

Publications on COVID-19 in High Impact Factor Journals: A Bibliometric Analysis*

Publicaciones sobre COVID-19 en revistas científicas con alto factor de impacto: Un análisis bibliométrico

Received: 04 June 2020 | Accepted: 16 July 2020

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ABSTRACT

The COVID-19 pandemic caused by the SARS-CoV-2 virus has sickened more than six million people worldwide. This context has led to an abundance of publications quickly since the beginning of the outbreak. In a few months, thousands of scientific papers have appeared. This article aims to provide a bibliometric analysis of the publications on COVID-19 in five high-impact journals indexed to the Web of Science Core Collection's Science Citation Index Expanded (SCI-EXPANDED) including *The Lancet*, *New England Journal of Medicine*, *Science*, *Nature*, and *JAMA-Journal of the American Medical Association*. We found 169 documents associated with the search criteria. The findings indicate that China, the United States, and the United Kingdom are the most represented countries in these publications, *The Lancet* is the journal with the highest number of contributions with 66% of documents, and the *University of Hong Kong* leads the ranking of institutions. Future bibliometric and scientometric studies on COVID-19 should provide updated information to analyse other relevant indicators in this field.

Keywords

COVID-19; bibliometrics; Web of Science; journals; impact factor.

RESUMEN

La pandemia COVID-19 causada por el virus SARS-CoV-2 ha enfermado a más de seis millones de personas en todo el mundo. Este contexto

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How to cite: López-López, W., Salas, G., Vega-Arce, C. A., Cornejo-Araya, M. B., & Yuh-Shan, H. (2020). Publications on COVID-19 in high impact factor journals: A Bibliometric analysis. *Universitas Psychologica*, 19, 1-12. <https://doi.org/10.11144/Javeriana.upsy19.pchi>

ha propiciado una abundancia de publicaciones rápidamente desde el inicio del brote. En pocos meses han aparecido miles de documentos de carácter científico. El presente artículo tiene por objeto realizar un análisis bibliométrico de las publicaciones sobre COVID-19 en cinco revistas científicas de alto impacto indexados al Science Citation Index Expanded (SCI-EXPANDED) de Web of Science Core Collection, entre las cuales se encuentran *The Lancet*, *New England Journal of Medicine*, *Science*, *Nature* y *JAMA-Journal of the American Medical Association*. Se encontraron 169 documentos asociados a los criterios de búsqueda. Los hallazgos indican que China, Estados Unidos y Reino Unido son los países más representados en estas publicaciones, *The Lancet* es la revista que presenta la mayor cantidad de contribuciones con un 66% de documentos y la *University of Hong Kong* lidera el ranking de instituciones. Futuros estudios bibliométricos y cuantitativos sobre COVID-19 deben brindar información actualizada que permita analizar otros indicadores relevantes para este campo.

Palabras clave

COVID-19; bibliometría; Web of Science; revistas científicas; factor de impacto.

Coronaviruses are a broad group of zoonotic viruses that cause diverse illnesses, ranging from the common cold to more severe diseases, such as Severe Acute Respiratory Syndrome (SARS) and the Middle East Respiratory Syndrome (MERS). These syndromes represent a major threat to public health (Abd El-Aziz & Stockand, 2020; Sheahan et al., 2020; Wolfe et al., 2007; Wu et al., 2020), requiring the development of public policies, as well as preventive and control strategies against the outbreak (Yang & Jung, 2020).

The novel Coronavirus Disease-19 (COVID-19) is a respiratory disease caused by the SARS-CoV-2 virus (Phan, 2020). This new outbreak was first reported in Wuhan in Hubei province (China), in December 2019 (Lu, Stratton, et al., 2020). Most of the initial cases had visited the Huanan South seafood market in Wuhan, where varieties of live exotic animals were also sold (Jalava, 2020; Lu, Zhao, et al., 2020; Zhu et al., 2020). Since the SARS outbreak 18 years ago, many SARS-related coronaviruses (SARS-CoV) have been discovered, with bats being their natural host (Li et al., 2005; Zhou et al., 2020).

At the genetic level, COVID-19 is closely related to SARS, and a lesser extent to MERS, which have emerged as epidemiological threats in recent years in China and the Middle East (Kotfis & Skonieczna-Żydecka, in press). People with COVID-19 may be asymptomatic; develop mild symptoms such as dry cough, sore throat, and fever; or develop bilateral pneumonia or low oxygen saturation, which may end in acute respiratory distress syndrome and death (Sohrabi et al., 2020). Unfortunately, to date, there is no known effective, proven, and recognized pharmacological treatment for SARS-Cov-2 (Cortegiani et al., 2020). Current therapeutic interventions are used to control associated conditions (thrombosis, inflammation, bacterial superinfections) or consequences of the course of the disease (oxygen therapy and respiratory support) to reduce fatality rates. Antiviral drugs and vaccines are in the early stages of development and may take many months or even years to be fully developed (Geier & Geier, 2020).

COVID-19 has spread worldwide, which is why the World Health Organization (WHO) declared it a pandemic (Liu et al., 2020; Mahase, 2020). Millions of people are infected, and hundreds of thousands have died (Tufan & Kayaaslan, 2020). The number of new cases is increasing daily, and this is monitored in real time by the Coronavirus Resource Center of the *Johns Hopkins University* and other repositories (Velavan & Meyer, 2020). As of June 3, 2020, 6,418,078 confirmed cases and 381,064 deaths due to this disease had been reported worldwide ^[1]. The rapid increase in confirmed cases and deaths has generated concern, representing a serious threat to global public health (Wang, Wang et al., 2020). Therefore, actions for management, prevention, and control of COVID-19 are extremely important for public health (Zheng et al., 2020), and these depend primarily on a country's health system's capacity (Gilbert, 2020). This also requires rigorous and continuous monitoring of the scientific evidence on COVID-19, to accurately identify and predict the adaptation, evolution, transmission, and pathogenicity of the disease. Additionally, it is critical to monitor the best tools for diagnosis and

clinical management, which are being updated as new results are published, including and excluding drugs for the management of patients (Sohrabi et al., 2020).

Governments of several countries have decreed mandatory physical isolation to reduce the transmission of the virus. These restrictions have resulted in lifestyle changes, closure of businesses providing non-essential services, loss of jobs, and impact on people's mental health (Saadat, Rawtani, & Hussain, 2020; Yang et al., 2020; Zhai, & Du, 2020). Thus, preliminary evidence in mental health suggests that symptoms of anxiety and depression (16-28%), and self-reported stress (8%) are common psychological reactions in this context and may be associated with sleep disorders (Rajkumar, 2020). Furthermore, while there are individual differences in the expression of fear and anxiety, these emotional responses may vary from optimal responses, proportionate to the threat, to prolonged and disproportionate emotional states (Quezada-Scholz, 2020).

As mentioned, the COVID-19 pandemic has not only affected people's health, but has also brought with it social, economic, and political repercussions that must be addressed (Duan & Zhu, 2020). Today, unlike other pandemics such as the so-called Spanish flu in 1918 (Martini et al., 2019; Saunders-Hastings & Krewski, 2016), there is greater progress in medicine, epidemiology, and different scientific disciplines, which allows evidence to be available for decision-making processes in a shorter time (Jester et al., 2020; Monto, & Fukuda, 2020). Accordingly, recommendations for people have emerged intending to increase hygiene and the use of facemasks to prevent contagion and spread of the virus (Feng et al., 2020; Hillier, 2020).

Everything that is known regarding COVID-19 has been established in a short time, and scientists are joining forces to find a solution and to mitigate this health problem (Ciotti et al., in press). Every discovery can be known in real time, thanks to globalization and information technologies, which have also transformed the way science communicates (García & Sánchez, 2019).

Scientific journals have developed a series of indicators that measure their research activities in relation to other journals. Among these factors is the Impact Factor (IF), which compares and evaluates the importance of one journal by considering the mean number of citations its articles receive in a period (Okagbue et al., 2019). In this regard, results of research conducted on COVID-19 are published in different scientific journals, which have implemented accelerated publication mechanisms to allow the rapid availability of scientific evidence for decision making.

In this context, bibliometric studies constitute a fundamental source in the evaluation process of scientific publications. Additionally, this kind of study provides relevant information to researchers about a specific field of knowledge. Regarding the COVID-19 pandemic, different bibliometric studies have been conducted in areas related to the state of the art in scientific research (Mohadab et al., 2020), indicators about the most cited countries, institutions, and articles (De Felice, Polimeni, & Valentini, 2020; O'Brien et al., 2020), keyword co-occurrence networks in the research by subject area (Aristovnik et al., 2020), publication type and research focus (Lou et al., 2020), the growth rate of research on the topic (Torres-Salinas, 2020), and literature analysis in the business and management domain, aiming to identify current and future areas of research (Verma & Gustafsson, 2020). Nevertheless, this type of research is still scarce, and aspects such as the scientific production of journals with the highest IF (which provides greater visibility to their articles) has not been investigated (Chiu et al., 2004).

In 2018, the top three, out of 160 journals, indexed in the Web of Science (WoS) category of general and internal medicine were *New England Journal of Medicine* ($IF_{2018} = 70.670$), *The Lancet* ($IF_{2018} = 59.102$), and *JAMA-Journal of the American Medical Association* ($IF_{2018} = 51.273$). In the multidisciplinary science category, out of 69 journals, *Nature* ($IF_{2018} = 43.070$) and *Science* ($IF_{2018} = 41.063$) were located in first

and second place, respectively. These journals also obtained a high ranking out of 9.172 journals indexed in SCI-EXPANDED in 2018, ranking as follow: *New England Journal of Medicine* (3rd), *The Lancet* (4th), *JAMA-Journal of the American Medical Association* (9th), *Nature* (13th) and *Science* (14th). Moreover, these journals have also been highlighted for publishing top-cited documents as articles (Ho, 2013) and reviews (Ho & Kahn, 2014), which have had over 1,000 citations.

Considering the visibility of the articles published in the mentioned journals and the context of the COVID-19 pandemic, the present study aims to conduct a bibliometric analysis of the global scientific production related to COVID-19 in five high impact journals.

Method

This study's data were retrieved from the Clarivate Analytics Web of Science Core Collection, the online version of the Science Citation Index Expanded (SCI-EXPANDED). This catalog indexes the 9,394 most influential journals in 2020 (Clarivate Analytics, 2020). SCI-EXPANDED is also highly used in the bibliometric analysis of various knowledge domains (Fu et al., 2012; Han & Ho, 2011) and classic papers (Baltussen & Kindler, 2004).

The database was searched under analog keywords ("COVID-19", "COVID-2019", "2019-nCoV", "2019 novel coronavirus", "COVID19", "COVID2019", "COVD-19", "corona virus disease 2019", "coronavirus disease 2019", "2019 novel coronavirus disease", "novel coronavirus disease-19", "severe acute respiratory syndrome coronavirus", "novel coronavirus 2019", "novel coronavirus infection", "acute coronary syndromes", and "CoV-2"). Other terms that did not apply to the subject studied as "Cordyline virus", "breast cancer patients (COV)" and "MERS-CoV 2" were excluded.

The extraction was carried out in terms of the topic (title, abstract, author keywords, and *KeyWords Plus*) within the publication

year with a limit of 2019 to 2020 (until April 30th, 2020). *KeyWords Plus* supplied additional search terms extracted from the titles of articles cited by authors in their bibliographies and footnotes in the WoS database and substantially augmented title-word and author-keyword indexing (Garfield, 1990). The final filter was the 'front page', in which only the papers having the searched keywords in their 'first page' (including article title, abstract, and author keywords) were retained (Fu et al., 2012). The impact factor of a journal was based on the 2018 *Journal Citation Report*. Affiliations in England, Scotland, Northern Ireland, and Wales were grouped as being from the United Kingdom (UK) (Chiu & Ho, 2007).

Results

Document Type and Journal

During the first four months of the new coronavirus disease outbreak (COVID-19), 169 documents were published in the target high impact journals chosen. Most of them are from *The Lancet* (111 documents, 66% of the total), followed by *New England Journal of Medicine* (21), *Science* (19), *Nature* (15), and *JAMA-Journal of the American Medical Association* (3). The majority of these publications correspond to editorial material (71) and letters (59), and *The Lancet* was the journal that published the highest number of articles (12), editorial material (51), and letters (41). Table 1 shows the distribution by document type in the analyzed journals.

Only three papers, including one article (Wang, Hu, et al., 2020), one letter (Chang et al., 2020), and one editorial material (del Rio & Malani, 2020), were published in *JAMA-Journal of the American Medical Association*.

Table 1
Distribution of document types

Document types	JAMA		Lancet		Nature		New Engl J Med		Science	
	TP	APP	TP	APP	TP	APP	TP	APP	TP	APP
Article	1	14	12	17	4	24	3	29	2	7.0
Correction	N/A	N/A	4	3.3	N/A	N/A	N/A	N/A	N/A	N/A
Early access	N/A	N/A	N/A	N/A	2	24	N/A	N/A	N/A	N/A
Editorial material	1	7	51	3.7	6	2	10	4.3	3	1.0
Letter	1	2	41	5.7	4	2	8	12	5	5.0
News item	N/A	N/A	N/A	N/A	1	N/A	N/A	N/A	9	1.4
Review	N/A	N/A	3	8.3	N/A	N/A	N/A	N/A	N/A	N/A

Note. TP: number of total publications;
APP: number of authors per publications; N/A: not available.

Countries

Among the 169 documents published in the high impact factor journals, 119 of them (70% of the total) had author affiliation information in the SCI-EXPANDED, and their authors' country and institution were analyzed. The documents' authors represent 43 countries. The top three productive countries were China (42 documents, 35% of the 119 publications), the USA (41 documents, 34%), and the UK (38 documents, 32%). Table 2 displays the top ten countries.

Table 2
Top ten productive countries with TP ≥ 5

Countries	Rank (TP)	Lancet Rank (TP)	New Engl J Med Rank (TP)	Science Rank (TP)	Nature Rank (TP)	JAMA Rank (TP)
China	1 (42)	2 (29)	2 (4)	2 (3)	1 (4)	1 (2)
USA	2 (41)	3 (22)	1 (11)	1 (4)	2 (2)	1 (2)
UK	3 (38)	1 (32)	3 (3)	3 (1)	2 (2)	N/A
Switzerland	4 (12)	4 (10)	5 (1)	3 (1)	N/A	N/A
Germany	5 (11)	5 (9)	4 (2)	N/A	N/A	N/A
Italy	6 (9)	6 (7)	N/A	N/A	2 (2)	N/A
Canada	7 (7)	6 (7)	N/A	N/A	N/A	N/A
Australia	8 (6)	10 (4)	N/A	N/A	2 (2)	N/A
Singapore	8 (6)	8 (5)	5 (1)	N/A	N/A	N/A
Saudi Arabia	10 (5)	8 (5)	N/A	N/A	N/A	N/A

Note TP: total number of publications; N/A: not available.

Institutions

The top ten most productive institutions are listed in Table 3. Nine out of the ten main institutions are located in China, the USA, and the UK. In addition, the 10th most productive institution is located in Switzerland. Wuhan University in China was the only one which has published documents in *The Lancet* (4 documents), *New England Journal of Medicine* (1),

Science (1), and *JAMA-Journal of the American Medical Association* (1). In contrast, University College London in the UK has only published documents in *Nature* (9). None of the top ten institutions had published documents in *JAMA-Journal of the American Medical Association*. Both the Chinese Academy of Sciences and Fudan University had two papers in *Nature* as the first author. Food and Agriculture Organization of the United Nations in Italy, New York University in the USA, Uppsala University in Sweden, Cayetano Heredia University in Peru, and San Raffaele Scientific Institute in Italy also published two papers in *Nature* with one first author respectively.

Table 3
Top ten productive institutions with TP ≥ 6

Institutions	R (TP)	Lancet R (TP)	New Engl J Med R (TP)	Science R (TP)	Nature R (TP)	JAMA R (TP)
University of Hong Kong, China	1 (10)	2 (7)	2 (3)	N/A	N/A	N/A
University College London, UK	2 (9)	1 (9)	N/A	N/A	N/A	N/A
London School of Hygiene & Tropical Medicine, UK	3 (8)	2 (7)	10 (1)	N/A	N/A	N/A
National Institute of Allergy and Infectious Diseases, USA	3 (8)	27 (2)	1 (5)	2 (1)	N/A	N/A
Capital Medical University, China	5 (7)	4 (5)	10 (1)	N/A	N/A	1 (1)
University of Oxford, UK	5 (7)	9 (4)	4 (2)	2 (1)	N/A	N/A
Wuhan University, China	5 (7)	9 (4)	10 (1)	2 (1)	N/A	1 (1)
Centers for Disease Control and Prevention, USA	8 (6)	14 (3)	2 (3)	N/A	N/A	N/A
Emory University, USA	8 (6)	4 (5)	N/A	N/A	N/A	1 (1)
WHO, Switzerland	8 (6)	4 (5)	10 (1)	N/A	N/A	N/A

Note TP: total number of publications;
R: rank; N/A: not available.

Authors

From the 169 documents, 854 authors were identified. Table 4 shows the top ten most productive authors. None of the top ten authors had published documents in *JAMA-Journal of the American Medical Association*. The editor-in-chief of *The Lancet*, Richard Horton, has published seven editorial materials in *The Lancet*. Kai Kupferschmidt, a contributing correspondent for *Science*, has published five news items in *Science*, including three first-author and one single-author news item. Jon Cohen, a staff writer for *Science*, has also published five news items in *Science*, including three first-author, two single-author, and three collaborative news items with Kupferschmidt.

Table 4
Top ten productive authors with TP ≥ 4

Authors	R (TP)	Lancet R (TP)	New Engl J Med R (TP)	Science R (TP)	Nature R (TP)	JAMA R (TP)
R. Horton	1 (7)	1 (7)	N/A	N/A	N/A	N/A
Y. Liu	2 (6)	3 (3)	10 (4.8)	N/A	1 (22)	N/A
J. Cohen	3 (5)	N/A	N/A	1 (5)	N/A	N/A
K. Kupferschmidt	3 (5)	N/A	N/A	1 (26)	N/A	N/A
Y. Hu	5 (4)	14 (2)	N/A	N/A	1 (22)	N/A
G.M. Leung	5 (4)	3 (3)	10 (4.8)	N/A	N/A	N/A
H. Li	5 (4)	3 (3)	10 (4.8)	N/A	N/A	N/A
C. Wang	5 (4)	2 (4)	N/A	N/A	N/A	N/A
F.X. Zhan	5 (4)	54 (1)	10 (4.8)	N/A	1 (22)	N/A
L. Zhang	5 (4)	14 (2)	N/A	N/A	1 (22)	N/A

Note TP: total number of publications;
R: rank; N/A: not available.

Discussion

The impact of COVID-19 on society has led to the development of research in different fields (Ciotti et al., in press), therefore, to an increase of scientific publications on the subject. This study aimed to conduct a bibliometric analysis of the world's scientific publications on COVID-19 in five high impact journals: *New England Journal of Medicine*, *The Lancet*, *JAMA-Journal of the American Medical Association*, *Nature*, and *Science*. The main results indicate that most of the documents were published in *The Lancet*, and the most productive institutions were from China, the USA, and the UK.

The journals analyzed in this study were selected due to their top ranking in Science Citation Index Expanded (SCI-EXPANDED). In this regard, one of the leading indicators considered for their evaluation was the journal impact factor (IF) (Okagbue et al., 2019). It is stated that the documents published in these journals have greater visibility and probability of being cited in the development of other studies on the subject (Liu et al., 2018; Liu et al., 2016). Furthermore, considering what has been reported in previous studies (Ho, 2013; Ho & Kahn, 2014), it is likely that documents published on COVID-19 in these journals will receive a significant number of citations, becoming classic articles (Garfield, 1977; Martínez et al., 2014), which will represent intellectual markers in the field of research of COVID-19 (Gutiérrez-Salcedo et al., 2018).

In the WoS category of general and internal medicine, *New England Journal of Medicine*, *The Lancet*, and *JAMA-Journal of the American Medical Association* rank in the top three in 2018. This order is not reflected in the number of publications reported on the topic during the studied period, where *The Lancet* stands out by publishing 66% of the studied documents. Despite being a medical journal, *JAMA-Journal of the American Medical Association* is exceeded in the number of publications by *Science* and *Nature*. This could be explained by the fact that the responses to COVID-19 involve an interdisciplinary approach, making journals from different disciplines attractive to the socialization of research results. However, this number of publications will not necessarily determine the IF of the journal. This is an indicator that is established over time and can be analyzed in a future study.

As mentioned previously, China, the USA, and the UK were identified as the most productive countries. In that sense, it is important to point out that in the first SARS outbreak in 2003, the USA and the UK were the countries that stood out with the highest number of publications (Chiu et al., 2004). Today, in the context of COVID-19, it is observed that China leads this list, coinciding with the virus's initial discovery and the response of its scientific community. In this regard, 9 of the 10 affiliated institutions are also located in the countries mentioned above. The World Health Organization, located in Switzerland, completes this top ten of institutions.

This field of study's emerging state is well represented by the large number of documents that correspond to editorial material and letters. The editorial material can allow for innovative ideas, representing a valuable source of knowledge dissemination (Galbán-Rodríguez & Arencibia-Jorge, 2014); while a letter to the editor provides the opportunity for commenting on the articles, contributing with suggestions, clarifying concepts, or providing alternative procedures to those proposed (Aalia, 2018). However, it is still necessary that the development of research in the field of

COVID-19, as a multidisciplinary area, allows its consolidation from a perspective that integrates the physical and mental health of the population (Holmes et al., 2020), as well as the psychological factors that affect health professionals (Lai et al., 2020). These are part of the multiple challenges confronting researchers in this pandemic (Meng et al., 2020; Tang et al., 2020; Zhang et al., 2020).

The present study is not exempt from limitations. Among such limitations: a) the period of data collection, b) the categories of analysis, and c) the disambiguation of the authors. Regarding the first point, although an accelerated production was recorded in the analyzed period (Kannan et al., 2020; O'Brien et al., 2020; Remuzzi & Remuzzi, 2020; Zhao & Chen, 2020), it continues. The following were established concerning the categories of analysis: distribution by journal, document type, country, institution, and authors. It is recommended to include other categories of analysis and indicators of analysis in future research. Finally, a potential issue in the authorship analysis might occur when different authors have the same name or when authors used different names overtime in their publications (Chiu & Ho, 2007). In this regard, the development of strategies to disambiguate and fix this issue to be more precise in identifying the authors is suggested (D'Angelo et al., 2011; Salas, 2019; Schulz, 2016).

This bibliometric study allows for visualizing the status of global scientific publications on COVID-19 in five high impact journals, and it also allows for the identification of the most prominent authors. In the future, it will be possible to carry out a retrospective analysis and investigate, for instance, whether the documents in these journals contributed to generate solutions to the COVID-19 pandemic more quickly. The findings might also guide researchers and universities in formulating institutional policies to disseminate COVID-19 research to achieve greater visibility and impact.

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Notes

* Research article. This paper was written in collaboration with Prof. Wilson López-López, Editor in Chief of *Universitas Psychologica*. Regular double-blind peer review was held by guest editors. No conflicts of interest declared.

[1] [information obtained from the *Johns Hopkins University's* Coronavirus Resource Center: <https://www.coronavirus.jhu.edu/map.html>]