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

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Original Research

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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 Enviromental 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 tendecies 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.[1–6]

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

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Table 1. Top research areas of COVID-19 articles

Research areas	No. of publications	%
General Internal Medicine	3787	9.945
Public Enviromental Occupational Health	3250	8.535
Infectious Diseases	2172	5.704
Science Technology Other Topics	2081	5.465
Enviromental 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

ANSI format, and transferred to VOSviewer (version 1.6.16) by making the necessary transformations. Bibliometric analysis and mapping processes were obtained with the VOSviewer 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). Only publications are included in the analyses; a total of 38,080 publications were evaluated. In the second stage of the study, as a result of bibliometric analysis, the number 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 10 January 2020 were examined.[7] Spearman correlation coefficient was used to examine the relationships. The statistical significance level was taken as 0.05, and SPSS (version 21) was used as a package program.

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%), enviromental sciences ecology (1798; 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. 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

(*Continued*)

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*)

Table 2. (*Continued*)

Id	Country	Documents	Citations
109	Moldova	4	4
110	Monaco	4	11
111	Mongolia	5	12
112	Montenegro	6	14
113	Morocco	116	239
114	Mozambique	17	338
115	Myanmar	9	16
116	Namibia	4	3
117	Nauru	2	3
118	Nepal	84	118
119	Neth Antilles	1	0
120	Netherlands	765	13671
121	New caledonia	3	5
122	New zealand	272	1098
123	Nicaragua	3	0
124	Niger	4	3
125	Nigeria	240	345
126	North Macedonia	14	47
127	North Ireland	88	243
128	Norway	291	1402
129	Oman	54	228
130	Pakistan	472	1744
131	Palestine	25	30
132	Panama	16	57
133	Papua N Guinea	3	2
134	Paraguay	16	18
135	Peoples R China(CHINA)	5727	160946
136	Peru	123	311
137	Philippines	109	269
138	Poland	443	1994
139	Portugal	358	1178
140	Qatar	118	483
141	Rep Congo	11	66
142	Romania	211	591
143	Russia	420	4652
144	Rwanda	15	28
145	Samoa	3	1
146	San Marino	1	25
147	Saudi Arabia	741	4231
148	Scotland	450	4283
149	Senegal	21	126
150	Serbia	72	159
151	Seychelles	1	6
152	Sierra Leone	10	2
153	Singapore	528	5914
154	Sint Maarten	1	0
155	Slovakia	58	82
156	Slovenia	80	480
157	Solomon Islands	2	4
158	Somalia	5	4
159	South Africa	456	1312
160	South Korea	706	6000
161	South Sudan	1	1
162	Spain	1863	11196

(*Continued*)

Table 2. (*Continued*)

Id	Country	Documents	Citations
163	Sri Lanka	38	97
164	Sudan	19	78
165	Sweden	461	3668
166	Switzerland	765	9142
167	Syria	8	5
168	Taiwan	378	3336
169	Tajikistan	1	1
170	Tanzania	22	27
171	Thailand	186	598
172	Togo	3	3
173	Tonga	1	0
174	Trinidad Tobago	13	79
175	Tunisia	62	260
176	Turkey	952	2227
177	U Arab Emirates	176	1677
178	Uganda	51	85
179	Ukraine	121	128
180	Uruguay	42	63
181	USA	10940	93111
182	Uzbekistan	4	2
183	Vatican	2	0
184	Venezuela	29	120
185	Vietnam	206	2719
186	Wales	149	1110
187	Yemen	16	28
188	Zambia	12	21
189	Zimbabwe	30	87

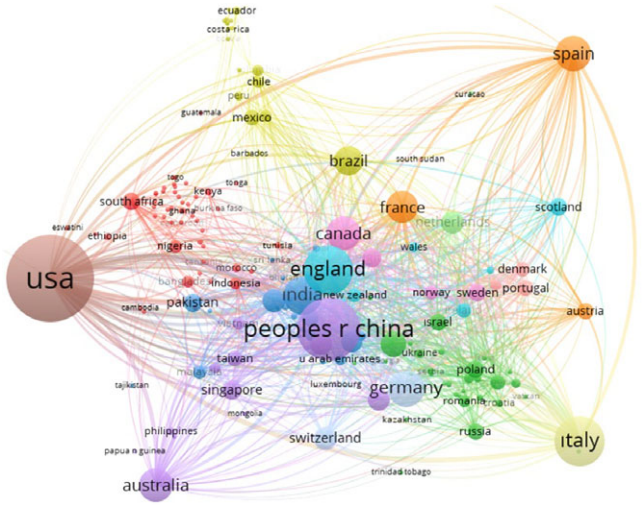

Figure 1. Network visualization map for international collaboration of worldwide.

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, Madagastar, 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, Kyrgyztan, 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, Dominician 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 İslands, 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, Liechtenstein, 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 biometric 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.

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

Authors	Publication name	Journal name	Volume and nssue, 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

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

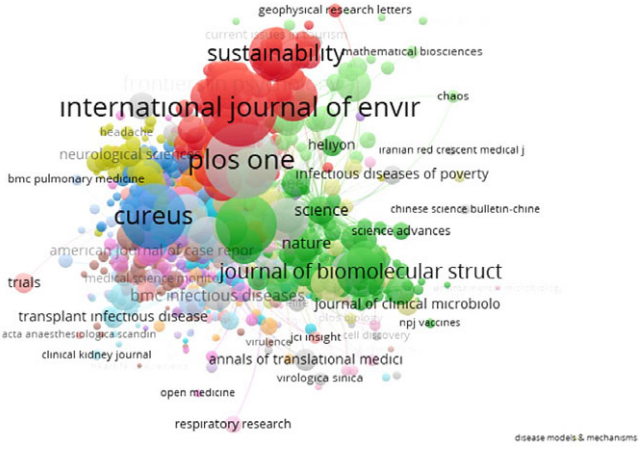

Figure 2. Network visualization map for citation analysis of journals.

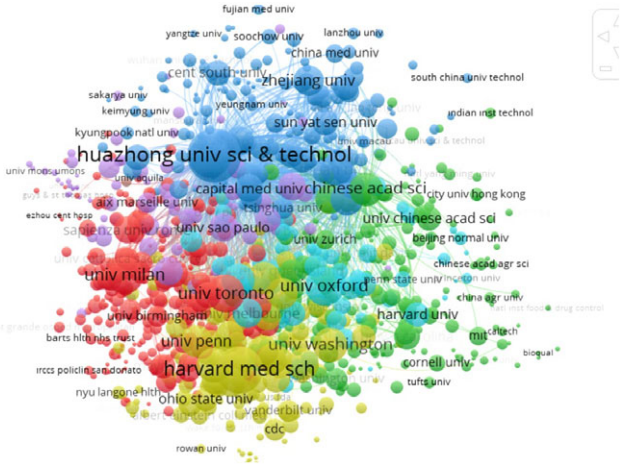

Figure 3. Network visualization map for citation analysis of organizations.

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 ($r = 0.806$; $P < 0.001$).

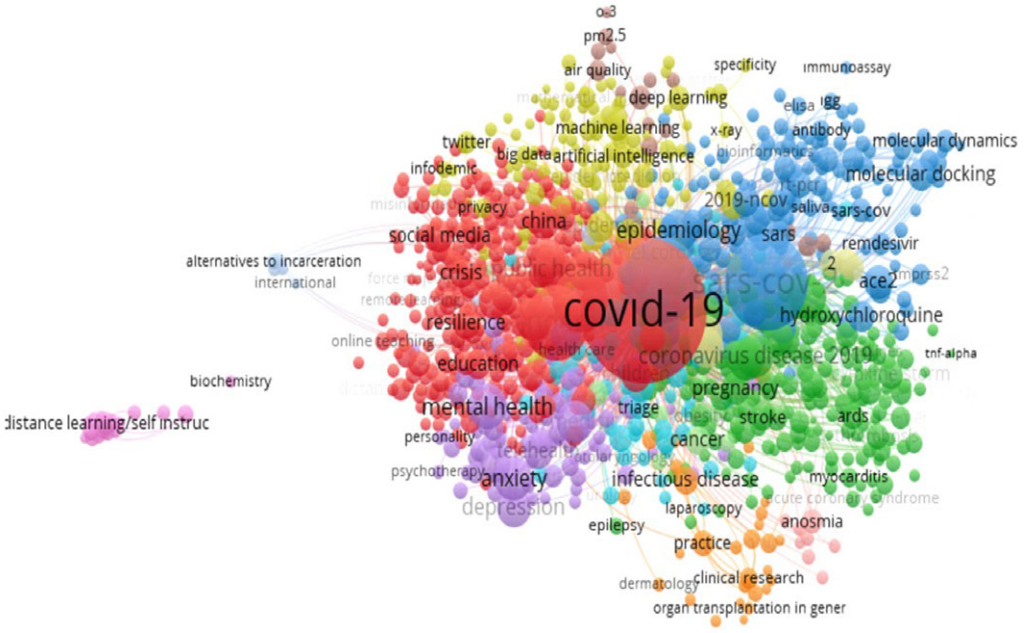

Figure 4. Network visualization map for keywords.

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 helpful on 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.[8,9]

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 has an important role for goverments to take necessary precautions and plans.

Authors Contributions. All authors contribute to all stages of the article.

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

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