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COVID 19 Researches by BRICS' Nations: A Bibliometric Study

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Abstract

Background: The novel corona virus (COVID 19), that is now considered as global pandemic due to its high rate of infectivity has impacted the world and caused morbidity and mortality on an unprecedented level in the era of modern medicine. In the past year, COVID 19 researches have been carried out at large by several countries across the globe. Therefore, the present study aimed to explore the researches brought out by BRICS countries in the form of publications to obliterate the COVID 19 pandemic.

Method: Scopus database was explored to collect the publications of BRICS pertaining to COVID 19. Data search was executed on 4th January 2020 and collected the required data for the study.

Results: Among the BRICS countries, China published the highest number of publications (5641) and the number of citations to the publications of china is significantly high (97806) compared to publications of other countries. As regards to collaborative researches, USA appears to be the most collaborative country with all countries of BRICS.

Keywords: Bibliometric analysis; novel coronavirus; coronavirus disease 2019 (COVID 19) and SARS-CoV-2

Introduction

Coronavirus disease 2019 (COVID 19) came to light in December 2019 in Wuhan, then covered all the territories of China and now turned up as a global pandemic (Wang et al., 2020). This new acute infectious disease has already affected more than 88 millions of people worldwide, causing nearly 1.91 million deaths to date. Which has become a great public concern. Thus, Chinese scholars at the end of 2019 published a chain of descriptive researches about the clinical features of COVID 19. Based on a deeper understanding of the pathophysiology, more studies were conducted on antiviral treatment and immune regulation, pathology of the disease and vaccine research. (Yu et al., 2020).

Since January 2020, COVID 19 became the top priority and leading subject in medical research. As a result of this, literature about COVID 19 rapidly published in the scholarly world. Following this surge of scholarly outputs. The presented has been carried out to understand the role of BRICS nations in obliterating the nature's biological weapon (COVID 19) with its scientific researches. The study focused on identifying the overall contributions of BRICS nations in COVID 19 researches. Main objectives of this study are to identify the prolific authors; productive organizations, most funding agencies, most collaborating countries, leading areas in COVID 19 researches according to Web of Science, type of publications such as open access and subscription based access and highly cited papers.

Literature Review

Aristovnik et al. carried out a bibliometric study on 16866 COVID 19 related publications covered by Scopus as of mid-2020. Study indicated the domination of health sciences in terms of number of relevant publications and total citations.

Chahrour et al. assessed COVID 19 publications with respect to gross domestic product (GDP) and population of each country. Their study shows China produced the greatest number of publications. With respect to continental research activity, Asian countries had the highest research activity.

Dehghanbanadaki et al., studied 923 documents indexed in the Scopus from December 1, 2019, to April 1, 2020. Study identified China ranked first with 348 documents, followed by the United States (n = 160).

A bibliometric study by Nasab & Rahim based on the data from the Web of Science (WOS), PubMed, and Scopus Core Collection on March 02, 2020. This study quantitatively and qualitatively analyzed the publication outputs, journals, authors, institutions, countries, cited references, keywords, and terms according to bibliometric methods using VOS viewer. The study resulted that China accounted for the highest proportion of published research, followed by the United States and Canada.

Methodology

The study undertaken by the researchers is a quantitative study. It is a study of citation analysis of all research publications pertaining to COVID 19 indexed in the Web of Science. Web of Science and Scopus are the two globally accepted bibliographic databases, of which

Web of Science maintained by Clarivate Analytics is the most popular database. The database contains the journals with high impact factor. So, research publications indexed in this database are chosen as the source for getting the required data for the present study. In order to investigate contributions of BRICS nations in COVID in researches the data sample was limited to the research publications made by the scholars of BRICS nations only.

As far as COVID 19 research is concerned there were 9811 research publications from BRICS nations in ‘Web of Science’ as on 04th January 2020. This result was obtained using ‘COVID 19’ as a keyword in the Web of Science. Further collected data was tabulated according to the objectives of the study and for the graphical representation of data VOS viewer was used.

Table 1
COVID 19 Researches by BRICS

Countries	No of Publications
China	5641
India	2049
Brazil	1391
South Africa	500
Russia	230
Total	9811

Table one presents the COVID 19 research by BRICS nations. It shows that five countries together published as many as 9811 publications. China outperformed other nations of BRICS by significantly dominating the COVID 19 research. India ranks second with 2049 publications. Brazil with 1391 research papers and South Africa with 500 research papers are in the subsequent places. Russia with 230 research papers stands at the last place among BRICS countries. This data indicates that China and India are the top leaders among BRICS nations in COVID 19 research.

Table 2
Extent of Use of BRICS Researches

Countries	No of Publications	No. of Citations	Average Citations	H index
China	5641	97806	17.34	149
India	2049	8660	4.23	37
Brazil	1391	6063	4.36	33
Russia	230	2309	10.04	22
South Africa	500	1712	3.42	19
Total	9811	116550		

Above table also depicts the extent of the use of research papers based on the number of citations. The publications of China altogether received 97806 citations depicting an h-Index

of 149. The average citation per item stands at 17.34. The total citations to Indian publications are 8660 with an h-Index of 37. Publications of Brazil have been cited 6063 times with 4.36 average citation per item. Russian publications have attained 2309 citations. It is pertinent here to highlight that though the publications of Russia are less in number the average citation per paper stands at 10.04 which is second highest next to the publications of china. The research performance of Russia is to be appreciated in this regard. Further, South Africa contributed 500 research papers, they have been cited 1712 times and the average citation per paper stands at 3.42.

Table 3
Publications by Types of Journal

Countries	Open Access		Subscription Based		Total	
	No.	%	No.	%	No.	%
Brazil	1323	95.11	68	4.89	1391	100.00
Russia	204	88.70	26	11.30	230	100.00
India	1790	87.36	259	12.64	2049	100.00
China	5205	92.27	436	7.73	5641	100.00
South Africa	469	93.80	31	6.20	500	100.00
Total	8991	91.64	820	8.36	9811	100.00

In global emergencies like the coronavirus (COVID 19) pandemic, many international publishers adopted the open science policies which remove obstacles to the free flow of research data and ideas, and thus accelerate the pace of research critical to combating the disease. Insight into openness of journals reveals that COVID 19 research is very open as 91.64% of total documents are published in open access journals. The highest openness of COVID 19 research is observed in Brazil (95.11%), while lower openness is identified in India (87.36%). Precedence of open access journals by all BRICS nations to make COVID19 research openly available is admired here.

Table 4
Prolific Authors in BRICS

Countries	Author	Affiliation	No of Publications
Brazil	De Souza CDF	Federal University of Alagoas.	13
	Santos VS	Universidade Federal de Alagoas.	13
Russia	Shoenfeld, Y.	St Petersburg State University.	10
	Moiseev, S.	Sechenov First Moscow State Medical University.	6
India	Wiwanitkit, V	DY Patil University.	80
	Amit Kumar	Central University Jharkhand.	48
China	Wang Y.	Sichuan Academy of Medical Science.	159
	Zang Y.	China Japan Friendship Hospital.	136

South Africa	Moodley K. Parker A	Stellenbosch University. Conserve Africa.	9 8
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The table depicts the best performing authors of BRICS nations based on the number of publications. The most productive authors in Brazil are De Souza and Santos VS with 13 publications each. In Russia Shoenfeld, Y. is the author with highest publications (10), next comes the Moiseev, S. with 6 publications. Wiwanitkit, V from DY Patil University found to be the most prolific author in India with 80 publications. Amit Kumar from Central University Jharkhand is the second highest with 48 publications. Wang Y. from China has published 159 highest articles which is in fact the highest among the authors of BRICS nations. Zang Y. is the second highest in China. Moodley K is the highest papers (9) published author in Russia followed by Parker A with 8 articles.

Among the authors of the five BRICS countries, the notable performance is of Wang Y. from Sichuan Academy of Medical and Zang Y. of China Japan Friendship Hospital. Involvement of these two authors in COVID 19 related research is worth highlighting here.

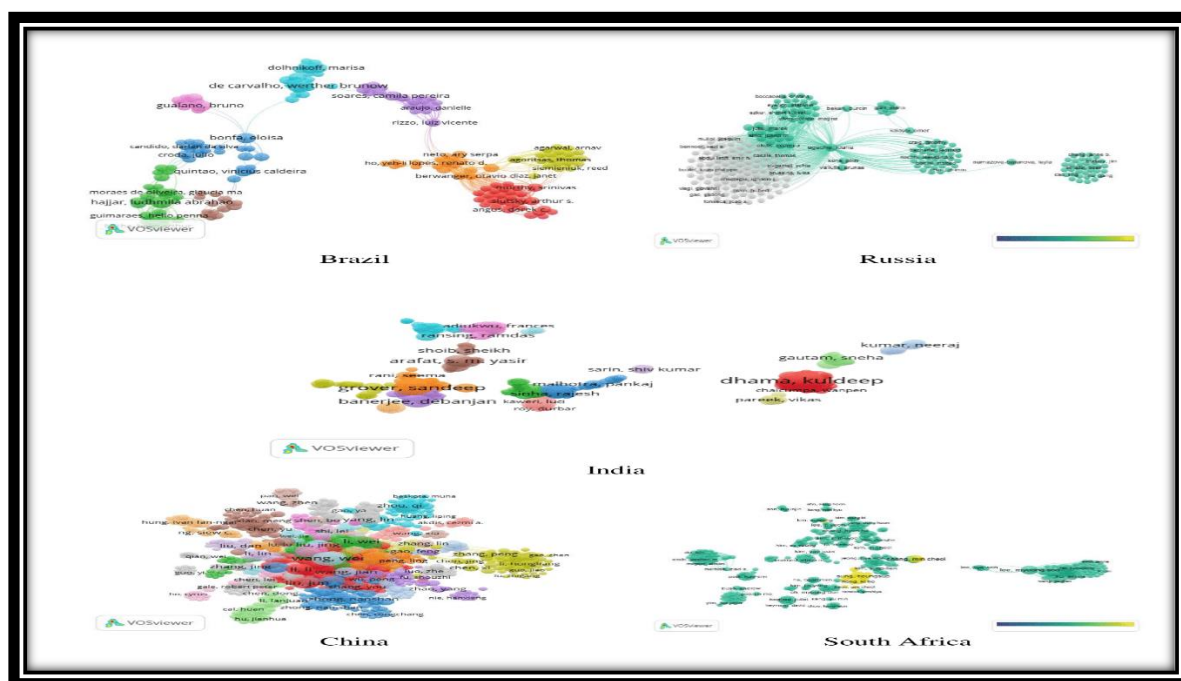


Figure 1: Prolific Authors

Table 5
Productive Organizations in BRICS

Countries	Organization	No of Publications
Brazil	Universidade De Sao Paulo.	344
	Fundacao Oswaldo Cruz.	136
Russia	Sechenov First Moscow State Medical University.	72

India	Russian Academy of Sciences	37
	All India Institute of Medical Sciences AIIMS New Delhi.	272
	Post Graduate Institute of Medical Education Research PGIMER Chandigarh.	155
China	Huazhong University of Science Technology.	781
	Wuhan University	456
South Africa	University of Cape Town	136
	Stellenbosch University	97

Table 5 shows some of the most productive institutions of BRICS nations by number of publications. The most involved institution among the institutions of BRICS nations is the Huazhong University of Science Technology (781), Wuhan University also played important roles in making COVID 19 researches (456). Universidade De Sao Paulo, Brazil too brought out phenomenal research (344). All India Institute of Medical Sciences AIIMS New Delhi, India significantly produced a sizable amount of COVID 19 researches (272). University of Cape Town South Africa provided an enviable number of COVID 19 publications (136).

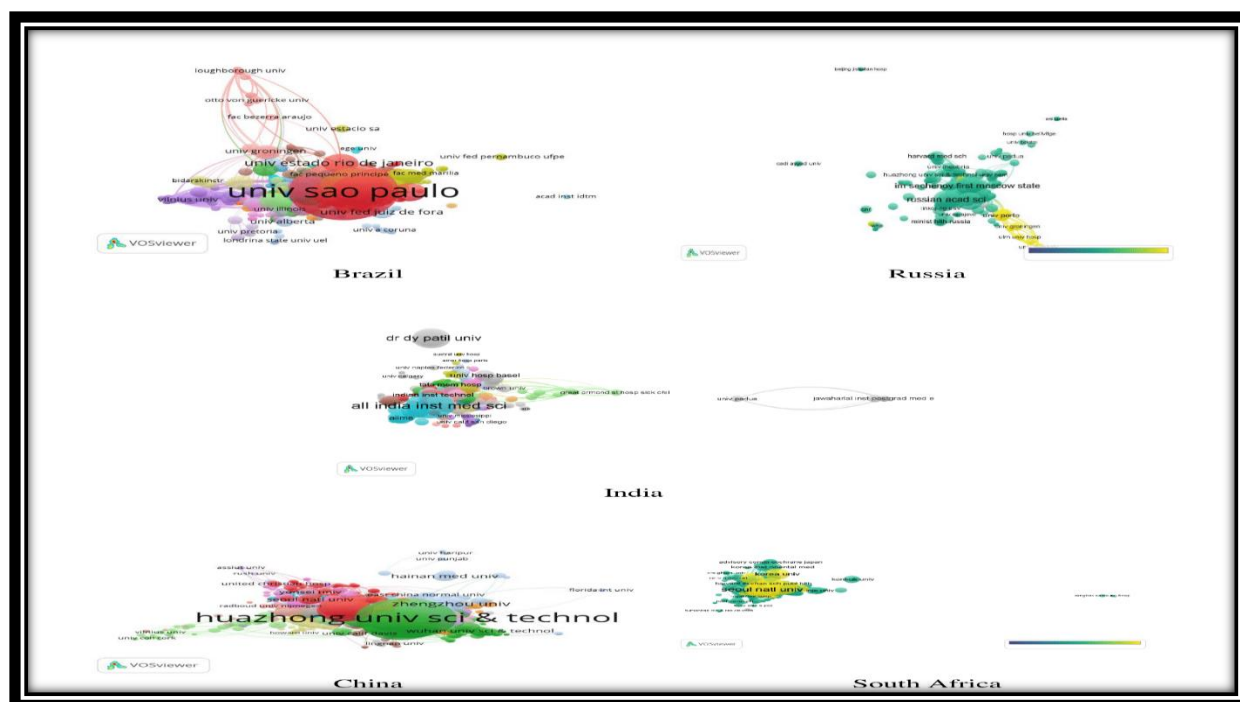


Figure 2: *Productive Organizations*

Table 6
Agencies Funded Publications of BRICS

Countries	Funding Agencies	No of Publications
Brazil	National Council For Scientific And Technological Development CNPQ.	189
	CAPES.	146
Russia	National Institutes of Health NIH USA.	7
	United States Department of Health Human Services.	7

India	Department of Science Technology India.	45
	Council Of Scientific Industrial Research CSIR India.	25
China	National Natural Science Foundation of China NSFC.	1318
	Fundamental Research Funds for the Central Universities	172
South Africa	National Institutes of Health NIH USA.	31
	United States Department of Health Human Services.	31

Agencies which predominantly supported the COVID 19 research in BRICS nations have been presented in table 6. As many as 1318 COVID 19 researches of China were funded by National Natural Science Foundation of China. This is in fact the agency under which a large number of COVID 19 related researches have been conducted among BRICS nations. The second highest funded agency is the National Council for Scientific and Technological Development CNPQ, Brazil (189). Agency Fundamental Research Funds for the Central Universities again from China stands at third place in funding a considerable number of researches (172). As far as Indian researches are considered 45 researches were brought out of funds given by Department of Science Technology.

Table 7
BRICS Collaborated Countries

BRICS	Collaborated Country	No of Publications
Brazil	USA	301
	England	152
Russia	USA	70
	Italy	68
India	USA	229
	England	170
China	USA	934
	England	423
South Africa	USA	170
	England	128

BRICS collaborated countries in COVID 19 researches are depicted in table 7. USA appears to be the most collaborated country among BRICS nations followed by England. USA altogether collaborated for 1704 publications of all BRICS nations. While England jointly worked with the COVID 19 researches of Brazil, India, China and South Africa and published a total of 873 publications. Italy found to be the second highest collaborated country with Russia. The coordination of USA and England among BRICS nations in conducting COVID 19 research is worth placing on record. USA appears to be the most collaborated country among BRICS nations followed by England.

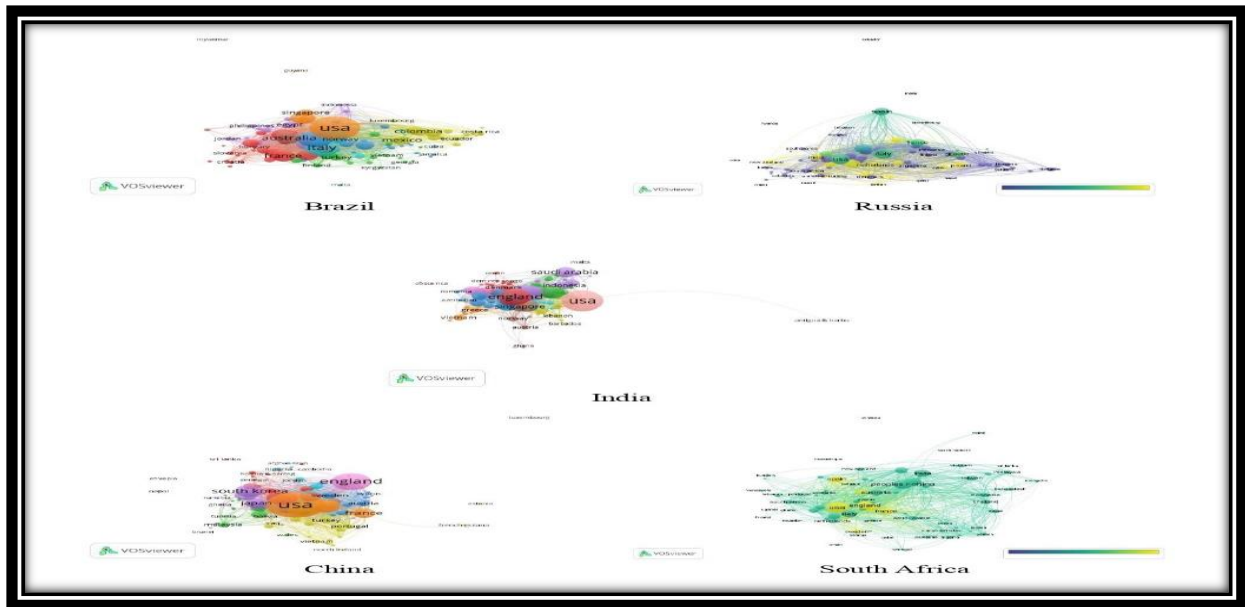


Figure 3: *Collaborated Countries*

Table 8

Publications by Web of Science Category

Countries	Web of Science Category	No of Publications
Brazil	Public Environmental Occupational Health.	221
	Medicine General Internal.	190
Russia	Immunology.	21
	Cardiac Cardiovascular Systems.	15
India	Public Environmental Occupational Health.	154
	Psychiatry.	146
China	Infectious Diseases.	588
	Medicine General Internal.	547
South Africa	Medicine General Internal.	130
	Public Environmental Occupational Health.	70

Table 8 presents the publications of BRICS nations by Web of Science's subject category. Study witnessed the highest number of researches in the field of Medicine General Internal (867) in China, Brazil and South Africa, followed by infectious diseases (588). Research in the area of public environmental occupational health is also found to be significantly high with 445 publications in Brazil, India and South Africa. Whereas Russia focused more on immunology (21) and cardiac cardiovascular systems (15). Psychiatry is identified as the second most important research domain in India with 146 publications.

Table 9 shows the journals which have been predominantly preferred by BRICS nations in publishing COVID 19 researches. Brazil has published maximum number of its research articles in the journal Clinics (62). While Russia published highest number of articles in

Kardiologiya (11). India published as many as 97 researches in Indian Journal of Ophthalmology. China's 170 COVID 19 researches have been in Journal of Medical Virology. South Africa has preferred to publish 87 articles in South African Medical Journal. Further most of these journals are from the respective countries. However, the top journal preferred by China is from USA.

Table 10 the above table projects the research papers which are highly cited as per Web of Science. The paper of F Zhou of China entitled clinical course and risk factors for mortality of adult inpatients with COVID 19 in Wuhan, China: a retrospective cohort study published in The Lancet has a total of 4744 citations. The paper published in Journal of the American College of Cardiology by Bikdeli et al. of Russia has been cited 484 times. Further, the paper published in New England Journal of Medicine by Ezekiel J. of Brazil has been cited 841 times. Singhal, Tanu of India have contributed a paper to Indian Journal of Pediatrics which has been cited 394 times. The contribution of Hopman, Joost et al. from South Africa in Journal of the American Medical Association has a total of 89 citations. These are the authors having highest number of citations for their specific research papers in COVID 19 researches.

Table 9

BRICS Preferred Journals

Countries	Journal	No of Publications	Publisher	Country of Journals	Impact Factor
Brazil	Clinics	62	University of Sao Paolo	Brazil	1.435
Russia	Kardiologiya	11	Media Sphera Publishing Group	Russia	0.30
India	Indian Journal of Ophthalmology	97	Wolters Kluwer Medknow Publications	India	1.019
China	Journal of Medical Virology	170	Wiley-Liss Inc.	USA	2.049
South Africa	South African Medical Journal	87	South African Medical Association	South Africa	1.500

Table 10

Highly Cited Publications of BRICS

Countries	Author	Publication	Journal	No. of Citations
China	F Zhou, T Yu, R Du, G Fan	Clinical course and risk factors for mortality of adult inpatients with COVID 19 in Wuhan, China: a retrospective cohort study.	The lancet	4744
Russia	Bikdeli, Behnood; Madhavan, Mahesh V.; Jimenez, David; et al.	COVID 19 and Thrombotic or Thromboembolic Disease: Implications for Prevention, Antithrombotic Therapy, and Follow	Journal of the American College of Cardiology	484
Brazil	Emanuel, Ezekiel J.; Persad, Govind; Upshur, Ross; et al.	Fair Allocation of Scarce Medical Resources in the Time of COVID 19-19	New England Journal of Medicine	481
India	Singhal, Tanu	A Review of Coronavirus Disease-2019 (COVID 19-19)	Indian Journal of Pediatrics	394
South Africa	Hopman, Joost; Allegranzi, Benedetta; Mehtar, Shaheen	Managing COVID 19 in Low- and Middle-Income Countries	Jama-Journal of the American Medical Association	89

Conclusion

This bibliometric study analyzed total of 9811 publications of BRICS nations related to COVID-19 that were extracted from the Web of Science database. The analysis of data presents some novel findings. First, BRICS nations altogether published a total of 9811 articles. Of them, China published highest publications, followed by India. Second, publications of China received large number of citations depicting an h index of 149. The total citations to Indian publications are 8660 with an h-Index of 37. Third, the highest openness of COVID 19 research is observed among BRICS nations (91.64%). Fourth, Wang Y. from China has published as many as 159 articles which is in fact the highest among the authors of BRICS nations. Fifth, Huazhong University of Science Technology appeared to be the most involved institution among the institutions of BRICS nations with 781 publications, followed by Wuhan University which played important roles in making 456 COVID 19 researches. Sixth, National Natural Science Foundation of China found to be the most funding agency as it supported for a large number of publications in comparison to other agency. Seventh, USA appears to be the most collaborated country among BRICS nations followed by England. Eighth, highest number of COVID researches is originated in the field of Medicine General Internal from China, Brazil and South Africa whereas infectious diseases wherein second highest research was carried out by BRICS nations. Ninth, publication by Chinese author F Zhou is found to be very impactful as it received a largest citations. This study also hypothesizes that the production rate of the countries and their casualties inflicted by the pandemic are somewhat positively correlated in any extent. For example, the China is the first county to have witnessed the COVID 19 so is the leading producer of researches. Overall this bibliometric study projected the complete scientific contributions of BRICS nations to obliterate the COVID 19 during this critical time.

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