Bibliometric Analysis of COVID-19 and the Association With the Number of Total Cases

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Abstract

Objectives: Coronavirus disease 2019 (COVID-19) has spread quickly all over the world. The number of studies in this field being performed and published is increasing day by day. The aim of this study is to analyze the publications in the field of COVID-19 with the help of bibliometric methods. After bibliometric analysis, the second aim is to investigate the relationship between the number of publications in countries and the number of total cases.

Methods: The data in the study were taken from the Web of Science (WOS) site. Analyses and mapping processes were performed using VOSviewer and SPSS package program. The words “COVID-19”, “Novel Coronavirus”, “2019-nCoV”, “SARS-CoV-2” were used as key words for analysis. The data include publications from 2019 to 2021 (January 10).

Results: As a result of the study, a total of 38,080 publications were evaluated. It was determined that the countries with the highest number of publications on COVID-19 were China and the United States, and the country with the highest number of citations was China. Most of the studies in the field of COVID-19 have been conducted on General Internal Medicine and Public Environmental Occupational Health. In addition, statistically significant relationships were observed between the number of publications and the number of total cases in terms of countries ($r = 0.806; P < 0.001$).

Conclusions: As a result, bibliometric analysis about COVID-19 can be useful for the future studies. It gives a general perspective of the studies.

The new coronavirus disease 2019 (COVID-19) is a virus that first appeared in China toward the end of 2019 and continues to spread today. This virus is highly contagious and has spread quickly all over the world. The World Health Organization (WHO) has declared this situation as a pandemic. It is transmitted by the droplets emitted by sick people by coughing or sneezing directly or by touching the mouth, nose, and eyes of other individuals in the environment. The disease is mainly transmitted by droplets. As of January 10, 2021, the number of cases worldwide was over 90 million, while the total number of deaths reached 1.93 million. Although COVID-19 has become alarming, the pandemic affects all sectors, especially the health sector, economy, service, tourism, education, etc. Governments are trying to take the necessary measures by making preparations regarding the pandemic. Therefore, the number of studies in this field being performed and published is increasing day by day. Identifying tendencies by performing bibliometric analyses of these studies will help in future studies.

In the evaluation of COVID-19 publications, bibliometric analysis, formed by examining the publications with mathematical and statistical techniques, will be used. Bibliometric analysis is defined as the quantitative analysis of certain characteristics of scientific documents or publications, such as the number of authors, journal, subject, and publication information. In bibliometric analysis, effective results are obtained for scientific communication by performing analyses according to certain characteristics, and these results will help in future studies. Methods used in bibliometric analysis include summarization as citation index, bibliographic matching, co-citation analysis, and bibliometric mapping method. Analysis uses a quantitative approach to observe, evaluate, and define published studies. These methods require a systematic, transparent, and repeatable review process, and this increases the quality of the examinations. It also makes it possible to get to know and promote the disciplines better and have an idea of the state of the field. 

The aim of this study is to analyze the publications in the field of COVID-19 with the help of bibliometric methods. After bibliometric analysis, the second aim is to investigate the relationship between the number of publications in countries and the number of total cases.

Methods

In this study, the publications related to COVID-19 were analyzed using the bibliometric technique. All the data in the study were obtained from the Web of Science (WOS) site, saved in...
Table 1. Top research areas of COVID-19 articles

| Research areas                             | No. of publications | %     |
|--------------------------------------------|---------------------|-------|
| General Internal Medicine                  | 3787                | 9.945 |
| Public Environmental Occupational Health   | 3250                | 8.535 |
| Infectious Diseases                        | 2172                | 5.704 |
| Science Technology Other Topics            | 2081                | 5.465 |
| Environmental Sciences Ecology             | 1708                | 4485  |
| Psychology                                 | 1374                | 3.608 |
| Immunology                                 | 1358                | 3.566 |
| Health Care Sciences Services              | 1356                | 3.561 |
| Business Economics                         | 1337                | 3.551 |
| Pharmacology Pharmacy                      | 1235                | 3.243 |

Table 2. Number of articles and citation numbers by country

| Id  | Country              | Documents | Citations |
|-----|----------------------|-----------|-----------|
| 1   | Afghanistan          | 6         | 5         |
| 2   | Albania              | 13        | 18        |
| 3   | Algeria              | 43        | 53        |
| 4   | Andorra              | 2         | 0         |
| 5   | Angola               | 2         | 0         |
| 6   | Argentina            | 200       | 405       |
| 7   | Armenia              | 8         | 48        |
| 8   | Aruba                | 1         | 0         |
| 9   | Australia            | 1637      | 14565     |
| 10  | Austria              | 410       | 5551      |
| 11  | Azerbaijan           | 12        | 21        |
| 12  | Bahamas              | 2         | 2         |
| 13  | Bahrain              | 24        | 21        |
| 14  | Bangladesh           | 205       | 770       |
| 15  | Barbados             | 9         | 30        |
| 16  | Belarus              | 19        | 58        |
| 17  | Belgium              | 559       | 4993      |
| 18  | Belize               | 1         | 0         |
| 19  | Benin                | 4         | 3         |
| 20  | Bermuda              | 2         | 0         |
| 21  | Bhutan               | 2         | 1         |
| 22  | Bolivia              | 17        | 69        |
| 23  | Bosnia & Herceg      | 20        | 29        |
| 24  | Botswana             | 14        | 17        |
| 25  | Brazil               | 1251      | 4018      |
| 26  | Brunei               | 17        | 77        |
| 27  | Bulgaria             | 58        | 124       |
| 28  | Burkina Faso         | 11        | 52        |
| 29  | Burundi              | 3         | 0         |
| 30  | Cambodia             | 5         | 3         |
| 31  | Cameroon             | 31        | 75        |
| 32  | Canada               | 1682      | 14117     |
| 33  | Cent Afr Republ      | 1         | 0         |
| 34  | Chile                | 219       | 475       |
| 35  | Colombia             | 194       | 653       |
| 36  | Comoros              | 1         | 0         |
| 37  | Costa rica           | 19        | 8         |
| 38  | Cote Ivoire          | 3         | 202       |
| 39  | Croatia              | 94        | 490       |
| 40  | Cuba                 | 62        | 25        |
| 41  | Curacao              | 4         | 4         |
| 42  | Cyprus               | 65        | 337       |
| 43  | Czech Republic       | 136       | 621       |
| 44  | Dem Rep Congo        | 21        | 38        |
| 45  | Denmark              | 324       | 3621      |
| 46  | Dominica             | 1         | 0         |
| 47  | Dominican Rep        | 8         | 2         |
| 48  | Ecuador              | 110       | 504       |
| 49  | Egypt                | 386       | 1606      |
| 50  | El Salvador          | 6         | 8         |
| 51  | England              | 3502      | 31927     |
| 52  | Estonia              | 41        | 285       |
| 53  | Eswatini             | 4         | 0         |
| 54  | Ethiopia             | 87        | 212       |

Results

The number of studies carried out in the field of COVID-19 between 2019 and 2021 (January 10) has been determined as 38,080. It was determined that 9.945% (3787) of the studies were carried out in the field of general internal medicine. In Table 1, information was given about in which area the studies on COVID-19 were conducted the most. It was seen that, the top 10 research areas about COVID-19 were general internal medicine (3787; 9.945%), public environmental occupational health (3250; 8.535%), infectious diseases (2172; 5.704%), science technology other topics (2081; 5.465%), environmental sciences ecology (1708; 4485%), psychology (1374; 3.608%), immunology (1358; 3.566%), health care sciences services (1356; 3.561%), business economics (1337; 3.551%), and pharmacology pharmacy (1235; 3.243%).

Most of the work in the field of COVID-19 has been written in English. It was seen that, 94.407% (35950) of the publications were published in English, and the second most used language was Spanish (2.009%; 765).

Considering the number of studies in the field of COVID-19 by years, it was determined that 97.264% of the studies were made in 2020, 1.605% was done in 2019 and 1.132% was published in January 2021.

Table 2 includes the numbers of COVID-19 publications made by country and the number of citations. All publications were written in 189 countries. When the countries were examined according to the number of publications, it was found that the countries with the highest number of publications were China and the United States. When the most cited numbers are evaluated, China ranks first.
Table 2. (Continued)

| Id | Country       | Documents | Citations |
|----|---------------|-----------|-----------|
| 55 | Fiji          | 8         | 5         |
| 56 | Finland       | 178       | 1003      |
| 57 | France        | 1442      | 18313     |
| 58 | French Guiana | 3         | 2         |
| 59 | Gabon         | 6         | 2         |
| 60 | Gambia        | 6         | 6         |
| 61 | Georgia       | 12        | 15        |
| 62 | Germany       | 1965      | 21369     |
| 63 | Ghana         | 72        | 64        |
| 64 | Gibraltar     | 2         | 3         |
| 65 | Greece        | 310       | 2156      |
| 66 | Greenland     | 1         | 0         |
| 67 | Grenada       | 8         | 4         |
| 68 | Guatemala     | 13        | 39        |
| 69 | Guinea        | 4         | 2         |
| 70 | Guinea Bissau | 3         | 9         |
| 71 | Guyana        | 1         | 0         |
| 72 | Haiti         | 4         | 6         |
| 73 | Honduras      | 9         | 34        |
| 74 | Hungary       | 167       | 449       |
| 75 | Jamaica       | 7         | 5         |
| 76 | Japan         | 730       | 5623      |
| 77 | Jordan        | 144       | 324       |
| 78 | Kazakhstan    | 29        | 93        |
| 79 | Kenya         | 90        | 204       |
| 80 | Kosovo        | 6         | 29        |
| 81 | Iceland       | 20        | 314       |
| 82 | India         | 2081      | 6650      |
| 83 | Indonesia     | 212       | 444       |
| 84 | Iran          | 674       | 3236      |
| 85 | Iraq          | 77        | 218       |
| 86 | Ireland       | 315       | 1326      |
| 87 | Israel        | 397       | 2023      |
| 88 | Italy         | 3544      | 29095     |
| 89 | Kuwait        | 69        | 358       |
| 90 | Kyrgyzstan    | 2         | 0         |
| 91 | Laos          | 5         | 20        |
| 92 | Latvia        | 8         | 14        |
| 93 | Lebanon       | 99        | 365       |
| 94 | Lesotho       | 1         | 0         |
| 95 | Liberia       | 2         | 7         |
| 96 | Libya         | 19        | 29        |
| 97 | Liechtenstein | 9         | 6         |
| 98 | Lithuania     | 41        | 218       |
| 99 | Luxembourg    | 48        | 203       |
| 100| Madagascar    | 6         | 9         |
| 101| Malawi        | 12        | 46        |
| 102| Malaysia      | 262       | 924       |
| 103| Maldives      | 3         | 98        |
| 104| Mali          | 6         | 28        |
| 105| Malta         | 29        | 78        |
| 106| Mauritania    | 1         | 2         |
| 107| Mauritius     | 11        | 183       |
| 108| Mexico        | 365       | 787       |

(Continued)
In Figure 1, a map showing the number of publications and collaboration relationships between countries around the world was obtained. The size of the circle in the map indicates the number of publications. The larger the circle, the higher the number of publications. The colors on the map show the clusters. As a result of bibliometric analysis, a total of 14 clusters were obtained. And these clusters are obtained as follows. In addition, the thickness of the lines in the graph indicate the strength of the relations between countries.

Cluster 1: Algeria, Bangladesh, Benin, Botswana, Burkina Faso, Burundi, Cambodia, Cameroon, Cent Afr. Republ, Comoros, Cote Ivoire, Dem. Rep. Congo, Eswatini, Ethiopia, Gabon, Gambia, Ghana, Guatemala, Guinea, Indonesia, Kenya, Laos, Lesotho, Liberia, Madagascar, Malawi, Maldives, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rep. Congo, Rwanda, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Tanzania, Togo, Tonga, Tunisia, Uganda, Zambia, Zimbabwe

Cluster 2: Albania, Armenia, Azerbaijan, Belarus, Bosnia&Herceg, Bulgaria, Crotia, Cyprus, Czech Repuclic, Estonia, Georgia, Greece, Hungary, Israel, Kazakhstan, Kosovo, Kyrgyzztan, Latvia, Lithuania, Malta, Moldova, Montenegro, North Macedonia, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Trinidad Tobago, Turkey, Ukranie, Uzbekistan, Vatican

Cluster 3: Afghanistan, Bahrain, Bhutan, Egypt, India, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Malaysia, Myanmar, Nepal, Oman, Pakistan, Palestine, Qatar, Saudi Arabia, Sri Lanka, Sudan, Syria, Tajikistan, U Arap Emirates, Yemen,

Cluster 4: Argentina, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Rep, Ecuador, El Salvador, French Guiana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, Venezuela

Cluster 5: Australia, Brunei, Fiji, Japan, Mongolia, New Calendonia, Papua n Guinea, China, Philippines, Singapore, Solomon Islands, South Korea, Taiwan, Thailand, Vietnam

Cluster 6: England, Gibraltar, Ireland, New Zealand, Northern Ireland, Scotland, Wales

Cluster 7: Andorra, Austria, Bahamas, France, Monaco, Spain

Cluster 8: Dominica, Grenada, Haiti, Nauru, Saint Maarten, United States

Cluster 9: Belgium, Bermuda, Canada, Iceland, Norway, Sweden

Cluster 10: Denmark, Finland, Guinea Bissau, Portugal, South Sudan

Cluster 11: Aruba, Curacao, Netherlands

Cluster 12: Germany, Liechtentstein, Switzerland

Cluster 13: Italy, San Marino

Cluster 14: Luxembourg

In Table 3, the 10 most cited studies on COVID-19 are given. It was seen that LANCET was very successful publications about COVID-19. A total of 38,080 publications were published in 5787 journals. Of these journals, there were 907 journals that have at least 10 publications. Of these journals, there were 1438 journals that have at least 10 citations. In Figure 2, the network visualization map shows these journals. In the figure, the size of the circles indicates the number of citations.

The network visualization map obtained as a result of bibliometric analysis of publications on COVID-19 in terms of organizations is given in Figure 3. As a result of the analysis, taking into account the number of documents and citations numbers, the most active 10 institutions were Huazhong University Science & Technology, Wuhan University, Capital Medical University, Chinese Academy of Sciences, Tsinghua University, University of Hong Kong, Chinese Academy of Medical Sciences, Harvard Medical School, China-Japan Frienship Hospital, and Fudan University, respectively.

As a result of the examination of the bibliometric analysis in terms of the keywords in the COVID-19 publications, Figure 4 was obtained. There were 48,522 keywords used in the publications about COVID-19. These keywords had 1162 keywords that were used in at least 15 different publications.
In the second stage of the study, as a result of bibliometric analysis, the numbers of publications related to COVID-19 belonging to the countries were obtained, and the relations of these numbers with the number of total cases on January 10, 2020, were examined (Table 4). It was found that there was a statistically significant relationship between the number of publications of the countries and the number of total COVID-19 cases. In addition, the strength of this relationship was found to be high ($r = 0.806; P < 0.001$).

Table 3. The 10 most cited studies on COVID-19

| Authors | Publication name                                                                 | Journal name                        | Volume and issue, pages | Times cited | Year       |
|---------|----------------------------------------------------------------------------------|-------------------------------------|-------------------------|-------------|------------|
| Huang, Chaolin; Wang, Yeming; Li, Xingwang; et al. | Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China | LANCET | Volume: 395 Issue: 10223 Pages: 497-506 | 8860 | FEB 15 2020 |
| Guan, W.; Ni, Z.; Hu, Yu; et al. | Clinical Characteristics of Coronavirus Disease 2019 in China | NEW ENGLAND JOURNAL OF MEDICINE | Volume: 382 Issue: 18 Pages: 1708-1720 | 5734 | APR 30 2020 |
| Wang, Dawei; Hu, Bo; Hu, Chang; et al. | Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China | JAMA-JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION | Volume: 323 Issue: 11 Pages: 1061-1069 | 5284 | MAR 17 2020 |
| Zhou, Fei; Yu, Ting; Du, Ronghui; et al. | Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study | LANCET | Volume: 395 Issue: 10229 Pages: 1054-1062 | 4919 | MAR 28 2020 |
| Zhu, Na; Zhang, Dingyu; Wang, Wenling; et al. | A Novel Coronavirus from Patients with Pneumonia in China, 2019 | NEW ENGLAND JOURNAL OF MEDICINE | Volume: 382 Issue: 8 Pages: 727-733 | 4801 | FEB 20 2020 |
| Chen, Nanshan; Zhou, Min; Dong, Xuan; et al. | Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study | LANCET | Volume: 395 Issue: 10223 Pages: | 4458 | FEB 15 2020 |
| Zhou, Peng; Yang, Xing-Lou; Wang, Xian-Guang; et al. | A pneumonia outbreak associated with a new coronavirus of probable bat origin | NATURE | Volume: 579 Issue: 7798 Pages: 270 | 3723 | MAR 2020 |
| Li, Qun; Guan, Xuhua; Wu, Peng; et al. | Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia | NEW ENGLAND JOURNAL OF MEDICINE | Volume: 382 Issue: 13 Pages: 1199-1207 | 3065 | MAR 26 2020 |
| Hoffmann, Markus; Kleine-Weber, Hannah; Schroeder, Simon; et al. | SARS-CoV-2 Cell Entry Depends on ACE2 and TMPRSS2 and Is Blocked by a Clinically Proven Protease Inhibitor | CELL | Volume: 181 Issue: 2 Pages: 271 | 2676 | APR 16 2020 |
| Lu, Roujian; Zhao, Xiang; Li, Juan; et al. | Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding | LANCET | Volume: 395 Issue: 10224 Pages: 565-574 | 2406 | FEB 22 2020 |

Table 4. Relationships between the number of articles and the total number of cases for countries

| Articles numbers | Total no. of cases |
|------------------|--------------------|
| $r$              | 0.806              |
| $P$              | <0.001             |
| $N$              | 189                |

Figure 2. Network visualization map for citation analysis of journals.

Figure 3. Network visualization map for citation analysis of organizations.
Therefore, with the increase in the number of cases, the number of studies conducted by countries in this field has increased.

**Discussion**

With the continued spread of the COVID-19 pandemic, the number of studies in this area is constantly increasing. Studies are carried out in many areas related to the subject. However, evaluating the quality of these publications and obtaining valuable information about the publications will be helpful in future studies.

De Felice and Polimeni applied a bibliometric analysis on coronavirus using the Scopus database. They analyzed 1883 studies. Similar to our study, the countries with the most studies were determined as China and the United States. Also, Farooq et al. made a bibliometric analysis on coronavirus and examined a total of 6694 registered studies on WOS. They found that the most studies about coronavirus was reported from within the United States and China, with The Journal of Medical Virology and CUREUS being the favorite publications.

In our study, 38,080 papers about COVID-19 were evaluated. The most used keywords in the studies were determined as COVID-19, SAR-COV2, and coronavirus. When the countries were examined according to the number of papers, it was found that the countries with the highest number of papers were China and the United States. When the most cited numbers were evaluated, China ranked first; Huazhong University Science & Technology and Wuhan University were among the most active institutions considering the number of documents and citations. In the second stage of the study, the relationship between the number of publications about COVID-19 and the number of total cases was examined. The relationships were found to be significant and high.

With this study, bibliometric analyses on countries, institutions, authors, and subject area related to COVID-19 were performed, and a general perspective was created. Another advantage of the study is, the investigation of the relations between the number of publications of the countries and the number of total cases per countries. We found that there was a statistically significant relationship between the number of publications of countries and the number of COVID-19 cases. These results show us that with the increase in the number of cases, the number of studies conducted by countries in this field has increased. Studies in the field of COVID-19 will constitute an important source of information in other sectors, especially in the health sector. These studies have an important role for governments to take necessary precautions and plans.

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**Competing interests.** The authors declare that there is no other conflict of interest to disclose.

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