Original Article

Türkiye's 3-Year Coronavirus Disease 2019 Publication Performance in the Shadow of the Pandemic: A Bibliometric Analysis

Yağmur Ekenoğlu Merdan[1] , Okan Aydoğan[2]

[1]Department of Medical Microbiology, Biruni University Faculty of Medicine, İstanbul, Türkiye
[2]Department of Medical Microbiology, İstanbul Medipol Faculty of Medicine, İstanbul, Türkiye

Abstract

OBJECTIVE: The pandemic created by coronavirus disease 2019 (COVID-19) has led researchers to study to deal with this infection. The number of studies about it being performed and published is increasing over time. Due to the dramatic growth of COVID-19 scientific publications, we conducted a bibliometric and visualized study to better understand the progress, collaborations, and trend topics of COVID-19 publications in Türkiye.

MATERIAL AND METHODS: The scientific literature on COVID-19 research in Türkiye from 2020 to 2022 was extracted from the Scopus database and analyzed using bibliometric and scientometric techniques.

RESULTS: A total of 426.662 COVID-19-related publications were published worldwide in the 3-year period and Türkiye ranked 12th according to both publication (8.394) and case numbers (17.004.677). The most cooperations of Türkiye were with the USA, the UK, and Italy. The 5 most used keywords were determined as "COVID-19," "SARS-CoV-2," "Pandemics," "Coronavirus," and "Anxiety" respectively. It was determined by the keyword analysis that the most focused topics were related to the "COVID-19 clinic."

CONCLUSION: Türkiye did not lag behind in the number of studies on her geography, and it was seen to be in the leading position compared to the Middle East countries. It is important to periodically evaluate such a large number of research articles from a broad perspective for planning and direction of future studies.

KEYWORDS: COVID-19, bibliometric analysis, Türkiye, VOSviewer
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INTRODUCTION

The onset of the coronavirus disease 2019 (COVID-19) pandemic, the diagnosis and treatment of the disease, and the lack of knowledge about the evolution and mutations of the newly identified virus have encouraged extensive research in the academic field, which has been reflected in the scientific literature with an exponentially increasing number of publications.[1,2]

Bibliometric analyses are a popular method used to research and analyze a large number of scientific data. Bibliometric studies are widely used by researchers for various reasons, such as determining emerging trends in publication and journal performance, cooperation models and research components, and exploring the intellectual structure of a particular field in the current literature.[3,4] While these studies enable the evolutionary nuances of a particular scientific topic to be revealed, they also provide light on different areas that have emerged in this regard. Mapping by visualization in the process of generating meaningful information from big data obtained through bibliometric studies has garnered a lot of interest in recent years and has started to become widespread.[5,6] Vosviewer is a useful application that is often used in the visualization of data obtained in bibliometric analysis studies, where complex relationships are revealed in data mining. With the COVID-19 pandemic, the focus of attention of researchers all over the world has been COVID-19, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and related issues. Hundreds of thousands of studies have been planned in a short time and have been included in the scientific literature as publications.[2]

In keyword network maps, the size of the circles is proportional to the frequency of the associated term. The relationship of keywords is determined by the number of times they are mentioned in the same article. Keywords with a high relationship level are located close to each other, while the colors of the circles indicate the related keyword clusters.[4,7]

In events such as pandemics and disasters that affect every segment of society and the scientific world, it is of great importance to conduct fast and effective scientific studies and submit the data to the literature. Determining the size, orientations, evolution, and research dimension of COVID-19 publications in the literature from a broad framework is important

Corresponding author: Yağmur Ekenoğlu Merdan, e-mail: ymerdan@biruni.edu.tr

for planning new studies on the subject and identifying deficiencies. By means of bibliometric analyses and visualization of network maps, it can be ensured that the literature related to the subject is examined in all its dimensions and can be a guide for researchers.

In this study, we aimed to investigate the most cited publications, research areas, the most productive institutions, and the most cooperative countries to determine the publication performance of our country related to COVID-19 in the 3-year period since the beginning of the pandemic and to examine the keywords used. As a result of the literature research we conducted, it has been seen that our study is the research covering the widest period in which COVID-19-related data of our country are presented.

MATERIAL AND METHODS

Publications registered in the Scopus database between 2020 and 2022 with the address "Türkiye" were included in the study. Recent search query image made on Scopus is "TITLE-ABS-KEY ("COVID-19" OR "SARS-CoV-2" OR "2019-nCoV" OR "novel coronavirus 2019") AND PUBYEAR > 2019 AND PUBYEAR <2023 AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (AFFILCOUNTRY, "Türkiye")). The keywords of the obtained data were visualized by mapping with the VOSviewer program (version 1.6.16). In the keyword analysis, the first 2000 publications that received the most citations between 2020 and 2022 were evaluated. Bibliometrically, the number of publications by year, language of publication, country, institution /organization, research area, and author were presented. In addition, the relationship between the number of COVID-19 cases and the number of submitted articles by country was investigated. In our study, SCImago Journal Rank (SJR) indicator was used to measure journal performance.[7]

RESULTS

Between December 31, 2022 and January 1, 2020, 426 662 COVID-19-related publications were published worldwide in the 3-year period. Of these publications, 293 830 were articles in the original research type. The number of

Table 1. List of Confirmed Worldwide Number of Cases and Coronavirus Disease 2019 Publications

	Country	Number of Cases	Country	Number of Publications
1	USA	101 211 478	USA	70 287
2	China	98 726 098	China	29 612
3	India	44 683 748	UK	26 937
4	France	38 449 944	Italy	19 423
5	Germany	37 879 714	India	18 071
6	Brazil	36 887 991	Germany	13 169
7	Japan	32 846 656	Spain	13 014
8	South Korea	30 311 979	Canada	12 142
9	Italy	25 488 166	Australia	11 011
10	UK	24 293 752	Brazil	9124
11	Russia	22 035 133	France	8924
12	Türkiye	17 004 677	Türkiye	8394

COVID-19 cases worldwide and the distribution of the number of original research by country were given in Table 1. Türkiye was 12th with both 17 004 677 confirmed cases and 8394 publications.

English was found to be preferred in 96.6% of the publications and Turkish was preferred in 2.79% of the publications when 8394 publications addressed to Türkiye were examined. It was found that 10 different languages were preferred in publications. The top 5 languages most frequently preferred in publications with an author from Türkiye are English, Turkish, Spanish, French, and Portuguese.

The top 10 preferred journals and their SJR values are presented in Table 2. A total of 764 (9.15%) articles have been published in the top 10 journals listed in Table 2. Of the obtained articles (n = 131), 1.57% were seen to be published in the "International Journal Of Clinical Practice."

It was found that 53% of the journals in which the publications were published were registered in the Scopus database in the area of "Medicine," 10% in "Social Sciences," 7% in "Biochemistry, Genetics, and Molecular Biology," and 6% in "Immunology and Microbiology."

When the countries of international researchers who collaborated on 8 349 articles addressed to Türkiye were examined, it was found that the most cooperations were with the USA, the UK, Italy, Spain, and Germany. In our study, it was determined that our neighbor Greece is the 15th country with the most cooperation in Türkiye-addressed COVID-19 publications. The world map showing all collaborations was given in Figure 1. The network map of the cooperated countries in the first 2000 publications that received the most citations is shown in Figure 1. Figure 1 presents a network map of 84 countries that have published at least 5 publications. It was found that the largest of the total 4 clusters on the map is the green cluster, which covers mostly Asian countries. In the presented map, it was determined that the country with the most cooperation was the UK (Yellow cluster) with 240

Main Points

- Along with the coronavirus disease 2019 (COVID-19) pandemic, research interests in the scientific world have focused on COVID-19, and the number of publications about COVID-19 has increased exponentially, surpassing the number of publications related to other topics in the scientific literature.

- In the 3-year period, Türkiye ranked 12th according to both publication and case numbers. The most focused topics were "COVID-19 clinic," "use of computer systems in COVID-19 diagnosis and follow-up," and "COVID-19 mental health effects."

- The research goals and focuses have changed from the beginning to the terminal period of the pandemic.

- It was detected that Türkiye has been in the leading position on COVID-19 publications compared to the Middle East countries.

Table 2. Top 10 Journals and the SCImago Journal Rank Values

| Journal	No. of Articles	%	SJR	Country
1. *International Journal Of Clinical Practice*	131	1.56	0.646	USA
2. *Journal Of Medical Virology*	101	1.20	2.656	USA
3. *Turkish Journal Of Medical Sciences*	100	1.20	0.44	Türkiye
4. *Revista Da Associacao Medica Brasileira*	74	0.89	-	Brazil
5. *European Review For Medical And Pharmacological Sciences*	70	0.84	0.658	Italy
6. *Acta Medica Mediterranea*	63	0.75	0.118	Italy
7. *Sustainability (Switzerland)*	62	0.74	0.664	Switzerland
8. *Journal Of Experimental And Clinical Medicine Turkiye*	59	0.71	0.102	Türkiye
9. *Bratislava Medical Journal*	53	0.63	0.324	Slovakia
10. *Current Psychology*	51	0.61	0.513	USA

SJR, SCImago Journal Rank.

publications, followed by the USA (n = 209) in the blue cluster and Italy (n = 167) in the red cluster, respectively. It was seen that the least cooperation is with African, Central Asian, and South American countries.

When the institutions of the authors in 8349 articles were evaluated, it was found that the most productive institution was the University of Health Sciences (n = 1206). It is seen that 27 of the 30 most productive institutions are state universities and 3 of them are foundation universities. The University of Health Sciences is followed by İstanbul University, İstanbul University-Cerrahpaşa, Hacettepe University, and Marmara University. The 3 foundation universities included in the list are Koç University, İstanbul Medipol University, and Başkent University.

Among the 8349 publications, the top 10 articles that received the most citations were given in Table 3. It is seen that there is international cooperation in 6 of the 10 most cited articles.

Totally, 2824 keywords used at least 5 times in the top 2000 most cited articles in our study were analyzed. In this context, it was determined that the 5 largest clusters were "COVID-19 clinic" (blue), "use of computer systems in COVID-19 diagnosis and follow-up" (purple), "COVID-19 mental health effects" (green), "COVID-19 treatment" (orange), and "COVID-19 and social media-related publications" (light blue), respectively (Figure 2A). The 10 most commonly used keywords were determined as "COVID-19," "SARS-CoV-2," "Pandemics," "Coronavirus," "Anxiety," "Depression," "Mortality," "Deep Learning," "Mental Health," and
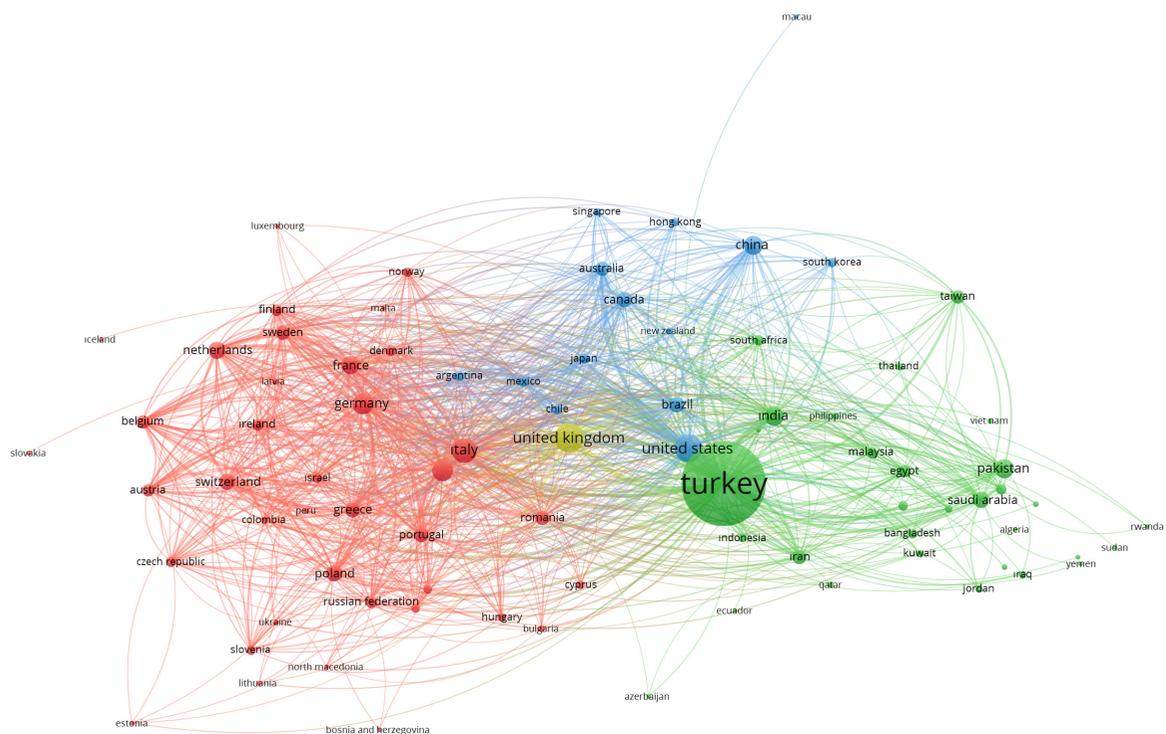
Figure 1. A network map of the countries with which Türkiye cooperates internationally.

Table 3. The 10 Most Cited Articles

	Number of Citations	Article Name	Journal Name	Year	Main Authors
1	6960	Safety and efficacy of the BNT162b2 mRNA COVID-19 vaccine	*The New England Journal of Medicine*	2020	Polack, F.P., Thomas, P.J., Kitchin, N., et al.
2	1335	Automated detection of COVID-19 cases using deep neural networks with X-ray images	*Computers in Biology and Medicine*	2020	Ozturk, T., Talo, M., Star, E.A., et al.
3	1291	Autoantibodies against type I IFNs in patients with life-threatening COVID-19	*Science*	2020	Bastard, P., Rosen, L.B., Zhang, Q., et al.
4	1146	Inborn errors of type I IFN immunity in patients with life-threatening COVID-19	*Science*	2020	Zhang, Q., Liu, Z., Moncada-Velez, M., Chen, J., et al.
5	633	Levels and predictors of anxiety, depression and Health anxiety during the COVID-19 pandemic in Turkish society: The importance of gender	*International Journal of Social Psychiatry*	2020	Ozdin, P., Flag Ozdin, S.
6	523	Safety and efficacy of the BNT162B2 mRNA COVID-19 vaccine through 6 months	*The New England Journal of Medicine*	2021	Thomas SJ, Moreira ED Jr., Kitchin N, et al.
7	472	Genomic characterization of a novel SARS-CoV-2	*Gene Reports*	2020	Khailany, R.A., Safdar, M., Ozaslan, M.
8	399	COVIDiagnosis-Net: Deep Bayes-SqueezeNet based diagnosis of the coronavirus Disease 2019 (COVID-19) from X-ray images	*Medical Hypotheses*	2020	Ucar, F., Korkmaz, D.
9	394	Efficacy and safety of an inactivated whole-virion SARS-CoV-2 vaccine (CoronaVac): interim results of a double-blind, randomized, placebo-controlled, phase 3 trial in Türkiye	*The Lancet*	2021	Tanriover, M.D., Doganay, H.L., Akova, M., et al.
10	385	Automatic detection of coronavirus disease (COVID-19) using X-ray images and deep convolutional neural networks	*Pattern Analysis and Applications*	2021	Narin, A., Kaya, C., Pamuk, Z.

COVID-19, coronavirus disease 2019; SARS-Cov-2, severe acute respiratory syndrome coronavirus 2.

"Machine Learning," respectively. The time-dependent keyword network map between January 2020 and December 2022 is given in Figure 2B.

DISCUSSION

Along with the COVID-19 pandemic, research interests in the scientific world have focused on the diagnosis and treatment of COVID-19 disease, the evolution and mutations of the SARS-CoV-2, and the development of new and effective vaccines as a way of prevention. In the first 3 months of the pandemic, the number of articles published about COVID-19 has increased exponentially, surpassing the number of publications related to many topics in the scientific world.[8,9] The number of COVID-19 publications added to PubMed has increased to over 300 publications daily from period to period.[10] The pandemic that started in China has been particularly severe in the USA and European countries with the number of cases and deaths (Table 1). The similarity between the number of cases and the publishing performance of the countries is striking. This can be considered a rapid response to the devastating and deadly effects of the pandemic, as well as its rapid spread. It is normal for health professionals to turn their attention to scientific literature to control the disease and determine treatment options, so it is essential that the literature about a new disease is updated frequently after independent peer review. Studies reported that before the pandemic

also show that the USA and China share the first place in the production of scientific data. While the USA and China account for about 25% of the total research and development (R&D) budget in the world, the countries following these 2 countries are listed as follows: Japan, Germany, South Korea, France, India, the UK, Russia, Brazil, Taiwan, Italy, Canada, Spain, Türkiye, and Australia.[11] There are bibliometric studies that show a positive relationship between the number of COVID-19 cases and publications, according to which it is expected that the countries most affected by COVID-19 will also be the countries that produce the most scientific documents.[12,13] Our country is 12th in both lists with the number of 17 004 677 cases and the number of 8394 publications in a harmonious way. Nine of the 12 countries where the most cases are reported are among the top 12 countries with the most publications (Table 1). However, this relationship does not apply to every country. It has been observed that 2 countries heavily affected by the pandemic, such as Italy and Iran, produce disproportionately fewer articles.[14,15] In a study covering the first 6 months of the pandemic, our country ranked 18th in terms of the number of publications, while it rose to 12th in the third year of the pandemic. In the same study, it is seen that the top 5 countries that produced the most publications in the first 6 months were the USA, China, Great Britain, Italy, and Canada. Canada, which was the fifth country that produced the most publications in the first month, has been replaced by India in the ongoing process.[16]

Figure 2. (A) A keyword network map of the 2000 publications that received the most citations, (B) A time-dependent keyword network map of the 2000 publications that received the most citations.

Of the 8394 articles addressed to Türkiye, only 2.79% were published in Turkish, while 96.6% of them were published in English. In co-authored studies, the article language is of course not determined solely by the decision of 1 author, but the publication language of the journal planned to be published is determined according to the joint decision of the authors, the content of the article, and the segment it addresses. The fact that the most collaboration was made with the USA and the UK in the publications presented from our country and the publication language of the most preferred journals is mainly in English can explain the reason that the most preferred publication language is English.

It was found that 53% of the 8394 publications evaluated in our study were indexed in the Scopus database in the fields of Medicine, 10% in the Social Sciences, 7% in Biochemistry, Genetics, and Molecular Biology, and 6% in Immunology and Microbiology. Similarly, publications are showing the dominance of health sciences in the number of COVID-19-related publications and reporting that life sciences, social sciences,

and humanities publications are relatively lagging behind.[17] It seems that social science studies are mainly focused on the effects of the pandemic on mental health and psychological studies.[18]

When the countries of international researchers who collaborated on 8349 articles addressing Türkiye were evaluated, it was found that the most cooperation was with the USA, the UK, Italy, Spain, and Germany. In our study, it was determined that our neighbor Greece is the 15th country with the most cooperation in Türkiye-addressed COVID-19 publications. In a study analyzing the COVID-19-related publishing performance of Greece, the top 3 cooperating countries are reported as Italy, the USA, and the UK, while Türkiye ranked tenth.[19] When the cooperating countries of Türkiye were examined, it was seen that the least cooperation is with African, Central Asian, and South American countries. Unlike the clusters covering the top 3 countries with the most co-authorship, it is interesting that most collaborations are in the green cluster, where Asian countries are predominantly located. It suggests that geographical proximity with the Middle Eastern and North African countries, which are commonly found in the green cluster, may have motivated the cooperation.

Among the 8349 publications addressed to Türkiye, it is observed that there is international collaboration in 6 of the 10 most cited articles (Table 3). The most cited article was published in *The New England Journal of Medicine* and received 6960 citations. Two of the most cited 10 articles were published in *The New England Journal of Medicine* and 2 in *Science*. Similarly, in a study that evaluated the most cited COVID-19 publications, it was reported that *The Lancet, The New England Journal of Medicine*, and *JAMA* were the most cited journals.[20,21] The top 5 most cited articles were published in 2020. When the journals in which the most Türkiye-oriented publications are published are evaluated, it was seen that 2 of the top 10 journals are addressed in Türkiye (Table 2). Of the 8 non-Turkish journals, 3 are from the USA, 2 are from Italy, and 1 each is from Brazil, Switzerland, and Slovakia. It is thought that early evaluation and publication are the main criteria for selecting authors' journals during the pandemic process. Since it is essential for every data to meet the scientific world quickly in a rapidly progressing process, both the evaluation periods of published studies have decreased, and the evaluation process has become controversial during this period.[22,23]

Keyword analysis showed that COVID-19 was not only studied in our country on diagnosis, treatment, and prevention methods but also intensively studied by researchers from a psychiatric and psychological point of view. So much so that it has been reported that Türkiye ranks sixth in the world in the production of publications on the theme of "mental health and COVID-19" and ranks fifth in publications in the field of paediatrics.[24,25] Some studies report the keyword clusters that stand out in our study in a similar way.[26]

While terms such as "pneumonia," "SARS-CoV-2," and "personal protective equipment" were prominent in the time-dependent keyword analysis covering the first period of the pandemic in the first quarter of 2020, the terms "Vaccines," "Molecular Docking," and "Transfer Learning" were used extensively as of the last quarter of 2021. At the beginning of the pandemic, the research goals were aimed at preventing transmission and the effects of the disease, while at the terminal period of the pandemic, research has evolved to issues related to the development of new vaccines and diagnostic methods.

Although our study contains useful data covering large-scale COVID-19 publications, it has some limitations. In our analysis, only 1 database (Scopus) was used, although it provides more comprehensive data than other databases. It should be taken into account that journals that are not screened in Scopus, especially nationally published journals, may have been excluded from the scope of our study.

With the COVID-19 pandemic, an exponentially increasing number of scientific publications have quickly been reflected in the literature. It is important to evaluate such a large number of research articles and identify trending topics to know the evolution and progress of publications on the subject from a broad perspective. We think that the comprehensive data presented in our study will shed light on the planning and direction of future studies, as well as health and R&D policies.

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