Chapter 20
Phenomenon of Coronavirus Publication Race

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Abstract In the Chapter, we explain the phenomenon of the coronavirus publication race, analyse a number of typical bibliometric articles, which are structured according to the standard principle—presenting ranked lists of publications distributed by countries, journals and institutions, as well as lists of the most cited articles. Twenty-one online platforms were identified, on which the largest number of articles on coronavirus topics were published, of which two samples were identified as of 15 December 2020 (82 articles with the term "COVID-19" in article titles and 63 articles with the term "Coronavirus" in article titles) articles with over 1,000 citations in Elsevier journals and over 500 times on other online platforms. These articles were categorized by authors, countries and institutions. The samples of articles were reduced to a single sample with one hundred and twenty-five articles that did not overlap in two samples, on the basis of which a detailed analysis of the structures of international co-authorship with the identification of thirty-one countries, the authors of which participated in international collaboration on the coronavirus research, was made. For this analysis, a square symmetric matrix of international co-authorship was developed. A content analysis of highly cited publications on SARS-CoV-2 was carried out, revealing overlapping topics, for which the multi-topic factor proposed by us was calculated.

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Introduction

Currently, there is an exponential growth in publications on the topic of coronavirus, and the coronavirus publication race itself is a very curious phenomenon. To research it, we used the advanced search capabilities of Google Scholar, testing the terms "Coronavirus" and "COVID-19" in it. A strong exponential growth of publications has always been observed in "inflated" research areas of knowledge (nanoscience, computer science, genomics, etc.) [1], but here the growth just goes off scale. We have tested these terms in Google Scholar for the last eight months and obtained the following data (Table 20.1). The search was carried out in the line "in which the exact phrase occurs", and the time interval was limited to 2020, since the term "coronavirus" itself has been known for a long time. It should be noted that a small percentage of articles for December 2019 cannot be searched by Google Scholar, so its minimum search coverage is one year.

We see that in 2020, approximately 260 thousand articles were published in which the word "Coronavirus" occurs, and about 3,700 articles with a similar Russian-language term. In the titles of articles, this term was found in both languages, respectively, in 58,900 and 160 articles (Table 20.1).

The number of responses to the terms "COVID-19", "SARS-CoV-2", "2019-nCoV" was several times less, and we assume that most of these responses were included in articles corresponding to responses to the query for the term "Coronavirus", since we noticed that in one and the same article the same viral infection is called differently. Thus, our experiments in Google Scholar have shown that of the

Table 20.1 Growth of scientific publications on the problem of coronavirus

Term	Number of publications when searching throughout the article	Number of publications when searching by article title
Coronavirus, 07.04.2020	23,100	11,700
Koronavirus (in Russian), 07.04.2020	137	4
Coronavirus, 11.05.2020	54,800	22,100
Koronavirus (in Russian), 11.05.2020	305	18
Coronavirus, 03.08.2020	92,600	33,200
Koronavirus (in Russian), 03.08.2020	1,350	60
Coronavirus, 16.11.2020	247,000	51,800
Koronavirus (in Russian), 16.11.2020	2,890	136
Coronavirus, 19.12.2020	259,000	58,900
Koronavirus (in Russian), 19.12.2020	3,650	160

four names of the infection in question, the name "Coronavirus" is the most popular in scientific papers.

Let us estimate the approximate share of publications on coronavirus-related topics from the total global volume of articles for the year. According to the US National Science Foundation (2018) report, 2,555,959 articles on science and engineering (S & E) were published in 2018. Of this amount, 259,000 coronavirus articles make up 10%. The calculation is not very correct, since the U.S. NSF counts articles against the Web of Science database, and Google Scholar counts all articles, including preprints.

Not only physicians and biologists write on the topic of coronavirus, but also sociologists, philosophers, linguists, psychologists, mathematicians, computer scientists, engineers and specialists in other fields of knowledge. A burning topic has appeared and everyone is trying to express themselves on it, but as Stefan Zweig wrote about this: "The biggest trouble for science is to turn into fashion."

How do the journals manage to print all this? But people no longer rely on them, they publish preprints on *ArXiv.org*, *medRxiv*, *ResearchGate*, on other servers and open access platforms, just to be the first.

Against this background, we see two orders of magnitude fewer articles with the Russian-language term of the virus in question.

Since a huge cluster of publications on coronavirus topics emerged, many review articles naturally arose, although research articles are distinguished by large lists of references as well. Our Advanced Search of Google Scholar anywhere in the article in the line: with exact phrase keyword "coronavirus" in conjunction with the keyword "review" (entered in the line: with at least of the words") in the search for 2020 resulted in 228,000 responses.

A visual review of them showed that the number of real publications in which these words occur simultaneously in their titles does not exceed 400. The following types of reviews are used: systematic review, rapid review, review and meta-analysis, narrative review, scoping review.

But we will be more interested in publications in a similar search, where the keyword "review" is replaced by the keyword "bibliometric analysis". In this case, we received 958 responses. We conducted both of the above experiments in Google Scholar on 01.04.2020. Let us consider some of the most important works from the last experiment.

It is known that PubMed has been hosting COVID-19—publications on a daily basis since January 17, 2020, when the number of publications was zero. At the same time, over 300 articles were posted on April 18 [1]. In this article, for the period under consideration, there is a graph of such publications posted on a daily basis, which in a smoothed form has an exponential form with sufficiently large oscillations. In a shorter period of time J. Lou et al. [2] from January 2020 to 1 March 2020 found 183 publications on PubMed, which were distributed among the first correspondent authors from 20 different countries and 80 different journals. Most of them are published in the *Journal of Medical Virology* (25). A total of 123 articles published in China were found, of which 103 in English, and only 18 articles from the USA.

Growth of publications on COVID topics on a daily and weekly basis is dealt with, respectively, in the works [4−5], which we found outside the framework of the above experiment in Google Scholar.

The first study using Dimensions, Scopus, Web of Science (WoS) and the curated list of LitCovid examined the daily growth of COVID-19-related publications in citation databases and digital libraries from January 1 to April 7 and found better coverage (9,435 publications) compared to WoS (718) and Scopus (1568). In the second study, PubMed grew around 1,000 publications weekly, and the PubMed Central (1398), medRxiv (989), and SSRN (608) repositories had the best coverage of COVID-19 open access publications.

In the work of K. Kousha & M. Thewall [1], the Dimensions search tool was used. Its search engine is similar to Google Scholar, in the sense of indexing documents using public information from the Web, but has an Applications Programming Interface (API) that supports automatic downloading for all query matches [5]. K. Kousha & M. Thewall [1] made queries on a daily basis from March 21 to April 18 2020 for various spellings of coronavirus infection, the dynamics of publications and their citation were studied. In addition, for the entire period of time (from December 2019 to March 24 2020), the distribution of publications by subject categories, journals and their types was carried out. Based on the authors' three tables, we made a summary table for such distributions (Table 20.2).

Their tables also indicated publications as of 24 March. It is worth noting that in the work of Kousha & Thewall [1], one of the tables did not quite correctly title publications in journals, since in addition to journals, preprint archives were also examined. Too many publications in this search are due to the fact that all types of them were searched, including articles, preprints, books, chapters, theses, monographs, proceedings, and even editorials and commentaries were taken into account in journal publications.

As you can see from Table 20.2, the total number of publications for the entire period was 21,392, which is consistent with our data obtained using Google Scholar as of April 7 2020 (Table 20.1). This is a very important result, as K. Kousha & M. Thewall [1] noted that "The exact COVID-19 coverage of Google Scholar is difficult to assess because it is not possible to download large sets of publication records." Indeed, Google Scholar allows you to view and download only the first thousand publications.

An order of magnitude fewer publications for the same period of time were identified by S.B. Patil [6], since he searched exclusively for articles and preprints, and only for one name of coronavirus infection—COVID-19. He collected 2,184 publications from 617 sources (journals and preprint archives), which were distributed across 57 countries and covered 6,389 authors, of which 343 published single-authored publications. From the author's three tables, we formed a summary table for the top ten publications in relation to countries, journals (including preprint archives) and institutions (Table 20.3).

In Yu, Y., et al. [7] as of 20 May 2020 on the subject of COVID-19, 15,805 articles were identified in the Web of Science (WoS) database, of which 186 were published in December 2019. Of this number, there were 10,601 research articles (67.1%) and

Table 20.2 Distribution of COVID-19 publications by the top 10 subject area, journals/sources & type document[a]

Rank	Subject area	All	%	Journal/Sources	All	%	Type document	All	%
1.	Public Health and Health Services	3,072	13	[None]	2,932	14	Article	16,330	76
2.	Medical Microbiology	2,773	10	medRxiv	1,234	6	Book	832	4
3.	Clinical Sciences	2,159	9	SSRN Electronic Journal	855	4	Chapter	1,645	8
4.	Biochemistry and Cell Biology	2,192	4	arXiv	389	2	Preprint	2,236	10
5.	Immunology	1,096	4	bioRxiv	358	2	Monograph	166	1
6.	Genetics	803	3	Research Square	341	2	Proceeding	186	1
7.	Cardiorespiratory Medicine & Haematology	459	2	BMJ	262	1			
8.	Artificial Intelligence and Image Processing	383	2	ChemRxiv	210	1			
9	Neurosciences	316	1	Viruses	196	1			
10.	Microbiology	364	1	Journal of Medical Virology	176	1			

[a]Kousha, K., & Thelwall, M. [1]

Table 20.3 Distribution of COVID-19 publications by the top 10 countries, journal/sources and institutions[a]

Rank	Country	All	%	Journal/Sources	All	%	Institutions	All	%
1.	China	647	29.6	Nature	354	16.2	Huazhong University of Science and Technology, China	62	2.8
2.	USA	229	10.5	New England Journal of Medicine (NEJM)	222	10.2	University of Hong Kong, Hong Kong	44	2.0
3.	UK	88	4.0	Journal of the American Medical Association (JAMA)	199	9.1	University of California, USA	41	1.9
4.	Singapore	33	1.5	medRxiv	181	8.3	Wuhan University, China	34	1.6
5.	Japan	28	1.3	Lancet	154	7.1	Zhejiang University, China	34	1.6
6.	Germany	19	0.9	Radiology	130	6.0	National University of Singapore, Singapore	31	1.4
7.	Canada	30	1.4	Lancet Respiratory Medicine	120	5.5	Zhongnan Hospital of Wuhan University, China	31	1.4
8.	Taiwan	22	1.0	Science	71	3.3	Shanghai Jiao Tong University, China	30	1.4
9.	Switzerland	23	1.1	British Medical Journal (BMJ)	67	3.1	Sun Yat-Sen University, China	30	1.4
10.	Netherlands	11	0.5	Journal of Medical Virology	61	2.8	Fudan University, China	28	1.3

[a]Patil, S.B. [6]

1,189 (7.5%)—review articles. 14,609 (92.4%) articles were written in English, 623 (3.9%)—in Chinese. 11,575 (73.2%) articles were Open Access, 3,626 (22.9%) were indexed in the WoS core database. From this article, we have combined data similar to the article [6] into a pivot table (Table 20.4).

In the same work, Top 100 most cited articles in the field of COVID-19 are selected. Visualized analysis was performed using the VOSviewer tool.

A fuller coverage of WoS publications was used by S. Al-Zaman [8] (December 2019 to June 2020), who obtained 16,384 COVID-19 related literature items, spread over 55,352 authors, 2,964 sources, 159 countries, 12,805 organizations, and 221 disciplines. Of the total number of publications, 40.015% falls on articles, from the USA—25.433%, in English—95.313% (there were observed publications in 19 languages). Most of the articles were published in the *British Medical Journal* (488) and by scientists from the University of London (2,259). In December, 793 articles were published. The author notes that at the time of writing, at least 15 relevant bibliometric analyzes have been published. As before, using the author's tabular data, we compiled a pivot table for three Top 10 positions (Table 20.5).

Similar studies on the Scopus database for the period from 1 December 2019 to 1 April 2020 were carried out by H. Dehghanbanadaki et al. [9]. A total of 923 COVID-19 documents were retrieved, of which 418 were original articles. All received 2,551 citations with an average citation of 2.76 per document. As before, for the three Top 10 positions (countries, journals, institutions) of the three tables of the above authors, we have compiled a summary in Table 20.6.

Much more Scopus-publications were obtained by S.H. Zyoud & S.W. Al-Jabi [10] from December 2019 up until June 2020. They found 19,044 publications, of which 48% (9140) were articles. Total publications included authors from 159 different countries. As before, we presented their data for three Top 10 positions in Table 20.7.

Similar studies were carried out by Zh.Tao et al. [11] on 9 February 2020 on Web of Science with search strategy: TI = (coronavirus) AND Language = English. Unlike previous studies, these authors covered a wider time interval: 2000−2020. As a result, 9,760 articles were found. As in the previous case, we presented them in Table 20.8.

From a comparison of Tables 20.3–20.7, we see that the top four countries include China, USA and UK everywhere, and the top ten countries — in addition to these countries, are also Germany and Canada. The same 5 countries appear in Table 20.8, obtained over a wider time interval. From these five tables we also see that the top ten journals include *The Lancet* and the *Journal of Medical Virology* 5 times, *BMJ*, *JAMA* and *NEJM* 4 times. In Tables 20.3–20.7, Huazhong University of Science and Technology appeared five times and Wuhan University four times.

Table 20.8, as noted above, was obtained over a wider time interval and not one of its journals was included in the other 5 tables. At the same time, the first three Chinese institutions are quite often found in Tables 20.3–20.7.

As we can see from Tables 20.3–20.8, the authors conduct their research in a typical way, identifying the first tens of countries, journals and institutions, the same applies to other publications of a bibliometric or scientometric nature. As we

Table 20.4 Distribution of COVID-19 publications by the top 10 countries, journal, institutions[a]

Rank	Country	All	%	Journal	All	%	Institutions	All	%
1.	China	838	5.3	British Medical Journal (BMJ)	211	1.3	Huazhong University of Science and Technology, China	90	0.6
2.	USA	705	4.5	Lancet	104	0.7	Wuhan University, China	64	0.4
3.	UK	295	1.9	Journal of Medical Virology	91	0.6	University of Hong Kong, Hong Kong	56	0.4
4.	Italy	282	1.8	Cureus	43	0.3	Zhejiang University, China	47	0.3
5.	Canada	130	0.8	Euro Surveillance	36	0.2	Fudan University, China	45	0.3
6.	Germany	129	0.8	Intensive Care Medicine	26	0.2	Capital Medical University, China	43	0.3
7.	India	128	0.8	Emerging Microbes & Infections	24	0.2	Chinese Academy of Sciences, China	40	0.3
8.	Australia	114	0.7	Archives of Academic Emergency Medicine	24	0.2	Chinese University of Hong Kong, Hong Kong	40	0.3
9.	France	87	0.6	New England Journal of Medicine (NEJM)	24	0.2	Harvard Medical School	67	0.4
10.	Switzerland	86	0.5	Nature Medicine	23	0.1	University of Toronto	36	0.2

[a]Yu Y., et al. [7]

Table 20.5 Distribution of COVID-19 publications by the top 10 countries, journal, institutions[a]

Rank	Country	All	%	Journal	All	%	Institutions	All	%
1.	USA	4,167	25.4	British Medical Journal (BMJ)	488	3.0	University of London, UK	488	3.0
2.	China	2,979	18.2	Journal of Medical Virology	303	1.8	Harvard University, USA	403	2.5
3.	Italy	1,921	11.7	Journal of Infection	261	1.6	University of California System, USA	352	2.1
4.	UK	1,575	9.6	Lancet	191	1.2	Huazhong University of Science & Technology, China	339	2.1
5.	Germany	745	4.5	Cureus	154	0.9	Harvard Medical School, USA	238	1.5
6.	India	738	4.5	Nature	136	0.8	Wuhan University, China	220	1.3
7.	Canada	730	4.5	Critical Care	120	0.7	University College London, UK	218	1.3
8.	France	662	4.0	Journal of the American Medical Association (JAMA)	113	0.7	Chinese Academy of Sciences, China	217	1.3
9.	Australia	620	3.8	New England Journal of Medicine (NEJM)	113	0.7	Inserm (French National Institute of Health and Medical Research), France	216	1.3
10.	Spain	496	3.0	Head and Neck	95	0.6	University of Toronto, Canada	204	1.2

[a]Sayeed Al-Zaman [8]

Table 20.6 Distribution of COVID-19 publications by the top 10 countries, journals and institutions[a]

Rank	Country	All	%	Journal	All	%	Institutions	All	%
1.	China	348	37.3	BMJ Clinical Research Ed Lancet	74 74	8.0 8.0	University of Hong Kong, Hong Kong Huazhong University of Science and Technology, China	30 30	3.3 3.3
2.	USA	160	17.3	Journal of Medical Virology	47	5.1	Tongji Medical College, China	28	3.0
3.	UK	80	8.7	Euro Surveillance Bulletin Europeen Sur Les Maladies Transmissibles European Communicable Disease Bulletin	26	2.8	Chinese Academy of Sciences, China	25	2.7
4.	Italy	47	5.1	Journal of The American Medical Association (JAMA)	21	2.3	Wuhan University, China	23	2.5
5.	Canada	44	4.8	Lancet Infectious Diseases	20	2.2	Capital Medical University, China School of Medicine	22 22	2.4 2.4
6.	Hong Kong	35	3.8	Travel Medicine And Infectious Disease	15	1.6	London School of Hygiene & Tropical Medicine, UK	20	2.2
7.	Germany	34	3.7	British Medical Journal (BMJ), Emerging Microbes and Infections, Intensive Care Medicine	14 14 14	1.5 1.5 1.5	Fudan University, China	19	2.1
8.	France	33	3.6	Journal of Korean Medical Science, Zhongguo dangdai erke zazhi (Chinese Journal of Contemporary Pediatrics)	13 13	1.4 1.4	Chinese University of Hong Kong, Hong Kong University of Hong Kong Li Ka Shing Faculty of Medicine, Hong Kong Chinese Academy of Medical Sciences, Peking Union Medical College, China	17 17 17	1.8 1.8 1.8
9.	Switzerland	31	3.4	Journal of Infection, New England Journal of Medicine (NEJM)	12 12	1.3 1.3	Zhejiang University School of Medicine, China Zhongnan Hospital of Wuhan University, China	16 16	1.7 1.7
10.	Australia South Korea	26 26	2.8 2.8	Nature	11	1.2	Zhejiang University, China University of Toronto, Canada	15 15	1.6 1.6

[a]Dehghanbanadaki H, et al. [9]

Table 20.7 Distribution of COVID-19 publications by the top 10 countries, journals and institutions[a]

Rank	Country	All	%	Journal	All	%	Institutions	All	%
1.	USA	4,479	23.5	British Medical Journal (BMJ)	522	2.7	Huazhong University of Science and Technology, China	422	2.2
2.	China	3,310	17.4	Journal of Medical Virology	311	1.6	Tongji Medical College, China	415	2.2
3.	Italy	2,314	12.2	Lancet	215	1.1	Harvard Medical School. USA	331	1.7
4.	UK	1,981	10.4	Journal of the American Medical Association (JAMA)	137	0.7	Inserm (French National Institute of Health and Medical Research), France	272	1.4
5.	India	1,104	5.8	Journal of Infection	135	0.7	Università degli Studi di Milano, Italy	258	1.4
6.	France	881	4.6	International Journal of Environmental Research and Public Health	131	0.7	University College London, UK	237	1.2
7.	Canada	790	4.1	Medical Hypotheses	129	0.7	Università degli Studi di Roma La Sapienza, Italy	232	1.2
8.	Germany	742	3.9	Lancet Infectious Diseases	126	0.7	IRCCS Foundation Rome, Italy	210	1.2
9.	Spain	680	3.6	International Journal of Infectious Diseases	125	0.7	University of Toronto, Canada	210	1.1
10.	Australia	676	3.5	Infection Control and Hospital Epidemiology	122	0.6	University of Oxford, UK	191	1.0

[a]Zyoud, S.H., Al-Jabi, S.W. [10]

Table 20.8 Distribution of COVID-19 publications by the top 10 countries, journals and institutions[a]

Rank	Country	All	%	Journal	All	%	Institutions	All	%
1.	USA	3,452	35.4	Journal of Virology	885	9.1	University of Hong Kong, Hong Kong	959	9.8
2.	China	2,402	24.6	Virology	296	3.0	Chinese Academy of Sciences, China	469	4.8
3.	Germany	642	6.6	PLoS One	238	2.4	Chinese University of Hong Kong, Hong Kong	411	4.2
4.	England	573	5.9	Emerging Infectious Diseases	204	2.1	University of North Carolina, USA	340	3.5
5.	Netherlands	551	5.6	Journal of General Virology	194	2.0	University of Iowa, USA	292	3.0
6.	Canada	498	5.1	Virus Research	192	2.0	Centers for Disease Control & Prevention, USA	269	2.8
7.	Japan	465	4.8	Viruses-Basel	166	1.7	Universiteit Utrecht, Netherlands	259	2.7
8.	South Korea	392	4.0	Archives of Virology	155	1.6	Vanderbilt University, USA	241	2.5
9.	France	379	3.9	Journal of Virological Methods	148	1.5	NIAID, USA	221	2.3
10.	Taiwan	373	3.8	Veterinary Microbiology	143	1.5	Seoul National University, South Korea	197	2.0

[a]Tao Z., et al. [11]

have noticed, mathematicians act similarly. Using a limited arsenal of well-known mathematical models of the spread of epidemics, the most popular of which is the SIR-model, or proposing new models, they make calculations for Wuhan, then for Northern Italy, then for Spain, etc. This is how not only specialists in mathematical modeling work on "conveyor belt", and as we showed above with reference to bibliometrics, but also all the others, otherwise, where would so many articles come from (Table 20.1)?

It should be noted that in the latest experiment in Google Scholar, in which 958 responses were received, not all responses are relevant, that is, in a relatively small percentage of publications, the keywords "coronavirus" and "bibliometric analysis" are found in the titles of articles. We observed the same situation when testing the keywords: "COVID-19" and "bibliometric analysis" (1,790 responses) on 01.05.2020; "Coronavirus" and "scientometric analysis" (168 responses); "COVID-19" and "scientometric analysis" (285 responses).

Since human coronavirus (HCoVs) was first observed in the 1960s, bibliometric and scientometric analyses often use more extensive years of literature coverage, for example, 1968−2020, 1970−2020, 2000−2020 and 2003−2020. The scientometric databases used here, as shown above, cover most often WoS, Scopus, PubMed, less often the new Dimensions search tool, and almost never Google Scholar. At the same time, we have shown above that Dimensions and Google Scholar search tools give similar results when searching for publications on coronavirus topics. This circumstance, and most importantly the maximum coverage of publications of this search engine and the convenience of using it determined its choice in our study.

In the process of a detailed visual review of responses to queries for the terms "COVID-19" and "Coronavirus" at the Advanced Search of Google Scholar, we identified 21 online platforms that produce publications on this topic. These are platforms for commercial publishers of periodicals, major journals, preprint archives, scientific networks and servers of international and national health organizations. They are briefly described in Appendix 1. This search with 15-day step (from November 1 to December 15 2020) revealed documents with these terms. The search was carried out both throughout the document and by its title. The terms "COVID-19" and "Coronavirus" were entered in the line 'with exact phrase", the name of the online platform was entered in the line "Return articles published in", the time interval was taken in the interval: 2020−2020.

In these experiments, the most cited articles with citations above 1,000 for *Elsevier* journals and with citations above 500 for publications of other online platforms were carefully visually identified. The results of the experiments are presented in Table 20.9. It ranked online platforms by the number of documents found as of November 1 2020 when searching the entire document for the term "COVID-19."

In general, the dynamics of the growth of documents is positive, but failures in the work of the Google Scholar search engine occurred in four cases when searching on platforms: Nature, SAGE, arXiv and National Acad Sciences for publications with the term "COVID-19", when a decline was noticed, and then again the growth of documents (Table 20.9). Google Scholar gives the most reliable data when searching by the title of the document. Looking at the top ten largest online platforms, we can

Table 20.9 Testing terms "COVID-19" and "Coronavirus" in Advanced Search of Google Scholar in the line: with the exact phrase

№	Online platform	COVID-19											
		Search on anywhere in the article				Search in the title of the article							
						Number of articles				With citations more 500 (Elsevier-more 1000)			
		1-Nov	15-Nov	1-Dec	15-Dec	1-Nov	15-Nov	1-Dec	15-Dec	1-Nov	15-Nov	1-Dec	15-Dec
1	Elsevier	37,900	41,500	43,500	46,300	18,100	18,400	20,700	24,100	17	18	20	20
2	Nature	18,100	17,900	11,700	12,400	1,890	1,960	2,050	2,120	7	7	9	10
3	Springer	16,500	18,900	20,400	22,600	11,000	11,900	14,000	15,600	9	9	9	10
4	Wiley Online Library	16,600	17,600	18,900	20,900	8,990	11,000	12,400	15,000	7	7	7	9
5	Oxford Academic	14,900	16,900	18,500	19,800	1,660	1,730	1,930	2,130	0	0	0	0
6	medRxiv	11,000	11,500	11,900	13,700	6,890	7,420	8,200	8,870	0	0	0	0
7	Emerald	7,300	7,740	8,950	9,200	790	833	906	975	0	0	0	0
8	SAGE (journals.sagepub)	7,130	7,920	8,880	9,350	2,200	2,600	3,980	3,520	1	1	1	2
9	British Medical Journal (BMJ)	5,830	6,720	8,790	10,200	2,290	2,500	2,960	3,430	0	2	3	3
10	arXiv	5,060	5,700	5,730	6,380	1,850	1,930	1,830	1,890	0	0	0	0
11	JAMA Network	1,280	1,380	1,520	1,630	680	719	769	802	16	18	20	20
12	Cell (in Elsevier)	1,090	1,290	1,330	1,400	315	443	462	475	3	3	3	5
13	National Acad Sciences	889	963	926	1,210	60	64	70	74	2	2	2	2

(continued)

Table 20.9 (continued)

№	Online platform	COVID-19											
		Search on anywhere in the article				Search in the title of the article							
						Number of articles				With citations more 500 (Elsevier-more 1000)			
		1-Nov	15-Nov	1-Dec	15-Dec	1-Nov	15-Nov	1-Dec	15-Dec	1-Nov	15-Nov	1-Dec	15-Dec
14	PLoS (journal.plos)	501	602	689	807	270	320	366	431	0	0	0	0
15	BioMedCentral (BMC)	336	388	486	550	165	193	229	261	0	0	0	0
16	NEJM Group	216	228	236	240	104	114	118	121	0	1	1	1
17	CDC (China CDC weekly)	137	140	148	153	85	88	110	114	0	0	0	0
18	WHO (who.int)	81	277	330	351	71	234	283	301	0	0	0	0
19	NIH (nih.gov)	59	109	116	126	52	84	89	95	0	0	0	0
20	ResearchGate	47	49	54	57	30	31	37	39	0	0	0	0
21	NBER	37	60	113	152	13	25	47	59	0	0	0	0
Total		144,993	157,866	163,198	177,506	57,505	62,588	71,536	80,407	62	68	75	82

(continued)

Table 20.9 (continued)

№	Online platform	Coronavirus											
		Search on anywhere in the article				Search in the title of the article							
						Number of articles				With citations more 500 (Elsevier-more 1000)			
		1-Nov	15-Nov	1-Dec	15-Dec	1-Nov	15-Nov	1-Dec	15-Dec	1-Nov	15-Nov	1-Dec	15-Dec
1	Elsevier	26,900	28,100	37,400	39,200	2,280	2,360	2,500	2,760	10	10	12	12
2	Nature	3,300	3,680	4,430	4,920	487	495	508	515	4	5	5	6
3	Springer	15,400	17,800	19,200	19,800	668	686	717	744	8	8	9	10
4	Wiley Online Library	13,300	14,300	18,000	18,200	681	711	742	769	9	9	9	9
5	Oxford Academic	3,640	4,690	6,600	6,630	299	329	377	396	1	2	2	2
6	medRxiv	9,430	10,300	10,700	11,300	530	537	551	566	1	1	1	1
7	Emerald	856	928	1,060	1,170	54	56	61	63	0	0	0	0
8	SAGE (journals.sagepub)	4,430	5,040	6,210	6,930	257	275	289	302	1	1	1	2
9	British Medical Journal (BMJ)	2,690	3,170	3,780	4,820	120	121	124	134	2	2	3	3
10	arXiv	2,410	2,550	2,760	2,960	144	149	152	154	0	0	0	0
11	JAMA Network	6,070	7,550	7,660	8,230	284	287	304	311	12	12	13	14
12	Cell (in Elsevier)	713	778	847	909	55	58	61	67	3	4	4	4
13	National Acad Sciences	155	167	180	189	9	10	10	10	0	0	0	0
14	PLoS (journal.plos)	495	590	660	758	45	50	54	60	0	0	0	0

(continued)

Table 20.9 (continued)

№	Online platform	Coronavirus											
		Search on anywhere in the article				Search in the title of the article							
						Number of articles				With citations more 500 (Elsevier-more 1000)			
		1-Nov	15-Nov	1-Dec	15-Dec	1-Nov	15-Nov	1-Dec	15-Dec	1-Nov	15-Nov	1-Dec	15-Dec
15	BioMedCentral (BMC)	286	323	387	436	23	25	30	36	0	0	0	0
16	NEJM Group	191	199	206	210	7	7	7	7	0	0	0	0
17	CDC (China CDC weekly)	170	179	183	188	63	68	72	72	0	0	0	0
18	WHO (who.int)	72	221	237	246	54	130	139	145	0	0	0	0
19	NIH (nih.gov)	55	92	99	107	11	15	17	17	0	0	0	0
20	ResearchGate	41	39	39	39	15	14	14	14	0	0	0	0
21	NBER	21	35	69	91	4	5	8	8	0	0	0	0
Total		90,625	100,731	120,707	127,333	6,090	6,388	6,737	7,150	51	54	59	63

see that the strongest growth in publications over a one and a half month interval occurred for the platform Wiley Online Library and SAGE when searching for the term "COVID-19".

Table 20.9 clearly identifies the online platforms with the highest number of highly cited articles. For both terms, these are the Elsevier, Nature, Springer, Wiley Online Library and JAMA Network platforms, with the latter platform with a small number of journals being equal to the Elsevier platform in terms of the number of highly cited articles.

The generalized quantitative characteristics of the above highly cited articles were determined on November 1 and December 15 2020, the data for the last moment of time are given in Table 20.10. From it we see that across all online platforms the number of highly cited articles varied from 1 to 20, the number of authors of these articles—from 1 up to 51, the number of affiliated countries—from 1 to 11, the number of affiliated institutions—from 1 to 38, the number of articles with international co-authorship—from 0 to 6.

The metrics for highly cited articles presented in Table 20.10 are summarized in Table 20.11.

In this table, platform citations, with the exception of *medRxiv*, correspond to the standard citations for Scopus and Web of Science databases depending on the journals included in those databases. On journal publisher online platforms data on altmetrics are presented. Articles in the journal *Cell* and *Elsevier* journals provide quantitative data on Shares, Likes & Comments and Tweets as such altmetrics, united in the Social Media group. Tweets and Likes data is available on *medRxiv* preprints, *National Acad Sciences* uses the term Online Impact for altmetrics, articles in *Wiley Online Library* and *NEJM* are tagged "metrics", which gives data on standard citation and altemetrics. The rest of the online platforms containing Scopus & WoS journals show altmetrics, which is a comprehensive indicator. In most cases, "Altmetric", "Metrics" include data on tweets, news outlets, Mendeley, blogs, Video uploaders, Redditors, Wikipedia page, Facebook pages, etc. Therefore, the following approach was used to systematize the data when reflecting values in the Altmetric indicator of Table 20.11. It consisted in fixing data on "Altmetric" or "Metrics" if they were available on the platform, and if they were not available, summarized data on Social Media was taken.

It is interesting that a number of articles with an average citation rate in our sample generated a very high level of interest among the general public. Thus, the article by A. Grifoni et al. (2020) "Targets of T cell responses to SARS-CoV-2 coronavirus in humans with COVID-19 disease and unexposed individuals" (N 81 in Appendix 2) with low citation rates in Google Scholar (786 citations) and on the publisher's platform (355 citations) had such Social Media scores on this platform: Shares, Likes & Comments—21,621 and Tweets—22,182.

Union of sets of high-cited article titles from a search for the terms "COVID-19" and "Coronavirus" by article title led us to 125 different articles (we united all the different articles from a set of 82 and 63 articles (Table 20.10)). They are all numbered in descending order by Google Scholar Citations as of December 15 2020 and are listed in Appendix 2.

Table 20.10 Generalized quantitative characteristics of highly cited articles with the terms "COVID-19" and "Coronavirus" in their titles as of 15.12.2020

Online platform	Number of articles	Number of authors			Number of affiliated countries			Number of affiliated institutions			Number of articles with international co-authorship
		Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	
Elsevier											
COVID-19	20	2	46	12	1	4	2	1	26	6	6
Coronavirus	12	2	35	15	1	7	2	3	16	8	5
Nature											
COVID-19	10	4	51	17	1	7	2	2	38	8	3
Coronavirus	6	2	29	14	1	6	2	2	13	5	4
Springer											
COVID-19	10	1	36	13	1	11	3	1	33	8	5
Coronavirus	10	1	46	16	1	10	3	1	33	8	6
Wiley Online Library											
COVID-19	9	1	25	8	1	5	2	1	21	5	2
Coronavirus	9	2	12	6	1	1	1	1	5	3	0
Oxford											
COVID-19	–	–	–	–	–	–	–	–	–	–	–
Coronavirus	2	2	12	7	1	2	2	3	4	4	1
medRxiv											
COVID-19	–	–	–	–	–	–	–	–	–	–	–
Coronavirus	1	37	37	37	1	1	1	24	24	24	0
SAGE											
COVID-19	2	3	4	4	1	3	2	2	4	3	1

(continued)

Table 20.10 (continued)

Online platform	Number of articles	Number of authors			Number of affiliated countries			Number of affiliated institutions			Number of articles with international co-authorship
		Min	Max	Ave	Min	Max	Ave	Min	Max	Ave	
Coronavirus	2	3	4	4	1	3	2	2	4	3	1
British Medical Journal											
COVID-19	3	24	46	38	1	7	3	3	34	19	1
Coronavirus	3	14	46	27	1	1	1	4	8	5	0
JAMA											
COVID-19	20	1	27	7	1	2	1	1	5	3	2
Coronavirus	14	2	28	11	1	2	1	1	21	4	2
Cell											
COVID-19	5	3	28	15	1	3	2	2	9	6	2
Coronavirus	4	6	20	15	1	3	2	2	8	4	1
National Academy of Sciences											
COVID-19	2	13	48	31	1	1	1	4	8	6	0
Coronavirus	–	–	–	–	–	–	–	–	–	–	–
NEJM											
COVID-19	1	–	26	26	–	1	1	–	23	23	0
Coronavirus	–	–	–	–	–	–	–	–	–	–	–

Table 20.11 Citation metrics of highly cited articles with the terms "COVID-19" and "Coronavirus" in their titles as of 12.15.2020

Online platform	Google scholar citations			Platform citations			Altmetric		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
Elsevier									
COVID-19	1,081	10,824	2,469	434	5,250	1,199	308	108,614	29,756
Coronavirus	1,049	19,786	4,536	465	9,807	2,188	308	94,214	15,036
Nature									
COVID-19	510	1,646	888	222	717	402	233	15,857	3,316
Coronavirus	513	7,893	2,478	250	3,848	1,362	339	6,047	2,146
Springer									
COVID-19	515	2,253	1,148	227	940	455	37	1,123	447
Coronavirus	515	1,907	1,048	227	590	408	37	572	267
Wiley Online Library									
COVID-19	501	1,117	718	302	548	412	99	3,597	960
Coronavirus	635	2,297	995	303	1,562	636	99	1,764	809
Oxford									
COVID-19	–	–	–	–	–	–			
Coronavirus	570	921	746	211	257	234	187	201	194
medRxiv									
COVID-19	–	–	–	–	–	–			
Coronavirus	894	894	894	6,472	6,472	6,472	2,973	2,973	2,973
SAGE									
COVID-19	537	829	683	310	348	329	386	386	386
Coronavirus	537	829	683	310	348	329	386	386	386
British Medical Journal									
COVID-19	529	621	581	373	621	529	183	1,975	1,332
Coronavirus	529	1,668	1,155	167	736	1,668	183	420	759
JAMA									
COVID-19	535	8,012	1,487	0	2,518	512	788	14,445	4,490
Coronavirus	501	11,247	2,467	0	4,772	914	367	11,578	3,498
Cell									
COVID-19	518	786	678	282	396	339	393	43,803	10,119
Coronavirus	565	3,685	1,496	300	1,797	728	339	43,803	13,027

(continued)

Table 20.11 (continued)

Online platform	Google scholar citations			Platform citations			Altmetric		
	Min	Max	Ave	Min	Max	Ave	Min	Max	Ave
National Academy of Sciences									
COVID-19	979	1,226	1,103	662	897	780	708	5,069	2,889
Coronavirus	–	–	–	–	–	–	–	–	–
NEJM									
COVID-19	965	965	965	379	379	379	9,717	9,717	9,717
Coronavirus	–	–	–	–	–	–	–	–	–

The characteristics of these numbered articles in the context of the number of authors, affiliated institutions, member countries and Google Scholar Citations are given in Appendix 3. From this Appendix, we determine the number of member countries in the considered highly cited articles; it is equal to 31.

Redistributing these articles by country, we come to Appendix 4. It ranked countries in descending order of the total number of articles. We see a noticeable leadership of China in terms of the number of articles and their citation. Based on Appendix 4, we get a more compact table, which clearly shows the distribution of the number of articles by countries without international co-authorship (89 articles) and with international co-authorship (36 articles) (Table 20.12).

In this table, we observe the 6 largest international collaborations with the number of countries greater than or equal to five. Five of them include the USA and China. Such collaborations, according to Table 20.10, may include more than 30 different institutions. We cannot estimate the impact of international collaborations on citation based on Table 20.12 data, since for this you need to know the lifetime of articles.

To study international collaborations, we have developed a symmetric square matrix of their features (Table 20.13), on the diagonal of which are the numbers of articles with international participation for each country (they are taken from Appendix 4), and the plus sign marks the countries with which articles with international participation are published. The matrix in the upper zone (11 countries from China to Saudi Arabia) is sufficiently dense, and in the middle and lower zone it is sparse. It follows from it that China, the USA and the UK are leading in the number of articles in international collaborations.

On the basis of the data gathered, the average values of the number of countries of participants and authors per article were calculated. In the first case, this value was 1.66 (approximately 2 countries), in the second—12.72 (about 13 authors).

Comparing the list of the first ten most cited articles from Appendix 2 with the data on the ranked lists of such articles from other studies, we showed that in the top ten articles of works [7, 9, 10] six articles coincided with our list, in the work of K. Kousha & M. Thelwall [1] and four articles coincided, in the work of S.B. Patil [6] three articles coincided.

Table 20.12 Distribution of articles by country with and without international co-authorship as of 15.12.2020

Country	Number of articles	Average citations google scholar citations
China	52	2,465
UK	7	1,584
France	2	1,962
USA	15	1,123
Taiwan	1	2,284
Italy	5	1,207
Netherlands	1	1,912
Singapore	2	1,129
India	1	1,211
Sweden	1	825
Australia	1	510
Spain	1	501
Total	89	1,973
China, Australia	3	3,421
China, USA, UK	2	2,108
China, USA	7	1,191
China, Singapore	1	1,907
USA, Switzerland, Sweden	1	1,753
UK, Netherlands	1	1,656
Switzerland, Greece	1	1,577
China, USA, Germany, Netherlands, Russia, Spain	1	1,326
China, USA, UK, Australia, Canada, Denmark, Italy, S.Korea, Netherlands, Saudi Arabia, UAE	1	1,315
China, UK, Germany, Italy, Oman, Republic of Congo, Saudi Arabia	1	1,276
China, Canada	1	1,182
China, Japan	1	1,117
USA, UK, Australia, Sweden	1	1,107
Belgium, France, Italy	1	962
China, USA, Netherlands	1	935
USA, UK	1	921
China, Belgium	1	862
China, USA, UK, Australia, Brazil, Canada, Netherlands, Poland	1	823

(continued)

Table 20.12 (continued)

Country	Number of articles	Average citations google scholar citations
China, USA, UK, Italy, Japan	1	803
UK, Canada	1	707
UK, Germany, Italy	1	679
China, USA, Italy	1	633
Taiwan, USA	1	606
USA, UK, Austria, Belgium, Germany, Ireland, Netherlands	1	593
Brazil, Italy, Paraguay	1	537
Brazil, Spain	1	530
Germany, Greece, Romania	1	518
Total	36	1,309
Summary	125	1,782

In conclusion of this study, we conducted a content analysis of our sample of articles, selecting 31 research topics (Table 20.14). This table shows the article numbers from Appendix 2 corresponding to these topics. From it we see a large number of articles covering several topics. To quantify this multi-topic character, you can enter a multi-topic factor equal to the number of all articles listed in Table 20.14 divided by 125, it will be equal to: 233/125 = 1.864.

Most often, in the articles under consideration, attention is paid to the geographical aspect of the study (31 articles), in the second place is the clinical picture of the disease (21 articles), in the third place is the issue of therapy (19 articles).

It is important to note that the analysis and distribution of the 125 most cited articles according to the criteria of their belonging to a particular field of knowledge was a very difficult task. The main difficulty is associated with the presence among these articles not only of those that could conventionally be called "mono-topical", but also the articles that can be called "bi-topical" and even "poly-topical". At the same time, the prevalence of a particular coronavirus topic in an article is not always unambiguous, since many articles contain subtopics, as a rule, already stated in the title of the article, and sufficiently manifest and important to be the basis for classifying a particular article in two or even several groups at the same time. It goes without saying that the assignment to a particular group is based not only on the title of the article or its abstract, but on the entire text. (Although, of course, no one doubts the correspondence between the content of the article, its abstract and the main text.) But even this approach, unfortunately, does not guarantee the absolute indisputability of assigning an article to one or another group (or groups). At the same time, the determination of the belonging of the overwhelming majority of articles to one or another of the groups we have singled out seems to us quite substantiated.

Table 20.13 Matrix of affiliated countries with international co-authorship on coronavirus topics as of 15.12.2020[a]

Country	China	USA	UK	Italy	Netherlands	Australia	Germany	Canada	Belgium	Brazil	Saudi Arabia	Japan	Spain	Sweden	Switzerland
China	23	+	+	+	+	+	+	+	+	+	+	+	+		
USA	+	20	+	+	+	+	+	+	+	+	+	+	+	+	+
UK	+	+	12	+	+	+	+	+	+	+	+	+		+	
Italy	+	+	+	7	+	+	+	+	+	+	+	+			
Netherlands	+	+	+	+	6	+	+	+	+	+	+		+		
Australia	+	+	+	+	+	6		+		+	+			+	
Germany	+	+	+	+	+		5		+		+		+		
Canada	+	+	+	+	+	+		4		+	+				
Belgium	+	+	+	+	+		+		3						
Brazil	+	+	+	+	+	+		+		3			+		
Saudi Arabia	+	+	+	+	+	+	+	+			2				
Japan	+	+	+	+								2			
Spain	+	+			+		+			+			2		
Sweden		+	+			+								2	+
Switzerland		+												+	2
Greece							+								+

(continued)

Table 20.13 (continued)

Country	China	USA	UK	Italy	Netherlands	Australia	Germany	Canada	Belgium	Brazil	Saudi Arabia	Japan	Spain	Sweden	Switzerland
Denmark	+	+	+	+	+	+		+			+				
France				+					+						
S. Korea	+	+	+	+	+	+		+			+				
Paraguay				+						+					
Singapore	+														
Austria		+	+		+		+		+						
Ireland		+	+		+		+		+						
Oman	+		+	+			+				+				
Poland	+	+	+		+	+		+		+					
Republic of Congo	+		+	+			+				+				
Romania							+								
Russia	+	+			+		+						+		
Taiwan		+													
UAE	+	+	+	+	+	+		+			+				
India															

(continued)

Table 20.13 (continued)

Country	Greece	Denmark	France	S. Korea	Paraguay	Singapore	Austria	Ireland	Oman	Poland	Republic of Congo	Romania	Russia	Taiwan	UAE	India
China		+		+		+			+	+	+		+		+	
USA		+		+			+	+		+			+	+	+	
UK		+		+			+	+	+	+	+				+	
Italy		+	+	+	+				+		+				+	
Netherlands		+		+			+	+		+			+		+	
Australia		+		+						+					+	
Germany	+						+	+	+		+	+	+			
Canada		+		+						+					+	
Belgium			+				+	+								
Brazil					+					+						
Saudi Arabia		+		+					+		+				+	
Japan																
Spain													+			
Sweden																
Switzerland	+															

(continued)

Table 20.13 (continued)

Country	Greece	Denmark	France	S. Korea	Paraguay	Singapore	Austria	Ireland	Oman	Poland	Republic of Congo	Romania	Russia	Taiwan	UAE	India
Greece	2											+				
Denmark		1		+											+	
France			1													
S. Korea		+		1											+	
Paraguay					1											
Singapore						1										
Austria							1	+								
Ireland							+	1								
Oman									1		+					
Poland										1						
Republic of Congo									+		1					
Romania	+											1				
Russia													1			
Taiwan														1		
UAE		+		+											1	
India																0

[a]*Note* The numbers indicate the total number of articles with international participation included in the sample

Table 20.14 Quantitative distribution of the 125 most cited articles by research topic

№	Research topic	Article numbers	Number of articles	%
1	Etiology (origin)	6, 27, 55, 70, 89	5	6.25
2	Pathogenesis	23	1	0.8
3	Infectiousness, transmission, dynamics of spread (including with asymptomatic course)	8, 18, 19, 27, 35, 49, 52, 53, 55, 88, 111	11	8.8
4	Detection, testing, diagnosis, monitoring	17, 54, 62, 84, 101, 104, 105, 108	8	6.4
5	Risk factors, comorbidity	3, 13, 15, 20, 31, 38, 39, 40, 75, 96, 124	11	8.8
6	Mortality	3, 13, 22, 25, 39, 85, 116	7	5.6
7	Clinical picture	1, 2, 3, 4, 9, 10, 15, 19, 37, 47, 64, 68, 70, 72, 74, 85, 88, 98, 103, 118, 120	21	16.8
8	Therapy	14, 27, 42, 43, 45, 48, 50, 54, 63, 64, 65, 73, 91, 94, 95, 110, 113, 117, 125	19	15.2
9	Comparisons, conclusions	5, 21, 44	3	2.4
10	Complications, damage to various body systems	24, 26, 30, 41, 57, 79, 86, 90, 118, 123	10	8
11	Virology	7, 35, 44, 53, 55, 69, 118, 121	8	6.4
12	Immunology	10, 64, 66, 81, 83, 87, 97, 113, 114, 119, 121, 122	12	9.6
13	Mathematical modeling, quantitative assessments	37, 52, 61, 104	4	3.2
14	Psychological impact, psychological and psychiatric aspects	32, 58, 59,78, 115	5	4
15	Social aspects	16, 46, 71, 78, 99, 106, 107	7	5.6
16	Reviews	19, 29, 48, 51, 70, 77, 82, 93, 104, 120	10	8
17	Age, gender, racial, family and ethnic aspects	3, 8, 43, 45, 77, 92, 100, 103, 125	9	7.2
18	Pharmaceuticals	12, 14, 43, 48, 50, 73, 95, 110, 116, 117	10	8
19	Vaccination	121	1	0.8
20	Epidemiology	4,7,16, 21, 23, 29, 34, 36, 46, 85, 106, 118	12	9.6
21	Laboratory data	28, 103, 112	3	2.4
22	Periodization	61	1	0.8

(continued)

Table 20.14 (continued)

№	Research topic	Article numbers	Number of articles	%
23	Geographic aspect	2, 5, 11,13, 15, 22, 24, 25, 34, 36, 39, 46, 47, 53, 61, 63, 69, 72, 74, 82, 88, 93, 99, 100, 101, 102, 106, 112, 116, 123, 125	31	24.8
24	Cellular level	30, 75, 81, 87, 114, 119, 121	7	5.6
25	Control measures and prevention	4, 60, 70, 71 85	5	4
26	Statistical data	61	1	0.8
27	Forecasting	15, 20, 22, 63, 104, 113,	6	4.8
28	Case reports	118, 122	2	1.6
29	Causes	70	1	0.8
30	Recommendations and guidelines	80	1	0.8
31	Impact on the branches of medicine	76	1	0.8

As for singling out the relevant groups, its criteria are a synthesis of the content analysis of the articles in question and similar groups that exist on some platforms, for example, ResearchGate. We are aware that the boundaries between some of the groups we propose may seem elusive. Thus, for example, a case report is hardly possible without describing the clinical picture, and the "cellular level" is relevant for many other groups identified by us.

Conclusions

In this chapter, we endeavored to explain the phenomenon of the coronavirus publication race, analyzed a number of typical bibliometric articles, which are structured according to the standard principle—presenting ranked lists of publications distributed by countries, journals and institutions, as well as lists of the most cited articles. With this analysis, we showed that there are no works that use Google Scholar for these purposes.

Based on this search engine, 21 online platforms were identified, on which the largest number of articles on coronavirus topics were published, of which two samples were identified as of December 15, 2020 (82 articles with the term "COVID-19" in article titles and 63 articles with the term "Coronavirus" in article titles) articles with over 1,000 citations in *Elsevier* journals and over 500 times on other online platforms. These articles have been categorized by authors, countries and institutions.

These samples of articles were reduced to a single sample with 125 articles that did not overlap in two samples, on the basis of which a detailed analysis of the structures

of international co-authorship with the identification of 31 countries, the authors of which participated in international collaborations, was made. For this analysis, a square symmetric matrix of international co-authorship was developed.

A content analysis of highly cited publications was carried out, revealing overlapping topics, for which the multi-topic factor proposed by us was calculated.

In general, a quantitative analysis of the phenomenon of the coronavirus publication race showed a clear superiority in it of China, which in many respects outstripped its closest competitors—the USA and the UK.

Appendix 1. Platforms for Commercial Publishers of Periodicals, Major Journals, Preprint Archives, Scientific Networks and Servers of International and National Health Organizations. Their Brief Description

1. Elsevier

Elsevier is a Netherlands-based information and analytics company specializing in scientific, technical, and medical content. Elsevier is a part of the RELX Group, which was known until 2015 as Reed Elsevier. It was founded as a small Dutch publisher in 1880. Elsevier publishes more than 500,000 articles annually in 2,500 journals. Its archives contain over 17 million documents and 40,000 e-books. Total yearly downloads amount to more than 1 billion. ["2018 RELX Group Annual Report" (PDF). RELX Company Reports. RELX. March 2019.]

2. Nature

"Nature is a weekly international journal publishing the finest peer-reviewed research in all fields of science and technology on the basis of its originality, importance, interdisciplinary interest, timeliness, accessibility, elegance and surprising conclusions" [https://www.nature.com/]. The first issue of Nature was published in November 1869. More than 88, 000 papers published Nature since 1900 are each represented by doi.

3. Springer

Springer is a leading global scientific, technical and medical portfolio, providing researchers in academia, scientific institutions and corporate R&D departments with quality content through innovative information, products and services. It was founded in 1842. Springer publishes more than 2,900 journals and 300,000 books [https://www.springer.com/].

4. Wiley Online Library

Wiley Online Library is a subscription-based library of John Wiley & Sons that launched on August 7, 2010, replacing Wiley InterScience [http://onlinelibrary.wiley.com/]. It is a collection of online resources covering life, health, and physical sciences as well as social science and the humanities. Wiley Online Library delivers access to over 4 million articles from 1,600 journals, more than 22,000 books, and hundreds of reference works, laboratory protocols, and databases from John Wiley & Sons and its imprints.

5. Oxford/Oxford Academic

Oxford University Press (OUP)

Oxford University Press (OUP) is the world's leading university press with the widest global presence.

The first book was printed in Oxford in 1478. In 1586 the University of Oxford's right to print books was recognized in a decree from the Star Chamber. Today OUP has offices in 50 countries, and is the largest university press in the world. It now publishes over 60 fully Open Access journals, alongside a number of Open Access monographs, and offer an Open Access publishing option on almost all of its journals [https://global.oup.com/academic/].

6. medrxiv

medRxiv … is a free online archive and distribution server for complete but unpublished manuscripts (preprints) in the medical, clinical, and related health sciences [https://www.medrxiv.org/content/about-medrxiv].Launched June 2019. As of January 17, 2021, it contains 1557 preprints.

7. Emerald -

Emerald Group Publishing/Emerald Publishing Limited

Emerald Publishing is one of the world's leading digital first publishers, commissioning, curating and showcasing research that can make a real difference. Emerald—Emerald Publishing Limited publishes social science research that tackles key societal challenges related to technology, business and people. It was founded in the United Kingdom in 1967. Emerald Group Publishing has its headquarters in Bingley. 500 thousand researchers in over 130 countries, 30 million downloads per year, 109 million visitors worldwide. It has a portfolio of over 350 journals and 3,500 books", its content platform Emerald Insight is home to more than 255,000 current and backfile articles across the fields of business, management, economics, engineering, computing, technology and social science [http://www.emeraldinsight.com/].

8. SAGE Publishing (formerly SAGE Publications)

SAGE Publishing, formerly SAGE Publications, is an independent publishing company founded in 1965 in New York by Sara Miller McCune and now based in Newbury Park, California. It publishes more than 1,000 journals, more than 800 books a year [https://uk.sagepub.com/en-gb/eur/home].

9. British Medical Journal (The BMJ)

The BMJ is a weekly peer-reviewed medical trade journal, published by the trade union the British Medical Association (BMA). The BMJ has editorial freedom from the BMA. It was founded in 1840. It is one of the world's oldest general medical journals. Originally called the British Medical Journal, the title was officially shortened to BMJ in 1988, and then changed to The BMJ in 2014. [https://www.bmj.com/content/348/bmj.g4168.

10. arXiv

arXiv is a free distribution service and an open-access archive for 1,823,661 scholarly articles in the fields of physics, mathematics, computer science, quantitative biology, quantitative finance, statistics, electrical engineering and systems science, and economics. Materials on this site are not peer-reviewed by arXiv. Launched August 14, 1991 [https://arxiv.org/].

11. The Journal of the American Medical Association (JAMA)

JAMA: The Journal of the American Medical Association is a peer-reviewed medical journal published 48 times a year by the American Medical Association. It publishes original research, reviews, and editorials covering all aspects of biomedicine. The journal was established in 1883 with Nathan Smith Davis as the founding editor. [https://www.ama-assn.org/about/ama-history/ama-history].

JAMA is the most widely circulated general medical journal in the world, with more than 277,000 recipients of the print journal, more than 1.6 million recipients of electronic tables of contents and alerts, and over 27 million annual visits to the journal's website. JAMA's reach includes a growing social media presence (more than 815,000 followers on Twitter and Facebook) and vast international news media exposure [https://jamanetwork.com/journals/jama/pages/for-authors].

12. Cell

Cell is a peer-reviewed scientific journal publishing research papers across a broad range of disciplines within the life sciences. Cell was established in 1974 by Benjamin Lewin. It is published bimonthly by Cell Press, which is an imprint of Elsevier [https://www.cell.com/cell/home].

13. National Acad Sciences PNAS

Proceedings of the National Academy of Sciences of the United States of America (abbreviated PNAS or PNAS USA) is a peer-reviewed multidisciplinary scientific journal. It is the official journal of the National Academy of Sciences. The journal has been published since 1915. It publishes original research, scientific reviews, commentaries, and letters [https://www.pnas.org/].

14. PLoS

PLOS One (stylized PLOS ONE, and formerly PLoS ONE) is a peer-reviewed open access scientific journal. It has been published by the Public Library of Science (PLOS) since 2006. In 2016 publication output in PLOS ONE was 22,054 research papers. [https://scholarlykitchen.sspnet.org/2017/01/05/plos-one-output-drops-again-in-2016/]

15. BMC/BioMedCentral

BMC Medicine is a peer-reviewed electronic-only medical journal. It has been published since 2003 by BioMed Central which is part of Springer Nature. It is described as "the flagship medical journal of the BMC series. An open access, open peer-reviewed general medical journal, BMC Medicine publishes outstanding and influential research in all areas of clinical practice, translational medicine, medical and health advances, public health, global health, policy, and general topics of interest to the biomedical and sociomedical professional communities. BMC has an evolving portfolio of some 300 peer-reviewed journals, sharing discoveries from research communities in science, technology, engineering and medicine [https://www.biomedcentral.com/about].

16. The New England Journal of Medicine(NEJM), NEJM Group

The New England Journal of Medicine (NEJM) is recognized as the world's leading medical journal and website. Published continuously for over 200 years, NEJM delivers high-quality, peer-reviewed research and interactive clinical content to physicians, educators, researchers, and the global medical community. [https://www.nejm.org/about-nejm/about-nejm]. The New England Journal of Medicine is a publication of NEJM Group—Owned & Published by the Massachusetts Medical Society. Today, NEJM is the most widely read, cited, and influential general medical periodical in the world. More than 600,000 people from nearly every country read NEJM in print and online each week. Each year, NEJM receives more than 16,000 research and other submissions for consideration for publication. About 5% of original research submissions achieve publication by NEJM; more than half originate from outside the U.S [https://www.nejm.org/about-nejm/about-nejm].

17. The World Health Organization (WHO)

The World Health Organization (WHO) is a specialized agency of the United Nations responsible for international public health. WHO began when our Constitution came into force on 7 April 1948.WHO are now more than 7000 people from more than 150 countries working in 150 country offices, in 6 regional offices and at our headquarters in Geneva. [https://www.who.int/about].

18. The National Institutes of Health (NIH)

The National Institutes of Health (NIH), a part of the U.S. Department of Health and Human Services, is the nation's medical research agency—making important discoveries that improve health and save lives. The National Institutes of Health is made up of 27 different components called Institutes and Centers. Each has its own specific research agenda, often focusing on particular diseases or body systems. Headquarters for the Office of the Director and the Institutes and Centers are located in Bethesda, Maryland, USA.The NIH traces its roots to 1887, when a one-room laboratory was created within the Marine Hospital Service (MHS), predecessor agency to the U.S. Public Health Service (PHS). The MHS had been established in 1798 to provide for the medical care of merchant seamen [https://www.nih.gov/].

19. ResearchGate

ResearchGate is a European commercial social networking site for scientists and researchers. It was founded in 2008 by the physicians Dr. Ijad Madisch and Dr. Sören Hofmayer along with computer specialist Horst Fickenscher. ResearchGate has more than 19 million members and more than 130 million publications [https://researchgate.net/press].

20. The National Bureau of Economic Research (NBER)

The National Bureau of Economic Research (NBER) is a private, nonpartisan organization that facilitates cutting-edge investigation and analysis of major economic issues. It disseminates research findings to academics, public and private-sector decision-makers, and the public by posting more than 1,200 working papers and convening more than 120 scholarly conferences, each year. The National Bureau of Economic Research (NBER) was founded in 1920, largely in response to heated Progressive-era controversies over income distribution. The number of affiliated researchers, just over 1,000 in 2008, was more than 1,500 in 2020 [https://www.nber.org/].

21. China CDC Weekly (CCDC Weekly)

China CDC Weekly (CCDC Weekly) serves as a platform for the China CDC. CCDC Weekly publishes authoritative professional information on national population health, disease and risk factor monitoring, investigation data and important public health event investigation reports. China CDC will use the CCDC Weekly to express views, countermeasures, and suggestions regarding Chinese and global health issues and to report relevant research and surveillance data, reviews, and opinions, etc. CCDC Weekly will help guide public health and clinical practices to cement the China CDC's professional influence. Established in November 2019 [https://publons.com/journal/672406/china-cdc-weekly/].

Appendix 2. Bibliographic Descriptions of Articles Ranked by Google Scholar Citations as of 12/15/2020

1. Huang C, Wang Y, Li X et al. (2020) Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. The Lancet 395(10223):497−506. https://doi.org/10.1016/S0140-6736(20)30183-5
2. Wang D, Hu B, Hu C et al. (2020) Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus–infected pneumonia in Wuhan, China. JAMA 323(11):1061−1069. https://doi.org/10.1001/jama.2020.1585
3. Zhou F, Yu T, Du R et al. (2020) Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. The Lancet 395(10229):1054−1062. https://doi.org/10.1016/S0140-6736(20)30566-3
4. Chen N, Zhou M, Dong X et al. (2020). Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. The Lancet 395(10223):507−513. https://doi.org/10.1016/S0140-6736(20)30211-7
5. Wu Z, McGoogan JM (2020) Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. JAMA 323(13):1239−1242. https://doi.org/10.1001/jama.2020.2648
6. Zhou P, Yang XL, Wang XG et al. (2020) A pneumonia outbreak associated with a new coronavirus of probable bat origin. Nature 579:270−273. https://doi.org/10.1038/s41586-020-2012-7

7. Lu R, Zhao X, Li J et al. (2020) Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. The Lancet 395(10224):565−574. https://doi.org/10.1016/S0140-6736(20)30251-8
8. Chan JFW, Yuan S, Kok KH et al. (2020) A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. The Lancet 395(10223):514−523. https://doi.org/10.1016/S0140-6736(20)30154-9
9. Xu Z, Shi L, Wang Y et al. (2020) Pathological findings of COVID-19 associated with acute respiratory distress syndrome. The Lancet Resp Med 8(4):420−422
10. Mehta P, McAuley DF, Brown M et al. (2020) COVID-19: consider cytokine storm syndromes and immunosuppression. Lancet (London, England) 395(10229):1033−1034
11. Wu F, Zhao S, Yu B et al. (2020) A new coronavirus associated with human respiratory disease in China. Nature 579:265−269. https://doi.org/10.1038/s41586-020-2008-3
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13. Wu C, Chen X, Cai Y et al. (2020) Risk factors associated with acute respiratory distress syndrome and death in patients with coronavirus disease 2019 pneumonia in Wuhan, China. JAMA Internal Med 180(7):934−943. https://doi.org/10.1001/jamainternmed.2020.0094
14. Gautret P, Lagier JC, Parola P et al. (2020) Hydroxychloroquine and azithromycin as a treatment of COVID-19: results of an open-label non-randomized clinical trial. Int J Anti Agents 56(1):105949. https://doi.org/10.1016/j.ijantimicag.2020.105949
15. Richardson S, Hirsch JS, Narasimhan M, et al. (2020) Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York city area. JAMA 323(20):2052–2059. http://doi.org/10.1001/jama.2020.6775
16. Wang C, Horby PW, Hayden FG et al. (2020) A novel coronavirus outbreak of global health concern. The Lancet 395(10223):470−473. https://doi.org/10.1016/S0140-6736(20)30185-9
17. Dong E, Du H, Gardner L (2020) An interactive web-based dashboard to track COVID-19 in real time. The Lancet Inf Dis 20(5):533−534. https://doi.org/10.1016/S1473-3099(20)30120-1
18. Bai Y, Yao L, Wei T et al. (2020) Presumed asymptomatic carrier transmission of COVID-19. JAMA 323(14):1406−1407. https://doi.org/10.1001/jama.2020.2565

19. Chen H, Guo J, Wang C et al. (2020) Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. The Lancet 395(10226):809−815. https://doi.org/10.1016/S0140-6736(20)30360-3
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Appendix 3. Generalized Characteristics of Highly Cited Articles Ranked by Google Scholar Citations as of 12/15/2020

Rank	Country	Number of countries	Number of authors	Number of affiliated institutions	Google scholar citations
1.	China	1	29	16	19,786
2.	China	1	14	1	11,247
3.	China	1	19	9	10,824
4.	China	1	14	9	9,967
5.	China	1	2	1	8,012
6.	China	1	29	4	7,893
7.	China, Australia	2	35	12	5,458
8.	China	1	21	3	5,034
9.	China	1	17	7	3,842
10.	UK	1	6	8	3,818
11.	China, Australia	2	19	7	3,711
12.	China	1	10	2	3,685
13.	China	1	25	8	3,364
14.	France	1	21	10	3,289
15.	USA	1	6	3	2,873
16.	China, USA, UK	3	4	8	2,870
17.	USA	1	2	1	2,682

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Rank	Country	Number of countries	Number of authors	Number of affiliated institutions	Google scholar citations
18.	China	1	7	5	2,552
19.	China, USA	2	15	6	2,394
20.	China	1	4	2	2,297
21.	Taiwan	1	5	6	2,284
22.	China	1	5	1	2,253
23.	USA	1	2	4	2,220
24.	China, USA	2	13	2	2,122
25.	Italy	1	3	3	2,067
26.	Netherlands	1	11	6	1,912
27.	China, Singapore	2	9	5	1,907
28.	China	1	8	3	1,823
29.	UK	1	8	4	1,780
30.	USA, Switzerland	2	10	2	1,753
31.	China	1	6	2	1,727
32.	China	1	18	5	1,682
33.	China	1	21	4	1,668
34.	UK, Netherlands	2	4	4	1,656
35.	China	1	23	2	1,646
36.	Italy	1	2	2	1,631
37.	UK	1	33	3	1,618
38.	Switzerland, Greece	2	3	2	1,577
39.	China	1	13	2	1,562
40.	China	1	10	1	1,505
41.	China	1	4	3	1,480
42.	China	1	27	2	1,378
43.	China, USA, UK	3	46	26	1,346
44.	China, USA, Germany, Netherlands, Russia, Spain	6	17	13	1,326
45.	China, USA, UK, Australia, Canada, Denmark, Italy, S. Korea, Netherlands, Saudi Arabia, UAE	11	36	33	1,315

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Rank	Country	Number of countries	Number of authors	Number of affiliated institutions	Google scholar citations
46.	China, UK, Germany, Italy, Oman, Republic of Congo, Saudi Arabia	7	12	14	1,276
47.	China	1	14	8	1,267
48.	USA	1	4	2	1,256
49.	Singapore	1	7	2	1,244
50.	China	1	13	4	1,226
51.	India	1	1	1	1,211
52.	UK	1	22	1	1,203
53.	China	1	8	5	1,197
54.	China, Canada	2	46	6	1,182
55.	China	1	5	3	1,160
56.	USA	1	7	3	1,139
57.	China, Japan	2	3	3	1,117
58.	USA, UK, Australia, Sweden	4	25	24	1,107
59.	China, Australia	2	7	5	1,094
60.	UK	1	11	1	1,081
61.	China, USA	2	11	10	1,049
62.	USA	1	3	2	1,038
63.	Italy	1	3	4	1,023
64.	Singapore	1	5	3	1,013
65.	China	1	48	8	979
66.	China	1	51	12	971
67.	UK	1	26	23	965
68.	Belgium, France, Italy	3	33	22	962
69.	China, USA	2	16	8	948
70.	China, USA, Netherlands	3	11	5	935
71.	USA, UK	2	2	3	921
72.	China	1	37	24	894
73.	China, Belgium	2	2	2	862
74.	China	1	14	2	855
75.	China	1	8	2	846

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Rank	Country	Number of countries	Number of authors	Number of affiliated institutions	Google scholar citations
76.	China	1	3	2	829
77.	Sweden	1	1	4	825
78.	China, USA, UK, Australia, Brazil, Canada, Netherlands, Poland	8	42	38	823
79.	China	1	16	3	820
80.	China, USA, UK, Italy, Japan	5	8	9	803
81.	USA	1	20	3	786
82.	China	1	3	3	784
83.	China	1	12	4	773
84.	China	1	7	2	762
85.	China	1	4	2	735
86.	China	1	5	5	735
87.	USA	1	15	8	733
88.	China, USA	2	9	2	724
89.	China	1	3	2	720
90.	Italy	1	1	1	711
91.	UK, Canada	2	2	4	707
92.	USA	1	1	1	707
93.	China	1	2	1	681
94.	UK, Germany, Italy	3	7	6	679
95.	China	1	6	1	673
96.	France	1	10	4	635
97.	China, USA, Italy	3	10	7	633
98.	UK	1	24	20	621
99.	USA	1	3	2	616
100.	China	1	7	3	612
101.	Taiwan, USA	2	3	3	606
102.	Italy	1	2	1	604
103.	China	1	6	2	600
104.	USA, UK, Austria, Belgium, Germany, Ireland, Netherlands	7	43	34	593

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Rank	Country	Number of countries	Number of authors	Number of affiliated institutions	Google scholar citations
105.	China	1	5	1	591
106.	China, USA	2	12	5	586
107.	USA	1	2	4	583
108.	China	1	12	4	570
109.	USA	1	6	3	565
110.	USA	1	6	2	565
111.	USA	1	1	1	550
112.	China	1	8	1	545
113.	China	1	8	4	541
114.	China	1	8	4	537
115.	Brazil, Italy, Paraguay	3	4	4	537
116.	USA	1	14	4	535
117.	Brazil, Spain	2	28	21	530
118.	China	1	46	3	529
119.	Germany, Greece, Romania	3	28	9	518
120.	China	1	6	3	515
121.	China, USA	2	8	3	513
122.	Australia	1	13	7	510
123.	Spain	1	25	21	501
124.	China	1	14	4	501
125.	China	1	6	3	501

Appendix 4. Generalized Characteristics of Highly Cited Articles, Grouped by Countries of Participants as of 12/15/2020

No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
1.	China	75	2,176	52	2,465	23	1,521	China, USA	7	1,191
								China, USA, UK	2	2,108
								China, Australia	3	3,421
								China, UK, Germany, Italy, Oman, Republic of Congo, Saudi Arabia	1	1,276
								China, USA, UK, Australia, Brazil, Canada, Netherlands, Poland	1	823
								China, USA, Italy	1	633
								China, USA, Germany, Netherlands, Russia, Spain	1	1,326
								China, Belgium	1	862

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
								China, USA, UK, Australia, Canada, Denmark, Italy, S. Korea, Netherlands, Saudi Arabia, UAE	1	1,315
								China, USA, Netherlands	1	935
								China, Singapore	1	1,907
								China, Canada	1	1,182
								China, Japan	1	1,117
								China, USA, UK, Italy, Japan	1	803
2.	USA	35	1,149	15	1,123	20	1,168	China, USA, UK	2	2,108
								China, USA	7	1,191
								USA, Switzerland, Sweden	1	1,753

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
								China, USA, Germany, Netherlands, Russia, Spain	1	1,326
								China, USA, UK, Australia, Canada, Denmark, Italy, S. Korea, Netherlands, Saudi Arabia, UAE	1	1,315
								USA, UK, Australia, Sweden	1	1,107
								China, USA, Netherlands	1	935
								USA, UK	1	921
								China, USA, UK, Australia, Brazil, Canada, Netherlands, Poland	1	823

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
								China, USA, UK, Italy, Japan	1	803
								China, USA, Italy	1	633
								Taiwan, USA	1	606
								USA, UK, Austria, Belgium, Germany, Ireland, Netherlands	1	593
3.	UK	19	1,325	7	1,584	12	1,174	China, USA, UK	2	2,108
								UK, Netherlands	1	1,656
								China, USA, UK, Australia, Canada, Denmark, Italy, S. Korea, Netherlands, Saudi Arabia, UAE	1	1,315

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
								China, UK, Germany, Italy, Oman, Republic of Congo, Saudi Arabia	1	1,276
								USA, UK, Australia, Sweden	1	1,107
								USA, UK	1	921
								China, USA, UK, Australia, Brazil, Canada, Netherlands, Poland	1	823
								China, USA, UK, Italy, Japan	1	803
								UK, Canada	1	707
								UK, Germany, Italy	1	679

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
								USA, UK, Austria, Belgium, Germany, Ireland, Netherlands	1	593
4.	Italy	12	1,020	5	1,207	7	6,205	China, USA, UK, Australia, Canada, Denmark, Italy, S. Korea, Netherlands, Saudi Arabia, UAE	1	1,315
								China, UK, Germany, Italy, Oman, Republic of Congo, Saudi Arabia	1	1,276
								Belgium, France, Italy	1	962
								China, USA, UK, Italy, Japan	1	803

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
								UK, Germany, Italy	1	679
								China, USA, Italy	1	633
								Brazil, Italy, Paraguay	1	537
5.	Netherlands	7	1,223	1	1,912	6	1,108	UK, Netherlands	1	1,656
								China, USA, Germany, Netherlands, Russia, Spain	1	1,326
								China, USA, UK, Australia, Canada, Denmark, Italy, S. Korea, Netherlands, Saudi Arabia, UAE	1	1,315
								China, USA, Netherlands	1	935

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
								China, USA, UK, Australia, Brazil, Canada, Netherlands, Poland	1	823
								USA, UK, Austria, Belgium, Germany, Ireland, Netherlands	1	593
6.	Australia	7	2,003	1	510	6	2,251	China, Australia	3	3,421
								China, USA, UK, Australia, Canada, Denmark, Italy, S. Korea, Netherlands, Saudi Arabia, UAE	1	1,315
								USA, UK, Australia, Sweden	1	1,107

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
								China, USA, UK, Australia, Brazil, Canada, Netherlands, Poland	1	823
7.	Germany	5	878	0		5	878	China, USA, Germany, Netherlands, Russia, Spain	1	1,326
								China, UK, Germany, Italy, Oman, Republic of Congo, Saudi Arabia	1	1,276
								UK, Germany, Italy	1	679
								USA, UK, Austria, Belgium, Germany, Ireland, Netherlands	1	593
								Germany, Greece, Romania	1	518

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
8.	Canada	4	1,007	0		4	1,007	China, USA, UK, Australia, Canada, Denmark, Italy, S. Korea, Netherlands, Saudi Arabia, UAE	1	1,315
								China, USA, UK, Australia, Brazil, Canada, Netherlands, Poland	1	823
								China, Canada	1	1,182
								UK, Canada	1	707
9.	Belgium	3	2,417	0		3	2,417	Belgium, France, Italy	1	962
								China, Belgium	1	862

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
								USA, UK, Austria, Belgium, Germany, Ireland, Netherlands	1	593
10.	Brazil	3	630	0		3	630	China, USA, UK, Australia, Brazil, Canada, Netherlands, Poland	1	823
								Brazil, Italy, Paraguay	1	537
								Brazil, Spain	1	530
11.	Saudi Arabia	2	1,296	0		2	1,296	China, USA, UK, Australia, Canada, Denmark, Italy, S. Korea, Netherlands, Saudi Arabia, UAE	1	1,315

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
								China, UK, Germany, Italy, Oman, Republic of Congo, Saudi Arabia	1	1,276
12.	Japan	2	960	0		2	960	China, Japan	1	1,117
								China, USA, UK, Italy, Japan	1	803
13.	Spain	3	786	1	501	2	928	China, USA, Germany, Netherlands, Russia, Spain	1	1,326
								Brazil, Spain	1	530
14.	Sweden	3	1,228	1	825	2	1,430	USA, UK, Australia, Sweden	1	1,107
								USA, Switzerland, Sweden	1	1,753
15.	Switzerland	2	1,665	0		2	1,665	USA, Switzerland, Sweden	1	1,753

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
								Switzerland, Greece	1	1,577
16.	Greece	2	1,048			2	1,048	Switzerland, Greece	1	1,577
								Germany, Greece, Romania	1	518
17.	Denmark	1	1,315	0		1	1,315	China, USA, UK, Australia, Canada, Denmark, Italy, S. Korea, Netherlands, Saudi Arabia, UAE	1	1,315
18.	France	3	1,629	2	1,962	1	962	Belgium, France, Italy	1	962
19.	S. Korea	1	1,315	0		1	1,315	China, USA, UK, Australia, Canada, Denmark, Italy, S. Korea, Netherlands, Saudi Arabia, UAE	1	1,315

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
20.	Paraguay	1	537	0		1	537	Brazil, Italy, Paraguay	1	537
21.	Singapore	3	1,388	2	1,129	1	1,907	China, Singapore	1	1,907
22.	Austria	1	593	0		1	593	USA, UK, Austria, Belgium, Germany, Ireland, Netherlands	1	593
23.	Ireland	1	593	0		1	593	USA, UK, Austria, Belgium, Germany, Ireland, Netherlands	1	593
24.	Oman	1	1,276	0		1	1,276	China, UK, Germany, Italy,,Oman, Republic of Congo, Saudi Arabia	1	1,276

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
25.	Poland	1	823	0		1	823	China, USA, UK, Australia, Brazil, Canada, Netherlands, Poland	1	823
26.	Republic of Congo	1	1,276	0		1	1,276	China, UK, Germany, Italy, Oman, Republic of Congo, Saudi Arabia	1	1,276
27.	Romania	1	518	0		1	518	Germany, Greece, Romania	1	518
28.	Russia	1	1,326	0		1	1,326	China, USA, Germany, Netherlands, Russia, Spain	1	1,326
29.	Taiwan	2	1,445	1	2,284	1	606	Taiwan, USA	1	606

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No.	Country	Total articles		Without the participation of other countries		Articles with international participation участием				
		Number of	Average citations	Number of	Average citations	Number of	Average citations	Country	Number of	Average citations
30.	UAE	1	1,315	0		1	1,315	China, USA, UK, Australia, Canada, Denmark, Italy, S.Korea, Netherlands, Saudi Arabia, UAE	1	1,315
31.	India	1	1,211	1	1,211	0				
	Total	125	1,782	89	1,973	36	1,309			

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