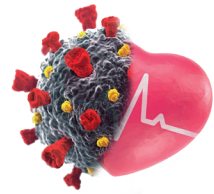

The Effects of COVID-19 Pandemic on Academic Researches and Publications

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The Effects of COVID-19 Pandemic on Academic Researches and Publications

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Abstract
This study focused on data-based literature evaluation. For this purpose, various scientometrics and bibliometric analyzes were carried out on scientific documents about coronavirus. Within the scope of the research, social network analysis method was used in order to find answers to the questions sought. The research has made inferences about collaboration models. The dynamics for R&D studies carried out in the pandemic process, which concerns the entire world, are described through productivity, collaboration and funding dynamics. Attention was drawn to the points of use for policy development based on data. If we summarize the prominent results in the study; Although collaborative practices were observed in research and development activities, it was observed that collaborations remained mostly on a national or regional scale. High aggregate constraints (HAC) and low aggregate constraints (LAC) tables allow us to evaluate the positions of actors in coronavirus research in terms of social network analysis values. Coronavirus research has been shown to be a priority research topic on the agenda of the whole world (annual growth rate19.43%.). In coronavirus researches, teams formed in various geographies of the world and their leaders have been identified. Lau SKP, Du LY, Al-Tawfiq JA, Memish ZA are both in the publication performance list and in the network values list. Institutions addressed in China, where the first cases of the pandemic process were observed, undertook a significant share in terms of the number of publications. When we examine the inter-institutional collaboration models, we can say that the institutions do not have a structure prone to collaboration. EU, Wellcome Trust and European Community (EC) have also undertaken a considerable burden, while the University of Hong Kong has also undertaken a significant burden in terms of funding.

Keywords
Coronavirus; COVID-19; anticipatory governance; emergency preparedness; bibliometrics; science and technology policy.

Introduction

We are facing the COVID-19 crisis that has shaken the world. COVID-19 pandemic, which has an incredible influence on production, consumption, daily life, social relations, institutions and society, has turned into an epidemic that has the potential to change the governments, laws and many more of the governments. COVID-19 coronavirus has become a virus that left its mark on 2020 and affects all the ways we do business. Due to this epidemic, which was defined as a pandemic by the World Health Organization (WHO) on March 11, 2020, all the dynamics of daily life, especially the education system, were affected. Many face-to-face activities were either carried out remotely or started in a diluted structure called flexible working hours. These changes, which must be made in the services, have not only affected every area of daily life but also have become a pressure on the economic structures of the countries. Increasing day-to-day death rates and high contagiousness caused the national and international research on the virus to focus on the COVID-19 virus. Almost all countries have started R&D studies and consortiums of various scales have been established in order to get rid of the pandemic process and produce treatment as soon as possible. Although some of the countries have collaborated on this issue, it has been observed that these relations remain limited (Yalçın & Şeker, 2020). On the other hand, many companies competing in the private sector acted together in this process and contributed to the consortium in the development of many technologies including the production of ventilation machines ("Ventilator Challenge UK to start production in COVID-19 fight," 2020).

In our study, the literature of the R&D activities carried out as a result of these dynamics was analyzed. In other words, a literature review was made on the bibliographic data of the COVID-19 articles in the international literature. In this context, especially after the World Health Organization (WHO) has defined the process as a pandemic, the evolutionary trend experienced by the increasing publication pattern has been addressed, and then the focus points have been determined in terms of publication dynamics.

Previous Studies

When the literature is examined, it is seen that there are several studies in which studies on COVID-19 virus are examined using bibliometrics. When the studies are considered in terms of the method they apply, it is seen that they follow a more descriptive way. For example, Zhou and Chen (2020) used systematic review management in their studies to evaluate the publication trends for coronavirus research in the last 20 years based on the prism work flow diagram (Zhou & Chen, 2020). In another study, Kostoff and Morse (2011) examined scientific documents about SARS virus by text mining method; they made evaluations about points such as co-author, country contribution and citation effect (Kostoff & Morse, 2011). Similar studies were carried out for studies on the MERS virus indexed in PubMed (Wang et al., 2016). Wang and others concluded that most of the documents reviewed in their study focused on preventing and controlling the disease. Rabaan et al. (2017) described the bibliometric properties of the publications in the Saudi Arabian hinterland in their studies on the publication dynamics of the MERS virus studies. One of the important results of the study is that epidemiology articles get more citation than other articles (Rabaan, Al-Ahmed, Bazzi, & Al-Tawfiq, 2017). In his study where the 8 highest pathogens identified by the world health organization examined the research trends, Swelleh (2017) examined the indicators such as author productivity, institutional productivity, research collaboration (Sweileh, 2017). In addition, studies approaching COVID-19 research in terms of author dynamics (Andersen, Nielsen, Simone, Lewiss, & Jagsi, 2020), studies aiming to improve the bibliography of publications about COVID-19 (Chen et al., 2020) are observed. On the other hand, it is observed that there are studies focusing on the determination of the nodes that play the role of hotspot in social network analysis and COVID-19 researches, and studies focusing on the determination of the subject areas where the research is concentrated (Jia et al., 2020; Lou et al., 2020; Mao, Guo, Fu, & Xiang, 2020; Yi et al., 2020; Zhai et al., 2020; Zhang et al., 2020). It is possible to say that our study differs from these previously conducted studies in the literature by blending bibliometrics and social network analysis by taking COVID-19 research with a holistic approach.

Research Questions

It is possible to say that our study differs from these previously conducted studies in the literature by blending bibliometrics and social network analysis (SNA) by taking COVID-19 research with a holistic approach. In this context, it is possible to define the questions we seek the answer in our research as follows:

1. *How is the publication trend in COVID-19 studies shaped by years?*
2. *Who are the pioneers in COVID-19 research? How can actors in COVID-19 research be identified in terms of their roles in social network analysis (SNA) values?*
   a. *Who is the most productive author?*
   b. *What is the most productive institution?*
   c. *What is the most productive country?*
3. *What are the funding agencies and their performance in COVID-19 research?*

In order to answer these questions, an online query process was conducted in all databases of Web of Science (WoS) to access bibliographic data of COVID-19 publications. The data obtained as a result of the query was cleaned and recorded in a relational database to be ready for analysis. R[1], Pajek[2] and MS Excel software were used in the analysis of the data, and VosViewer[3] was used in the visualization phase.

Bibliometric indicators

When the data set is examined, it is seen that a total of 29874 document data published between 1968-2020 has been reached. While 4339 of the documents were single authors, it was observed that there were 0,394 documents per author. Collaboration index was calculated as 2.85. The annual growth rate of COVID-19 literature was determined as 19.43%. In the analysis, only the data of the scientific publications, which are citable are used. For this reason, document types such as retracted publication, news item, notes are left out of evaluation. The number of documents analyzed after this filtering process is 20881.

Author productivity

Bibliometric indicators and metrics based on citation analysis were handled together to identify the researchers who carried COVID-19 research. Dominance factor, h-index and citation analysis values of authors were used together to measure author productivity and impact. The dominance factor

[1] https://cran.r-project.org/
[2] http://mrvar.fdv.uni-lj.si/pajek/
[3] https://www.vosviewer.com/

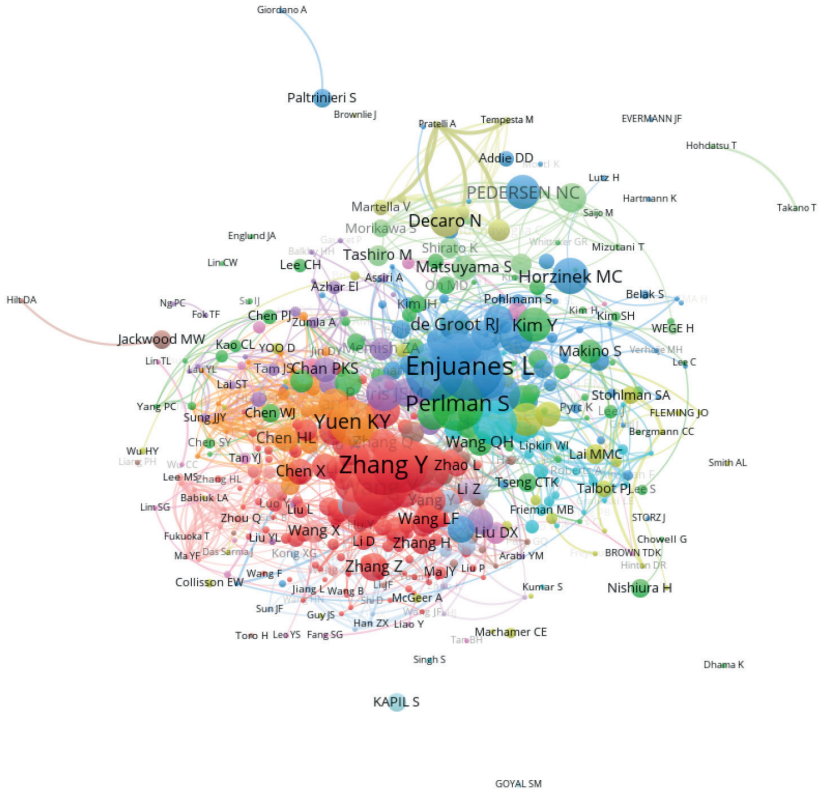
is based on a weighted calculation principle for the first time by Kumar and Kumar (2008), considering the rankings of the authors. Accordingly, the name rankings of the authors in the document serve as a metric to be used to calculate the dominance value of the relevant author (Kumar & Kumar, 2008). In terms of their values, the top 20 authors, are presented in table 1. When the table is examined closely, it is observed that the researchers, who are in the top ranks in terms of dominance factor, have high individual performances, and they have taken the responsibility of first authorship in multi-author studies. In this regard, it can be said that the authors listed in table 1 also assume the leadership role of the research groups formed in COVID-19 studies. With similar analyzes, it is possible to identify research clusters as well as to make inferences about research group leaders. The h-index value is used as another productivity index that expresses the intersection of the number of publications and citations of a scientist. In this metric literature proposed by Hirch (Hirsch, 2005), it is a frequently used metric, although it has been criticized for being an injustice between academics who have just started their research life and academics who have been operating in the field for a long time(Jacso, 2008; Jacso´, 2008; Prasad & Jacsó, 2008). The h-index represents the intersection of the number of publications and the number of citations (Yalcin, H., Shi, W., & Rahman, Z., 2020). Even if an author received more than 100 citations in total, if the total number of publications is 10, the maximum h-index value that the author can receive is limited to 10. In other words, the total number of publications the author has in the h-index plays a decisive role. When comparing authors in h-index calculations, it is recommended that researchers' activity periods are taken into consideration. in fact, it is necessary to be sensitive in using h-index and similar metrics used for calculating scientific productivity.

Table 1. Author Productivity Metrics

Rank by DF	Author	Dominance Factor	Total Documents	Single-Authored	Multi-Authored	First-Authored	Rank by Documents	h-index	Citation sum within h-core	All citations
1	AL-TAWFIQ JA	0.494	85	2	83	41	32	28	2899	3296
2	LAU SKP	0.342	121	1	120	41	14	47	6256	7394
3	WOO PCY	0.323	131	1	130	42	11	48	6420	7748
4	CAVANAGH D	0.253	86	11	75	19	31	41	5893	6429
5	DU LY	0.253	83	0	83	21	39	30	1913	2505
6	MEMISH ZA	0.218	136	3	133	29	9	42	4933	5771
7	WANG L	0.216	112	1	111	24	20	29	3589	3958
8	ZHANG L	0.190	84	0	84	16	33	16	4724	4890
9	WANG J	0.185	124	0	124	23	13	26	2115	2514
10	CHEN Y	0.172	87	0	87	15	29	23	2378	2718
11	POON LLM	0.171	84	2	82	14	33	44	8878	9303
12	WANG Y	0.164	159	0	159	26	5	23	1400	2079
13	LI Y	0.156	147	0	147	23	8	35	4593	5306
14	LIU DX	0.138	94	0	94	13	26	31	1552	2294
15	LIU Y	0.137	117	0	117	16	16	27	5128	5613
16	TAGUCHI F	0.136	83	2	81	11	39	24	1287	1718
17	CHAN PKS	0.131	84	0	84	11	33	31	3184	3703
17	THIEL V	0.131	84	0	84	11	33	36	4847	5352
19	MAKINO S	0.130	92	0	92	12	27	39	2994	3791
20	HAAGMANS BL	0.126	96	1	95	12	25	37	4677	5260

When the authors are ranked in the top twenty in terms of their performance, SNA and graph theory approach have been handled together to analyze the roles they assumed in the network for COVID-19 research. When this framework is examined, it is possible to determine the roles of the authors in the network. Although they perform effectively in terms of the number of publications, the authors who play as a hub in the network make possible the continuity of scholarly communication. When the network map of the authors who contributed to COVID-19 researches in terms of SNA is examined, it is observed that the actors in the network differ in terms of their connection indicators with the authors at the top of the list in terms of publishing performance (Figure 1).

Figure 1. Author Network



When the network map is examined closely, it is noteworthy that Lau SKP, Du LY, Al-Tawfiq JA, Memish ZA are both in the publication performance list and in the network values list. In this respect, it is possible to say that these researchers are important nodes/actors for COVID-19 researches.

Institution Productivity

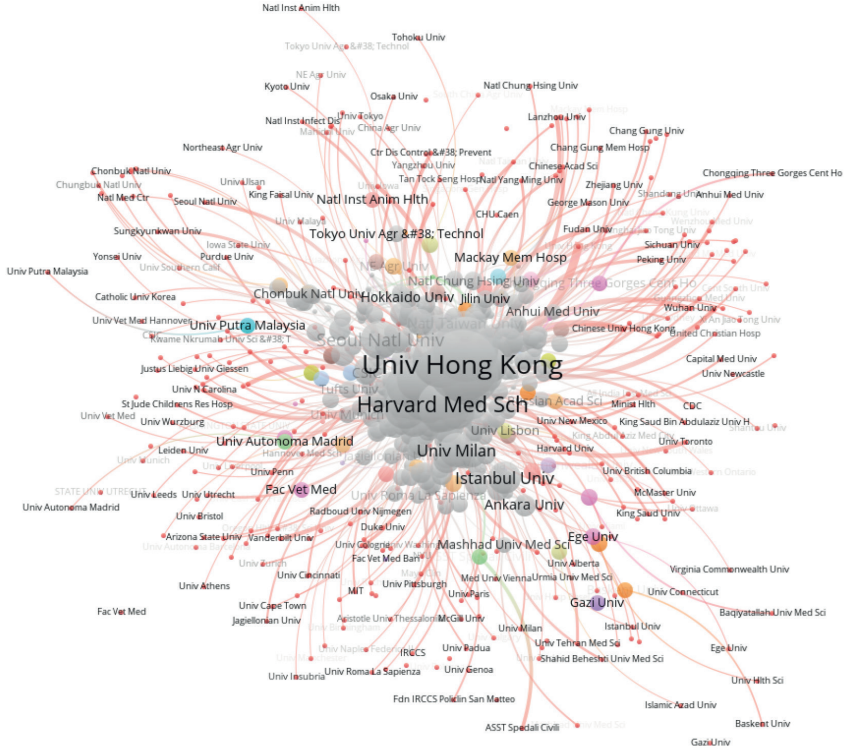
When we examine the COVID-19 documents in terms of institutional productivity, it is possible to say that the institutions addressed in China, where the first cases of the pandemic process were observed, undertook a significant burden in terms of the number of publications. However, when we look at the number of citations that publications have created in the literature, it is possible to make a systemic inference about institutional productivity and their impact. The list created according to the productivity analysis made in this context is presented in Table 2.

Table 2. Institution Productivity

h-index	Unit	Citation sum within h-core	All citations	All Documents
121	UNIV HONG KONG	38884	74375	1267
83	CHINESE UNIV HONG KONG	20631	33648	684
83	UNIV N CAROLINA	10952	21217	434
73	CHINESE ACAD SCI	17538	27279	628
73	VANDERBILT UNIV	9498	14428	308
73	UNIV UTRECHT	10454	17499	358
72	UNIV SO CALIF	9400	16482	277
71	CTR DIS CONTROL & PREVENT	23307	28638	338
70	NIAID	9909	14440	267
70	HARVARD UNIV	13314	15843	213
64	UNIV TORONTO	12037	16855	413
64	UNIV IOWA	7032	15200	392
60	LEIDEN UNIV	9812	13494	239
57	MINIST HLTH	9292	12415	258
54	UNIV WASHINGTON	5804	8165	259
54	UNIV PENN	5581	9099	296
52	UNIV TEXAS	4864	6778	136
49	UNIV BONN	6331	7672	130
49	SCRIPPS RES INST	4565	6526	170
48	ERASMUS MC	8335	9985	158

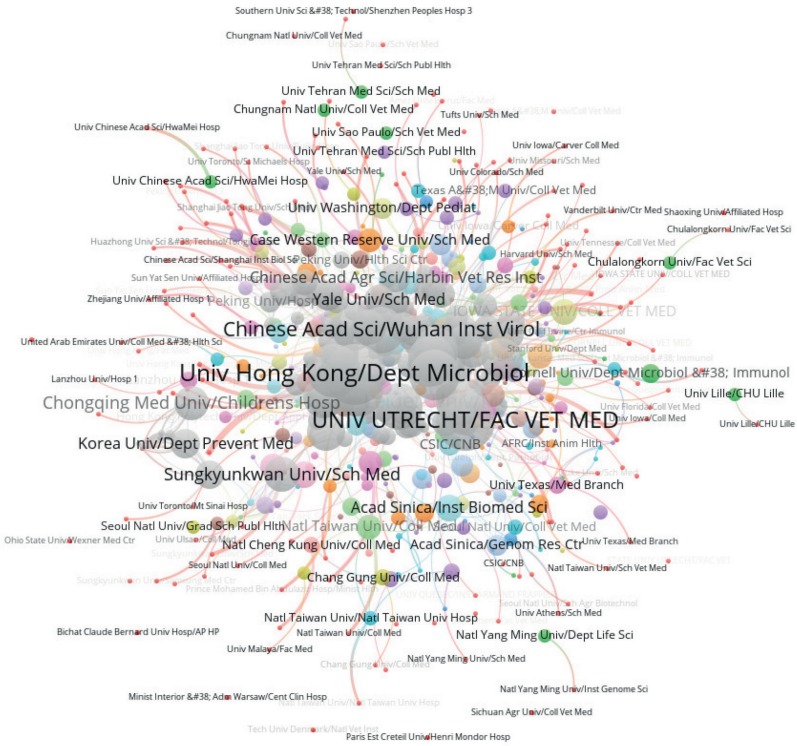
Another remarkable result is the fact that the Chinese addressed institutions, which are the country where the case is first seen, are at the top of the list, and UNIV N CAROLINA is the US representative. When we examine the inter-institutional collaboration models, we can say that the institutions do not have a structure prone to collaboration. It is observed that collaborations are carried out with other units within the same institution. In this regard, although there is an intense search for the diagnosis and treatment of the virus in the pandemic process, it cannot be said that the institutions are very motivated in terms of collaboration (Figure 3).

Figure 2. Institution Network



When the institution network is analyzed, it is worth noting that the organizations addressed in China are in important positions in the network in proportion to the number of publications. At the same time, while it is observed that the institutions addressed in the USA are included in the network, Univ Hong Kong has the highest degree in the social network map created according to the degree of connectivity, while in terms of the value of the interconnection (Figure 3). Betweenness is one of the metrics frequently used in network theory. It represents the degree of network elements (nodes) between each other (De Nooy, Mrvar, & Batagelj, 2018). Considering this metric, a more centralized node has more control over the network than the nodes in the network. In the example in our study, it is possible to say that Chinese Univ Hong Kong, Prince Wales Hospital is an important actor in COVID-19 researches (Table 3).

Figure 3. Affiliation Network



Network members with high aggregate constraints (HAC) appear to be drawn closely together, while low constraints (LAC) are shown as longer connections to highlight structural holes. In this way, it is possible to make inferences about the positions of the nodes in the network and their mobility in the network. Low constrained nodes (LAC) have a more flexible structure in terms of mobility, whereas for constrained large nodes (HAC) they may be the opposite (De Nooy et al., 2018; Prota, Vitale, & D'Esposito, 2017). In this respect, it is possible to say that Utrecht University, Heilongjiang Dealer Agr Univ, Cleveland Clin Fdn, Chinese Univ Hong Kong, Vanderbilt Univ, Univ Hong Kong and Huazhong Univ Sci & Technology are important points in the COVID-19 network. In this respect, it is obvious that the development of the collaboration of the departments in the table will contribute positively to the solution of the pandemic process. Table 3 can be examined for details about the departments such as degree and betweenness centrality metrics.

Table 3. Affiliation Network Metrics

HIGH AGGREGATE CONSTRAINTS (HAC)		LOW AGGREGATE CONSTRAINTS (LAC)		ALL DEGREE		BETWEENNESS CENTRALITY	
UNIV UTRECHT	FAC VET	CTR DIS CONTROL & PREVENT	ATLANTA	UNIV HONG KONG	DEPT MICROBIOL	UNIV HONG KONG	DEPT MICROBIOL
HEILONGJIANG BAYI AGR UNIV	COLL ANIM SCI & VET MED	UNIV HONG KONG	SCH PUBL HLTH	UNIV N CAROLINA	DEPT EPIDEMIOL	UNIV UTRECHT	FAC VET MED
CLEVELAND CLIN FDN	DEPT NEUROSCI	CHINESE ACAD SCI	WUHAN INST VIROL	UNIV HONG KONG	LI KA SHING FAC MED	UNIV HONG KONG	LI KA SHING FAC MED
CHINESE UNIV HONG KONG	PRINCE WALES HOSP	UNIV UTRECHT	FAC VET MED	UNIV IOWA	DEPT MICROBIOL	UNIV IOWA	DEPT MICROBIOL
VANDERBILT UNIV	MED CTR	UNIV PENN	PERELMAN SCH MED	CHINESE ACAD SCI	WUHAN INST VIROL	LEIDEN UNIV	MED CTR
UNIV HONG KONG	LI KA SHING FAC MED	UNIV BONN	INST VIROL	UNIV UTRECHT	FAC VET MED	UNIV HONG KONG	SCH PUBL HLTH
HUAZHONG UNIV SCI & TECHNOL	TONGJI HOSP	NIAID	VACCINE RES CTR	CHINESE ACAD SCI	INST MICROBIOL	CHINESE ACAD SCI	WUHAN INST VIROL
UNIV SO CALIF	SCH MED	NIAID	INFECT DIS LAB	LEIDEN UNIV	MED CTR	UNIV N CAROLINA	DEPT EPIDEMIOL
SUNGKYUNKWAN UNIV	SCH MED	NIH	FOGARTY INT CTR	UNIV N CAROLINA	DEPT MICROBIOL & IMMUNOL	CTR DIS CONTROL & PREVENT	ATLANTA
UNIV HONG KONG	QUEEN MARY HOSP	UNIV BONN	MED CTR	UNIV BONN	MED CTR	GUANGZHOU MED UNIV	AFFILIATED HOSP 1
SHANGHAI JIAO TONG UNIV	SCH MED	CSIRO	AUSTRALIAN ANIM HLTH LAB	UNIV TEXAS MED BRANCH	DEPT MICROBIOL & IMMUNOL	HARVARD UNIV	SCH MED
WASHINGTON UNIV	SCH MED	GUANGZHOU MED UNIV	AFFILIATED HOSP 1	VANDERBILT UNIV	MED CTR	CHINESE UNIV HONG KONG	PRINCE WALES HOSP
UNIV GRONINGEN	UNIV MED CTR GRONINGEN	EMORY UNIV	SCH MED	GUANGZHOU MED UNIV	AFFILIATED HOSP 1	UNIV N CAROLINA	DEPT MICROBIOL & IMMUNOL
VANDERBILT UNIV	SCH MED	UNIV PITTSBURGH	SCH MED	UNIV HONG KONG	STATE KEY LAB EMERGING INFECT DIS	CORNELL UNIV	COLL VET MED
UNIV CHINESE ACAD SCI	HWAMEI HOSP	UNIV PENN	DEPT MICROBIOL	NEW YORK BLOOD CTR	LINDSLEY F KIMBALL RES INST	NATL UNIV SINGAPORE	YONG LOO LIN SCH MED
NATL TAIWAN UNIV	COLL MED	CHINESE ACAD MED SCI	PEKING UNION MED COLL HOSP	UNIV HONG KONG	SCH PUBL HLTH	EMORY UNIV	SCH MED
PRINCE MOHAMED BIN ABDULAZIZ HOSP	MINIST HLTH	CHARITE UNIV MED BERLIN	INST VIROL	HARVARD UNIV	SCH MED	UNIV VIRGINIA	SCH MED
NATL CHENG KUNG UNIV	COLL MED	UNIV COLORADO	SCH MED	ALFAISAL UNIV	COLL MED	SUNGKYUNKWAN UNIV	SCH MED
HUAZHONG UNIV SCI & TECHNOL	UNION HOSP	UNIV IOWA	DEPT MICROBIOL & IMMUNOL	CHINESE UNIV HONG KONG	PRINCE WALES HOSP	CHINESE ACAD SCI	INST MICROBIOL
HUAZHONG UNIV SCI & TECHNOL	TONGJI MED COLL	KANSAS STATE UNIV	COLL VET MED	UNIV VIRGINIA	SCH MED	VANDERBILT UNIV	MED CTR

Country Productivity

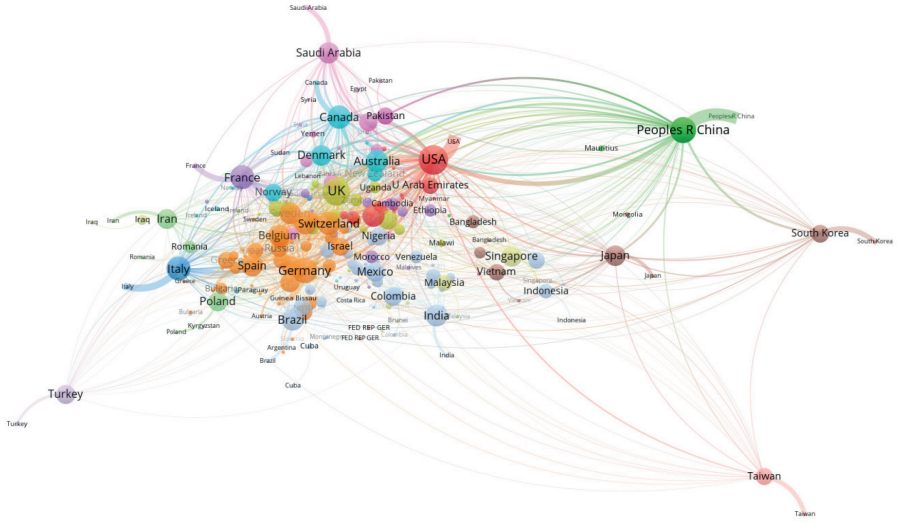
Country contribution and impact values are presented in table 4. In this context, it is observed that although China is below the USA in terms of the number of publications, the number of publications and citations is at the top of the list in terms of the h-index values that constitute the intersection point.

Table 4. Country Productivity

COUNTRY	CITATION SUM WITHIN H-CORE	ALL CITATIONS	ALL DOCUMENTS	H-INDEX
PEOPLES R CHINA	200216	473723	16674	281
USA	101957	496289	20838	234
GERMANY	40350	90324	3501	136
NETHERLANDS	39785	80916	1839	133
UK	37029	90448	4930	131
CANADA	44301	101736	3582	129
SAUDI ARABIA	25945	57489	1977	114
FRANCE	16565	42574	3183	94
AUSTRALIA	15842	32766	2076	85
ITALY	9976	34279	5656	81
TAİWAN	12663	45553	2556	79
SWITZERLAND	12509	24128	1188	79
JAPAN	9106	31248	2016	71
SINGAPORE	13268	31126	1527	71
SPAIN	9426	20302	1569	69
SOUTH KOREA	7908	31302	2572	68
SWEDEN	10582	16758	579	54
BELGIUM	4728	8698	611	50
FINLAND	8616	11033	268	49
THAILAND	5245	7208	372	42

When the network map is analyzed, it is worth noting that although the cooperation between the USA and China is observed, these collaborations are limited, as with all other countries. It is observed that the countries in the European Union form a research cluster among them (Orange cluster), while Asian countries also form a cluster in the spiral of Japan, South Korea and Taiwan. On the other hand, it is observed that Saudi Arabia, which has reached a certain critical intensity especially in publication activities during MERS virus and coronavirus researches, is also in cooperation with various countries, especially European countries (Figure 4).

Figure 4. Country Collaboration Network

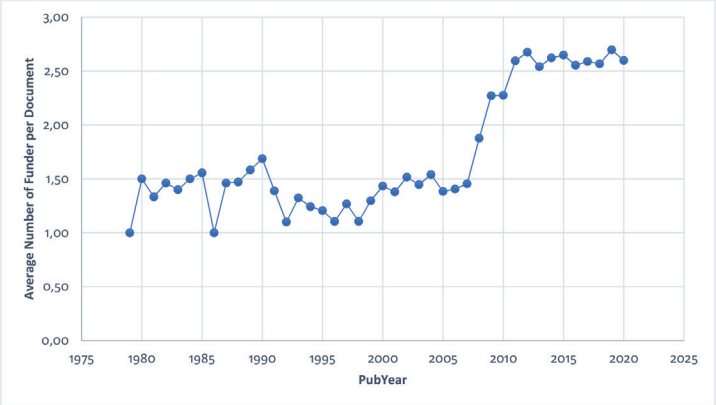


Funding Dynamics

Scientists who continue their studies in search of diagnosis and treatment for the virus in the pandemic process need a budget in order to carry out these studies. Funding is used as a critical instrument to perform scientific activities. In this part of the study, the funding situations in the studies conducted for the COVID-19 outbreak, which is considered as a pandemic process in human history, are described. The purpose of this analysis is to reveal the analysis of the support provided by the important institutions that direct the R&D and Science policies of the countries to the COVID-19 research. In this regard, it is possible to state that there are 8843 publications supported by a fund provider. It is seen that the publication[4] with the most funding support is supported by a total of 56 funders. It is observed that the average number of funders per publication does not fall below 2 as we approach today. We have already mentioned that collaborative research is conducted only with other units within the institution. This table that appears here differs from the research trend mentioned. This may be attributed to funders operating more nationally or internationally than regionally (Figure 5).

[4] Graft Cryopreservation Does Not Impact Overall Survival after Allogeneic Hematopoietic Cell Transplantation Using Post-Transplantation Cyclophosphamide for Graft-versus-Host Disease Prophylaxis

Figure 5. Number of Funder per Documents (average)



When we look at funders based on the number of publications they support and the effects they create in the literature based on citation analysis, the dominance of US addresses is clearly seen. While the USA, China, UK and EU representative funders follow, the US-sponsored funds in terms of their impact in the literature, although the publications supported by the Chinese Natural Foundation (National Natural Science Foundation of China) are at the top of the list in terms of numbers. it is possible to observe that it lags supported studies. When we look closely at the main activity areas of the funders, it is seen that the funding burden is similarly met by the institutions specialized in the field of health. In terms of general funders, it is possible to say that funders such as EU, Wellcome Trust and European Communities (EC) have also undertaken a considerable burden, while the University of Hong Kong has also undertaken a significant burden in terms of funding. In this regard, it is useful to say that it is important how much the institutions act depending on their focus in R&D activities regardless of their scale.

h-index	Funding Unit	Citation sum within h-core	All citations	All documents
100	NIAID NIH HHS United States Department of Health & Human Services National Institutes of Health (NIH) - USANIH National Institute of Allergy & Infectious Diseases (NIAID)	20506	44279	743
67	NINDS NIH HHS United States Department of Health & Human Services National Institutes of Health (NIH) - USANIH National Institute of Neurological Disorders & Stroke (NINDS)	7186	12989	280
56	NIGMS NIH HHS United States Department of Health & Human Services National Institutes of Health (NIH) - USANIH National Institute of General Medical Sciences (NIGMS)	7490	9423	133
52	NIH United States Department of Health & Human Services National Institutes of Health (NIH) - USA	5050	9223	310
50	National Institutes of Health United States Department of Health & Human Services National Institutes of Health (NIH) - USA	5540	9485	287
47	NCI NIH HHS United States Department of Health & Human Services National Institutes of Health (NIH) - USANIH National Cancer Institute (NCI)	5638	6838	100
45	PHS HHS United States Public Health Service	7188	7773	75
42	National Natural Science Foundation of China National Natural Science Foundation of China	4204	9161	755
39	Wellcome Trust Wellcome Trust	5456	6011	82
36	Medical Research Council Medical Research Council UK (MRC)	2883	3549	84
33	European Union European Union (EU)	2759	3322	89
31	NCRR NIH HHS United States Department of Health & Human Services National Institutes of Health (NIH) - USANIH National Center for Research Resources (NCRR)	2530	3108	75
30	NHLBI NIH HHS United States Department of Health & Human Services National Institutes of Health (NIH) - USANIH National Heart Lung & Blood Institute (NHLBI)	2272	2486	50
25	Biotechnology and Biological Sciences Research Council Biotechnology and Biological Sciences Research Council (BBSRC)	1768	2305	70
24	European Commission European Commission Joint Research Centre	1506	1827	53
23	National Institute of Allergy and Infectious Diseases United States Department of Health & Human ServicesNational Institutes of Health (NIH) - USANIH National Institute of Allergy & Infectious Diseases (NIAID)	1629	1873	56
23	University of Hong Kong University of Hong Kong	1894	2058	41
22	Deutsche Forschungsgemeinschaft German Research Foundation (DFG)	1323	1553	51
22	European Community European Community (EC)	1958	2067	33
19	Swiss National Science Foundation Swiss National Science Foundation (SNSF)	1851	1971	40

Discussion

In this study, in which we examined the literature of COVID-19 researches, it was observed that international collaborations did not develop at the desired level although there was a seeking behavior for a solution for the virus as soon as possible during the pandemic process as a global level. The high cost of vaccination research, the differentiation of science policies of the countries can be shown as the obstacles for scientists to develop collaborations. However, it is very important for countries to take a data-based approach in decision making, especially in such situations that concern humanity. In this regard, supporting the studies and practices that center on the data, which we can call as anticipatory governance, will both enable a proactive management in the area of localization in the crisis period and enable the monitoring of the effects of the decisions taken. In the analyzes made, it is clearly seen that the studies on coronavirus focus primarily on diagnosis and treatment. Within the framework of seeking solutions, seeing that many brands working as rivals can take part in the same consortium to produce respirators, taken as an example for developing collaborations, and similar approaches should be evaluated at the R&D stage and on scientific research. While the analysis conducted in terms of funders shows that the number of funding institutions is very limited in COVID-19 researches, it is seen that it takes time to transform the results produced from the researches supported by the institutions that direct science policies of countries into scientific documents. In this respect, it is necessary to focus on an action plan for conducting scientific research activities in pandemic and similar crisis settings.

The difficulties in accessing scientific information in the early period of the pandemic process also showed the importance of knowledge asymmetry. In this respect, there are things to do about open science, open research data and management. In other words, it is useful to identify policies that prevent one side from having better or more information than others in searches for solutions to global crises such as the pandemic process that concerns humanity. This can be turned into an advantage with regulations on the management of open science and research data. In this context, funders, especially universities, need to determine policies. This can be turned into an advantage with regulations on the management of open science and research data. Countries that realize the importance of sharing research data make various arrangements in this regard. The U.S. National Science Foundation has been requesting a data management plan from its researchers, from which it has funded since 2011 (Bishoff & Johnston, 2015; Zencir & Oğuz, 2020). In order to prevent the negative effects of information asymmetry, studies should be conducted to identify the actors connected to the HAC and LAC indicators conducted in our study and to develop collaborations on these nodes. As exemplified in this study, determining the pioneers of the area, determining the institutions and countries that give direction to the area will provide important outputs for making a conscientious decision. In this respect, determining the research teams, determining their leaders will be used as an important instrument in budget distribution, for example, and will enable effective management

of limited resources. It is also important to focus on the management of open science and open research data to create the infrastructure necessary to eliminate existing information asymmetry. The number of publications addressed in China is a significant size, and the publications show similar results in terms of citation values. It is worth noting that the publications on the cases in Wuhan, where the virus was first seen, had an important effect on this issue. On the other hand, opening the data obtained in search of solutions for the pandemic process to everyone is necessary for fast and reliable progress in the process. In this respect, it should be remembered that research data has a key importance in the scientific world regarding its use for verification purposes, economic and social values. For this reason, the data must be made accessible and barriers to sharing must be removed. In this context, it is necessary to decide on various models to provide access to scientific information and the data produced from them while creating a science and technology policy for the emergency conditions during the pandemic and crisis periods. Numerous stakeholders play important roles in research and innovation during emergency or pandemics. These include but are not limited to communities affected by the outbreak; national and international researchers and research institutions; charities, public developers and manufacturers and Private sectors; multilateral organizations; and numerous joint research networks. Different and occasionally conflicting values, perspectives and priorities, each with its stakeholder, adding an additional layer of complexity. Preparation planning is essential to effectively deal with epidemics or emergencies. An anticipatory governance approach is essential in pandemic processes such as COVID-19, to share and harmonize activities in the field of emergency preparedness at national and international level, to strengthen country capacities and to carry out coordinated and effective support efforts for cross-border health threats.

The desire to quickly share the findings reached during the pandemic process with the scientific world has brought some ethical problems. In addition, ideological approaches cause academic results to be erroneous. The journal's uncontrolled publication processes to announce the results to the scientific world quickly lead to the spread of such political or ideological approach with misinterpretation of data. Unfortunately, even very reputable and prestigious academic journals fall into this error (Bayram et al., 2020; Koca, 2020). Such biased, erroneous and directive studies also harm the process of combating the pandemic in countries. Instead of scientific publications, some of the researchers prefer to share their views on social media without any peer review and ethical concerns. The widespread and rapid impact of social media has caused such comments and information to spread very quickly in the eyes of the societies, creating fear and anxiety. Even studies based on personal interpretations, not on data, increased in this period. In addition to such publications, there are also studies analyzing the situation in countries according to scientific data. Reports and books published by TÜBA can be evaluated in this respect (Şeker et al., 2020; Özgenç et al. 2020). TÜBA has created multidisciplinary reports by compiling scientific publications on the pandemic and the chronological course of the outbreak in the world, including the developments in diagnosis

and treatment, as other science academies. TÜBA has opened its scientific projects and studies to online access to the scientific world and researchers with the responsibility of being a science academy..

It is important to publish with academic responsibility especially during the pandemic process. At this point, journals and publishers as well as academics have an important ethical duty. In extraordinary situations such as COVID-19, the desire of the scientific community to find a solution as soon as possible and to share the results with the public, prevents the peer evaluation processes in scientific studies to be carried out with the required quality. Failure to review the progress in R&D processes with due diligence may cause the related publications to be withdrawn or retraction later. In this respect, it is observed that a similar situation is experienced in studies conducted on the 2019 coronavirus pandemic. Until now-as of August 25, 2020- the number of publications published in the field of COVID-19 in the WoS and retracted for various reasons (2), the number of publications published as correction is 163. Considering the document type while examining the relevant literature, it will also ensure that the information is correct and that necessary peer review has been done, and the necessity of verifying the data obtained from document types such as letter to the editor (letter), communication (correspondence) should be underlined. Within this framework, the accuracy and reliability of the information produced especially in the areas that emerge can be ensured. Researchers all over the world seeking solutions to the pandemic process and transforming research into publications have made the amount of information produced on the subject difficult to manage. It is obvious that refereeing or peer evaluation, which is one of the most basic tools of quality control in scientific publishing, becomes more difficult, especially due to the increasing amount of information in this process. Precisely at this stage, the need for peer assessment to be carried out with all possible details should be underlined once again.

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