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BIBLIOMETRIC ANALYSIS OF BRAZILIAN PRODUCTION ON COVID-19

ANÁLISE BIBLIOMÉTRICA DA PRODUÇÃO BRASILEIRA SOBRE A COVID-19

ANÁLISIS BIBLIOMÉTRICO DE LA PRODUCCIÓN BRASILEÑA EN COVID-19

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Objective: to analyze the Brazilian scientific production on COVID-19. Method: bibliographic, descriptive, quantitative and bibliometric analysis research. The source of information was PubMed, with a period between November 17, 2019 and May 18, 2020. RSudio and VOSviewer software, bibliometrix and biblioshiny bibliometric packages, and Word Cloud Art were used for data analysis. Results: the Brazilian authors identified in the 248 articles are mostly from the medical area, working in institutions in the Southeast and Northeast regions of Brazil and maintain international collaboration, mainly with the United States, Italy and Canada. There is publication in several journals, especially those of Brazilian origin. The keywords and published articles refer to biomedical themes. Conclusion: Brazilian scientific production lacks researches on COVID-19 that reflect on the impacts of the pandemic on society, workers and health economy in Brazil.

Descriptors: COVID-19. SARS-CoV-2. Betacoronavirus. Bibliometrics. Brazil.

Objetivo: analisar a produção científica brasileira sobre a COVID-19. Método: pesquisa bibliográfica, descritiva, quantitativa e de análise bibliométrica. A fonte de informação foi a PubMed, com recorte temporal entre 17 de novembro 2019 e 18 de maio 2020. Foram utilizados para a análise dos dados os softwares RSudio e VOSviewer, os pacotes bibliométricos bibliometrix e biblioshiny, e o site Word Cloud Art. Resultados: os autores brasileiros identificados nos 248 artigos são, em sua maioria, da área da medicina, atuando em instituições nas Regiões Sudeste e Nordeste do Brasil e mantêm colaboração internacional, principalmente entre os Estados Unidos, Itália e Canadá. Há publicação em diversos periódicos, com destaque para os de origem brasileira. As palavras-chave e os artigos publicados remetem às temáticas biomédicas. Conclusão: a produção científica brasileira carece de pesquisas sobre a COVID-19 que reflitam sobre os impactos da pandemia para a sociedade, os trabalhadores e a economia da saúde no Brasil.

Descritores: COVID-19. SARS-CoV-2. Betacoronavírus. Bibliometria. Brasil.

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Objetivo: analizar la producción científica brasileña en COVID-19. Método: investigación bibliográfica, descriptiva, cuantitativa y de análisis bibliométrico. La fuente de información fue PubMed, con un periodo entre el 17 de noviembre de 2019 y el 18 de mayo de 2020. Para el análisis de datos, se utilizaron el software RSudio y VOSviewer, los paquetes bibliométricos bibliometrix y biblioshiny, y Word Cloud Art. Resultados: los autores brasileños identificados en los 248 artículos son en su mayoría del área de la medicina, trabajando en instituciones en las regiones sureste y noreste de Brasil y mantienen la colaboración internacional, principalmente entre los Estados Unidos, Italia y Canadá. Hay publicación en varias revistas, especialmente las de origen brasileño. Las palabras clave y los artículos publicados se refieren a temas biomédicos. Conclusión: la producción científica brasileña carece de investigaciones sobre COVID-19 que reflexionen sobre los impactos de la pandemia en la sociedad, los trabajadores y la economía de la salud en Brasil.

Descriptores: COVID-19. SARS-CoV-2. Betacoronavirus. Bibliometría. Brasil.

Introduction

In Brazil, from the first notification on February 26, 2020 to June 1, 2020, 26,447 cases of COVID-19 were confirmed, and, of these, 29,937 died[1]. According to the consolidated distribution of COVID-19 around the world and updated daily by the European Centre for Disease Prevention and Control (ECDC)[2], Brazil is the second and fourth country to lead the world statistics of reported infections and confirmed deaths, respectively.

The current pandemic, caused by coronavirus 2[3] respiratory syndrome (SARS-CoV-2) or COVID-19 and declared by the World Health Organization (WHO) in March 2020, is responsible for the infection of almost five million people worldwide[2]. The SARS-CoV-2 virus has a high infectivity rate and, therefore, the health system of several countries[4-5] has entered a state of emergency due to numerous hospitalizations, with a high number of contaminated health professionals, especially Brazilian nursing personnel, with more than 5,000 confirmed cases[6].

In view of this scenario, the scientific community in several areas, such as epidemiology[7], medicine[8], public health[9] and economics[10], is committed to researching, publishing and consolidating scientific evidence, which is essential for guiding the population, health professionals and managers, thus aiming to build safe and effective strategies to cope with the pandemic.

In this perspective, knowing the trend of scientific publications, identifying gaps, is essential for scientific communication, as well as for the investigation of the quality of researches. Thus, bibliometric analysis is an indispensable tool for evaluating these publications.

Bibliometric analysis is a useful technique to quantitatively and objectively assess the current research on a given subject and its local or worldwide influence with an aspect of scientific quality[11-12]. The indicators created by bibliometry aim to show immediate results to support science and technology, and the consequent creation of public policies[11-12]. However, thus far, three articles[13-15] of world production were found and there is no previous evidence of a local Brazilian bibliometric analysis on the theme of COVID-19.

In view of these considerations, the investigative question that guided the production of this article was: What are Brazilian researchers producing on the theme of COVID-19?

In order to answer the investigative question, this study aims to analyze the Brazilian scientific production on COVID-19.

Method

Bibliographic, descriptive research, with quantitative approach that used the method of bibliometric analysis. Bibliometry contributes statistically to evaluate trends in production growth, publication, authorship and use on a given theme researched in several areas of knowledge[16].

Based on other studies[17-18], this study followed five stages: research objective, research

protocol, data collection, data analysis and summary of results.

The definition of the theme, the objective and the guiding question of the research, presented in the introduction, comprised the first stage of this bibliometric study.

In the second stage, called search protocol, the database, keywords and search strategy were defined. PubMed, a database of the National Center for Biotechnology Information (NCBI), was chosen because it covers the documents of the Medical Literature Analysis and Retrieval System Online (MEDLINE) and comprises more than 30 million citations for biomedical literature, nursing, pharmacology, dentistry, veterinary and other health areas. The keywords in English: COVID-19, SARS-CoV-2, Coronavirus and Brazil were defined for the object of study and crossed with the Boolean characters OR and AND. The search strategy used was: "COVID-19" *OR* "SARS-CoV-2" *OR* "Coronavirus" *AND* "Brazil".

In the third stage, data collection, all documents indexed in the period between November 17, 2019 and May 18, 2020 were included, which comprises 6 months from the first rumors about COVID-19 to the date of collection from the database. There was no exclusion of documents, because PubMed indexes only original or revision articles. Also in this step, a database was built through the Excel program® (version 2016). The Journal Impactor Factor (JIF) and authors' H-index information were extracted from Clarivate Analytics' Journal Citation Reports database and from the Scopus database, respectively. The training area of the authors was collected on the Lattes curriculum platform.

During the fourth stage, data analysis, the software RStudio® (version 3.6.1) and VOSviewer® (version 1.6.6) were used. For the execution of the bibliometric analysis, in interface to RStudio, the *bibliometrix* and *biblioshiny* packages were installed. With the packages and metadata installed, it was possible to access the total number of publications/year, author's name, countries/regions, authoring metrics, journal sources and keywords. Through VOSviewer, the collaboration network was analyzed by co-authorship and co-occurrence of the keywords. The frequency of words in the abstracts of the articles was graphically presented by the online platform Word Cloud Art.

For the layout and presentation of the results, the last stage of the bibliometric method, the figures generated by the cited packages and the tables created by Excel were used. Due to the large number of documents, the ten terms (Top 10 ranking) with higher prevalence were chosen for presentation. In addition, for the ranking of the Top 10 of the most productive authors, the largest number of articles and the H-index were considered, in this order. For the identification of the affiliation of the authors, the first institution reported in the article was taken into account.

The elements analyzed in this article are: authorship distribution, international collaboration between authors, journals of greater relevance and JIF, co-occurrence of keywords and articles most cited with the frequency of words in their abstracts.

Since this study uses secondary data available free of charge in a data repository, there was no need to submit to the Research Ethics Committee (REC).

Results

The search identified 248 articles with the participation of Brazilian authors, published in 155 journals, co-authored by 1,585 researchers, affiliated in various institutions distributed in 26 countries.

The authors located in institutions in the Southeast and Northeast regions concentrate 90% of the publications, out of 10 authors analyzed, according to Table 1. The authors' mean publication and H-index were approximately 5 and 17, respectively. Medicine corresponded to 60% of the authors' training area. It is also noteworthy that, among the most productive authors, 30% did not have Brazilian nationality, being linked to the respective Brazilian institution by contract as visiting or postdoctoral professor.

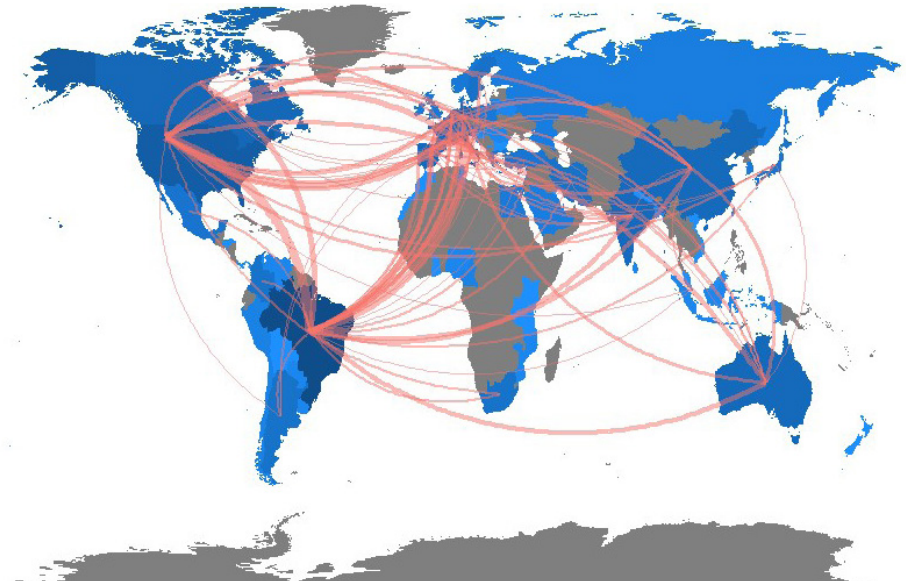
Table 1 – Top 10 of most productive authors on COVID-19 in Brazilian publications, institution/affiliation, region, H-index, nationality and training area. Salvador, Bahia, Brazil – 2020

Authors	Institution/Affiliation	Region	N	H-index	Nationality	Training area
Giovanetti M	Fundação Oswaldo Cruz	Southeast	9	15	Italian	Biology
Rolim-Neto ML	Escola de Medicina Juazeiro do Norte	Northeast	8	4	Brazilian	Psychology
Hussain A	Universidade Federal do Ceará	Northeast	5	25	Norwegian	Medicine
Kroumpouzos G	Escola de Medicina Jundiaí	Southeast	5	15	North American	Medicine
Castro R	Fundação Oswaldo Cruz	Southeast	5	7	Brazilian	Dentistry
Da Silva CGL	Escola de Medicina Juazeiro do Norte	Northeast	5	5	Brazilian	Medicine
Kowalski LP	Universidade de São Paulo	Southeast	4	63	Brazilian	Medicine
Croda J	Universidade Federal do Mato Grosso do Sul	Midwest	4	18	Brazilian	Medicine
Perazzo H	Fundação Oswaldo Cruz	Southeast	4	14	Brazilian	Medicine
Martins-Filho PR	Universidade Federal do Sergipe	Northeast	4	13	Brazilian	Dentistry

Source: Created by the authors.

The international collaboration of Brazilian authors was mainly evidenced among the United States (51 articles), Italy (44 articles) and Canada (24 articles). Figure 1 reveals the flow of the worldwide geographic distribution of this collaboration.

Figure 1 – Geographic distribution of the international collaboration between the authors



Source: Created by the authors.

As shown in Table 2, the journal Reports in Public Health concentrates the largest publications by Brazilian authors on the theme of COVID-19. Nevertheless, in terms of the citation scientometric factor, in the JIF – which reflects the average number of citations that the articles received in this journal – the journal Reports in Public Health occupies the last place in relation to the other journals described.

Table 2 – Top 10 of journals with the highest number of published articles on COVID-19 according to the Journal Impactor Factor. Salvador, Bahia, Brazil – 2020

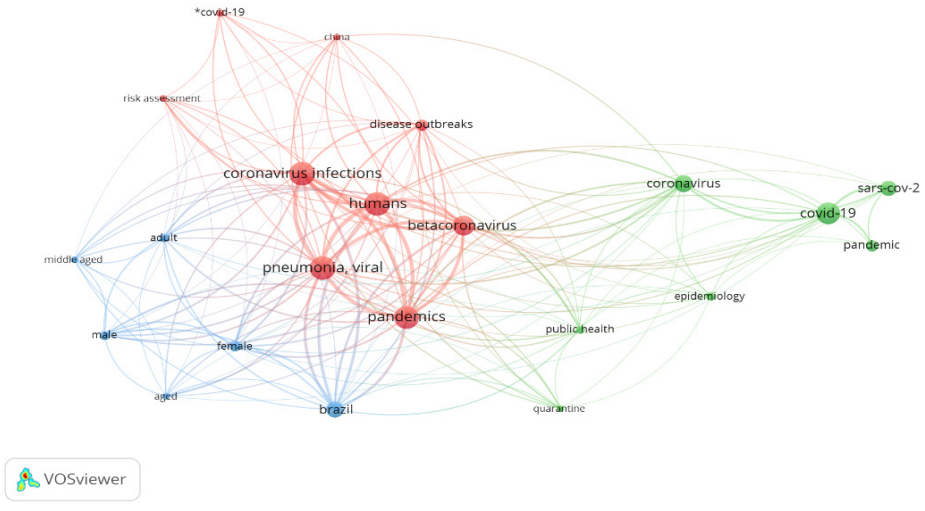
Journals	N	JIF
Reports in Public Health	9	1,170
Psychiatry Research	9	2,208
Journal of Medical Virology	8	2,049
Science of The Total Environment	8	5,589
Travel Medicine and Infectious Disease	6	4,868
Dermatologic Therapy	5	1,740
Oral Oncology	5	3,730
Epidemiologia e Serviços de Saúde: Revista do SUS Brasil	4	NF
Journal of the Brazilian Society of Tropical Medicine	4	1,498
Data in Brief	3	NF

Source: Created by the authors.

Legend: JIF: Journal Impactor Factor - 2018; NF: Not found.

Figure shows the formation of keywords through nodes that connect in networks of three colors: green, red, and blue. The size of the node and item indicate the frequency of occurrence of a keyword, and its relationship is stronger the closer they are to each other. The green set has seven keywords and covers the term COVID-19, its synonyms, epidemiology and global recommendation for coping with the pandemic, such as quarantine. The red color set refers to descriptors related to the coronavirus subtype and respiratory infections secondary to the virus. The blue color set includes the terms related to demographic characteristics and the location of studies on COVID-19.

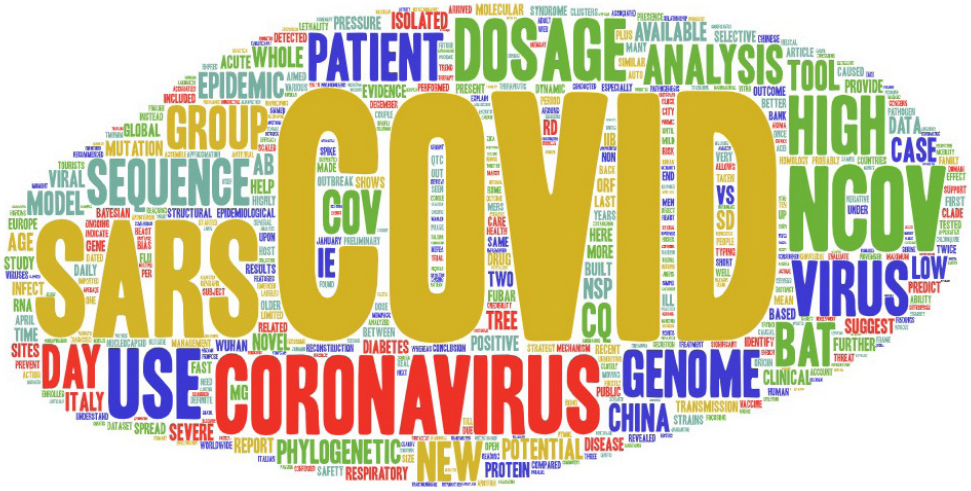
Figure 2 – Co-occurrence of keywords among the articles



Source: Created by the authors.

Among the ten most cited articles[19-28], there is hegemony of the Biology area and the co-authorship of Giovanetti, of Italian nationality, in 60% of the publications. The result of the frequency of the words in Figure 3 denotes that the main thematic discussion is directed to coding, sequencing the genome of SARS-CoV-2. Furthermore, words that denote the recommendations for prevention during the pandemic, such as isolation and human contact measures, are also evidenced.

Figure 3 – Frequency of the words most cited in the abstracts of the most cited articles



Source: Created by the authors.

Discussion

The Brazilian scientific community has followed the magnitude of the importance of discussions aimed at coping with the pandemic caused by COVID-19. However, in relation to the volume of world production[13,15], Brazil has not had significant publications. It is believed that the contingency of funds in universities[29], the lack of funding for Brazilian scientific researchers[30], the passivity and obscurantism of the current policy[9,31] may have directly affect the scientific development of Brazilian researches on SARS-CoV-2.

The Brazilian scientific and technological development has mostly been present in the Southeast and South Regions[32], with these regions leading the research statistics and scientific production. However, in this study, researchers located in institutions in the Northeast region surpassed the publications on COVID-19 in the South Region. The leadership of the Northeast Region results from the encouragement of educational institutions to provide the opening of new spaces in postgraduate studies, the increased interinstitutional partnerships[32] and the internationalization of their actions.

The need for the internationalization of higher education is a crucial factor for the development of research. Internationalization or active modality – reception of foreign researchers in Brazil – is a strong indicator and driver for scientific, technological and cultural development[33]. As well as the active modality, passive internationalization – sending Brazilian researchers abroad – is important to create, expand and consolidate the networks of cooperation between institutions. In this study, internationalization, especially in the passive modality, with international collaboration with Italian researchers, contributed to Brazil entering the ranking of published articles and citations on the theme of COVID-19.

However, in this study, asymmetries still occur between the five Brazilian regions, between researchers and the areas with the highest domain of scientific production. Scientific publications continue in a selective group of researchers

with high productivity in the Medical field, as found in the H-index. Although the H-index is controversial[34] among the scientific community, it quantifies by the citations of the productions of a given researcher, but does not measure the qualitative values of science, as occurs in the nursing area[35]. Nursing is as essential as medicine in this moment of pandemic, mainly due to its role in the care of symptomatic patients hospitalized by COVID-19. From this perspective, there is need to focus on researches towards other aspects of SARS-CoV-2, such as the impact of the pandemic on the daily lives of nursing professionals and the systematization of care, since no publication was verified in the Top 10 with authors from the respective area.

Investing in research is expanding the possibilities of scientific production, in addition to guiding decision makers to plan health actions, systems and services. In the current scenario, the countries that most published about COVID-19 are located in North America, Europe and Asia. These countries lead the technological race and prioritize investments in research and, consequently, lead the ranking of publications[14].

The coronavirus pandemic generated an increase in the volume of publications[13] that mainly use the term COVID-19 as the main descriptor. By analyzing Figures 2 and 3, it is possible to verify the valuation of studies on a biomedical trend, with terminologies such as viruses, disease and treatment. Although the cure or vaccine for the disease is extremely important, there is need to investigate the impacts that the pandemic will cause on people's mental health[22], in the economy and education sector[10], for example.

In another perspective, among the journals classified in the Top 10 (Table 2), there is an interest of Brazilian researchers in journals with the most varied scope, with questions focused on public health and clinical research. Nevertheless, the journal with the highest number of publications on COVID-19, of Brazilian origin, is the one with the lowest classification in the JIF. This fact denotes that, perhaps, the language used by the journal interferes with access, reading and citation by other international researchers.

The limitations of this study are due to the choice of a single database, keywords and the use of bibliometric packages. The choice of database and keywords may have camouflaged studies with the same theme and not indexed in the same basis. The bibliometric packages used are limited in the application of more robust filters and analyses. In addition, the presentation of the Top 10 ranking may be a limitation, since only the first ten items were considered. Thus, other similar investigations are suggested, after the pandemic period, crossing other databases, to investigate the Brazilian production on COVID-19.

Through the panorama of the last six months of the Brazilian scientific production on COVID-19, this study brings as contributions the presentation of the focus of the researches and the gaps of knowledge on the theme SARS-CoV-2. Furthermore, there stands out the importance of international collaborations for the growth of Brazilian production worldwide.

Conclusion

The Brazilian scientific production on COVID-19 has medicine as hegemonic area, with essentially biomedical themes, directed to the sequencing of the genome of the SARS-CoV-2, the cure of the disease and clinical-observational studies. At the same time, the scientific production of Brazilian researchers is maintained through international collaboration among several countries, and lacks researches on COVID-19, which reflects on the impacts of the pandemic on society, health workers and economy in Brazil.

Nonetheless, the bibliometric analysis showed the need for stimulating new researches and scientific production in other areas on the theme of COVID-19, such as the nursing area, in the field of mental health and social and economic impacts for the health area in Brazil.

Collaborations:

1 – Conception, design, analysis and interpretation of data: Wilton Nascimento Figueredo and Tássia Teles Santana de Macêdo;

2 – Writing of the article and relevant critical review of the intellectual content: Wilton Nascimento Figueredo, Tássia Teles Santana de Macêdo, Gustavo Marques Porto Cardoso and Elionara Teixeira Boa Sorte Fernandes;

3 – Final approval of the version to be published: Wilton Nascimento Figueredo, Tássia Teles Santana de Macêdo, Gustavo Marques Porto Cardoso and Elionara Teixeira Boa Sorte Fernandes.

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