted that by 2025 that the joint research productivity will have 80 percent growth in the field of corona virus.

CONCLUSION

The present review paper presents an overview of the literature on corona viruses since its inception. The analysis presented in this review provides interesting insights regarding the past and progress of this pandemic in the world. The Google scholar is used to perform this review study. The study highlights the most contributed year wise contributions, authorship pattern, citations, citations per year and citation per author in a way that has not presented before in this regard. An elongated discussion is included to give an insight into COVID-19 from scratch. The Novel outbreak of COVID-19 disease has some very high research scopes particularly required for its prevention, cure and efficient dealing. Research studies focusing

on curtailing the ongoing outbreak and preventing future outbreaks of such kind is the most pressing need. Moreover, looking towards the social impact of this disease, the rural enterprise has severely affected due to various Government policies viz. curfew, lockdowns, restrictions, etc. So, a distinct and worthwhile research direction would be to give policy dimensions for the betterment of rural enterprises.

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