



## Commentary



## Nigeria's scientific contributions to COVID-19: A bibliometric analysis

## A B S T R A C T

**Introduction:** The COVID-19 pandemic has prompted a historic global research effort to create a knowledge base that can guide mitigation strategies. This study uses the Scopus database to examine the literature published by Nigerian institutions since the outbreak of COVID-19, with a focus on bibliometric items, global collaboration, Scopus subject area classification, document types, active authors and institutions, journals, highly cited papers, and funding agencies.

**Method:** We searched for articles indexed in the Scopus database between January 1st, 2020 and July 20th, 2022 using predetermined search terms. All article types and study designs were included.

**Results:** During the period under consideration, researchers affiliated with Nigerian institutions published a total of 2,217 COVID-19 papers out of a total of 281,589 global outputs, implying that Nigerian institutions contributed 0.8% of total global COVID-19 scientific output. The majority of the documents published were articles/original research ( $n = 1,455$ , 68.4%). The National Institute of Health was the top funder, and the University of Ibadan was the most active institution. The vast majority of publications (38.3%) were in the field of health sciences, with 1197 papers in the medicine sub-category. The top journal was Pan African Medical Journal, which published 114 COVID-19 papers with at least one Nigerian institution affiliation. The most active collaborator with Nigerian institutions was the United States. With 745 citations, the most cited paper with at least one Nigerian institution affiliation was from the Nigeria Center for Disease Control.

**Conclusion:** Nigerian institutions have contributed to the scientific output of COVID-19. There is, however, a need to improve research capacity across all subject areas.

## 1. Introduction

COVID-19 is a major global public health issue, and Nigeria is not immune [1–3]. As of July 20th, 2022, it had caused over half a billion infections internationally and killed over 6 million people. Since the pandemic's outbreak, researchers across the globe have conducted relevant research in areas such as virology and immunology, transmission of infection and clinical processes, public health, disease treatment and monitoring, experimental therapy, and vaccine development. Bibliometric analysis is an objective evaluation of scientific research that can statistically reveal the science hotspots, emerging trends, and pivotal research institutions of significant academic research activities; clarify ideas for scientific researchers; and serve as a foundation for collaborative research [4]. Understanding contribution to COVID-19 research requires quantifying COVID-19-related publications.

Nigeria had reported over 250,000 cases and approximately 3,100 deaths as of July 20th, 2022. This study examines the literature published by Nigerian institutions since the outbreak of COVID-19 using the Scopus database. We focus on bibliometric items, global collaboration, Scopus subject area classification, document types, active authors and institutions, journals, highly cited papers, and funding agencies in order to provide a resource for COVID-19-related researchers and decision-makers.

## 2. Methods and materials

Scopus was used as the primary and sole database for this bibliometric analysis. This database has over 23,000 more indexed journals (from over 5,000 publishers) than the Web of Science in all scientific fields [5]. Scopus is completely inclusive of Medline, making Scopus far

superior [5,6]. The database offers two search methods: basic and advanced, both of which allow complex and long search queries to be used to achieve a high validity search result. Scopus allows one to search for terms in titles, titles/abstracts, journal names, author names, and affiliations, among others. In fact, both Times Higher Education and QS World Universities use Scopus data to develop and implement their ranking methodologies for universities worldwide [7]. The Scopus database is reputable globally and it is well-known to index papers from quality journals with good peer review systems and editorial oversight.

We develop the search query for an advanced search in the Scopus database. The following query string was utilized for the search - (*TITLE (covid-19 OR sars-cov-2 OR coronavirus OR 2019-ncov OR covid-19 OR coronavirus-19 OR "Coronavirus disease" OR coronaviruses OR "COVID 19" OR covid19 OR 2019ncov OR "severe acute respiratory syndrome coronavirus 2" OR sarscov2 OR sarscov OR "Wuhan virus" OR "Wuhan coronavirus" OR "corona virus" OR betacoronaviruses OR "coronavirus infections") AND AFFILCOUNTRY (nigeria) AND PUBYEAR > 2019 AND PUBYEAR < 2023*).

Any COVID-19 document with at least one author affiliated with a Nigerian institution, including universities, that was indexed in the database between January 1st, 2020 and July 20th, 2022, was eligible for inclusion. There were no language restrictions placed on the search, and all article types were included. Documents that did not meet the inclusion criteria were excluded. Contributions from researchers of Nigerian origin who do not list a Nigerian affiliation on their COVID-19 paper were not counted as contributions from a Nigerian institution. On July 20th, 2022, one of the authors (YAA) extracted data from Scopus and another author (MP) reviewed it for accuracy and fit into our inclusion criteria. To ensure that the search queries fit within the scope of inclusion criteria, they were validated by reviewing the top 100 cited

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**Table 1**

Overview of scientific documents on COVID-19 research in all subject areas with at least a Nigerian research institution affiliation (January 1st, 2020 to July 20th, 2022).

Database Summary {Bibliometric Items}	Total (January 1st, 2020 to July 20th, 2022)
Total documents	2,127
Total citations	16,655
Cited documents	1,377
Average citations	12
<b>Document Type</b>	<b>Number (%)</b>
Article/original research	1,455 (68.4%)
Review	256 (12.0%)
Letter	146 (6.9%)
Note	102 (4.7%)
Book chapter	69 (3.3%)
Conference paper	54 (2.5%)
Editorial	22 (1.0%)
Erratum	10 (0.5%)
Data paper	7 (0.4%)
Short survey	6 (0.3%)
<b>Top 10 Funding Sponsor</b>	<b>Number of Output Funded</b>
National Institutes of Health	58
Bill and Melinda Gates	32
Fogarty International Center	21
Wellcome Trust	18
National Institute of Allergy and Infectious Diseases	16
World Health Organization	16
National Institutes for Health Research	15
European Commission	14
Centers for Diseases Control and Prevention	13
European and Developing Countries Clinical Trials Partnership	12

documents on COVID-19 in Nigeria. This method was used to eliminate potentially misleading data by excluding documents focusing on areas other than COVID-19 and not having at least a Nigerian affiliation on the paper. The Scopus database data was exported to Microsoft Excel. Bibliometric items, Scopus hierarchical classification, types of documents, active authors and institutions, journals, highly cited papers, and funding agencies were all included in the exported data. The data was analyzed using descriptive statistics.

**3. Result and discussion**

Between January 1st, 2020 and July 20th, 2022, the total number of COVID-19-related publications obtained by using COVID-19-related terms as a topic in the Scopus search engine (Title/Abstract/Keywords) without specifying the name of any country was 281,589 publications, reflecting the overall global COVID-19 research output. All the papers yielded in the search results met our inclusion criteria and were included. During the period of our analysis, researchers affiliated with Nigerian institutions published a total of 2,217 COVID-19 papers, according to results from the search query mentioned in the method section. This implies Nigeria has contributed 0.8% of the total global COVID-19 research outputs.

At least 1,377 of the 2,127 publications (64.7%) have been cited at least once, for a total of 16,655 citations. The majority of the documents published (1,455) were articles/original research (68.4%). The National Institute of Health funded 58 documents, with Bill and Melinda Gates funding 32. See Table 1 for more information. These findings reveal that Nigerian institutions are actively contributing to COVID-19 knowledge advancement. However, there is an urgent need for Nigeria to develop strategies based on the contributions of its scientists in order to advance pandemic responses in Nigeria and globally. Bridging the gap between research institutions and industry/national health policymakers is pertinent. Research does not end with the production of scientific data; there is a need to push for the actual translation of findings into policies and practices. Our findings also highlight the importance of

**Table 2**

Distribution of COVID-19 related documents according to the Scopus hierarchical classification and list of top 10 research institutions (January 1st, 2020 to July 20th, 2022).

Subject Area	Scopus Subject Area Classification (number of documents)
Health Sciences (38.3%)	Medicine (1,197); Nursing (46); Health Professions (45); Veterinary (14); Dentistry (8)
Social Sciences and Humanities (22.7%)	Social Sciences (416); Economics, Econometrics and Finance (95); Business, Management and Accounting (78); Arts and Humanities (76); Psychology (64); Decision Sciences (63)
Physical Sciences (18.8%)	Computer Science (160); Environmental Science (127); Engineering (118); Mathematics (103); Astronomy (51); Chemistry (39); Energy (38); Earth and Planetary Sciences (26); Chemical Engineering (16); Physics and Material Science (14)
Life Sciences (17.7%)	Biochemistry, Genetics and Molecular Biology (187); Immunology and Microbiology (180); Pharmacology, Toxicology and Pharmaceutics (108); Agricultural and Biological Sciences (83); Neuroscience (50)
Multidisciplinary (2.5%)	-
<b>Top 10 Research Institutions Based on COVID-19 outputs</b>	<b>Number of publications (number of document citations)</b>
University of Ibadan (including College of Medicine and University Teaching Hospital)	510 (5,321)
University of Lagos (including the College of Medicine and Lagos University Teaching Hospital)	253 (1989)
University of Nigeria	210 (789)
University of Ilorin	145 (1483)
Obafemi Awolowo University (including Obafemi Awolowo University Teaching Hospital)	113 (739)
Bayero University	105 (1209)
Ahmadu Bello University	102 (623)
University of Calabar (including University of Calabar College of Medical Sciences)	101 (895)
Federal University of Technology, Akure	81 (868)
University of Port Harcourt	69 (652)

strengthening research capacity across Nigerian research institutions. Furthermore, the National Institutes of Health funded 58 of the documents indexed in the Scopus database, while the funding sources for 1,743 papers were not specified. However, there were no Nigerian institutions or governments among the top ten funders. This is a call to action for the Nigerian government to increase its investment in research and development.

The majority of the documents (38.3%) were in the field of health sciences, with 1197 documents in the medicine sub-category. Approximately 2.5% of the documents (84) were classified as multidisciplinary. Despite the fact that we did not evaluate the specific area of Scopus topics classification, there is a need for more research output in all subject areas, as well as more multidisciplinary research, to advance the science of COVID-19. The University of Ibadan was Nigeria's leading research institution in terms of scientific outputs (510) and citations (5321), followed by the University of Lagos with 253 scientific outputs and 1989 citations. The Nigeria's Federal Medical Centers (44 publications), the Nigeria Institute of Medical Research (42 publications) and the Nigeria Center for Disease Control (41 publications) were the three leading non-academic institutions in terms of scientific output for COVID-19. More information can be found in Table 2.

From January 1st, 2020 to July 20th, 2022, Pan African Medical Journal was ranked as the top journal, publishing 114 COVID-19

**Table 3**

Top 10 journals, top 10 cited papers and top 10 active authors with at least a Nigerian research institution affiliation (January 1st, 2020 to July 20th, 2022).

Top 10 Journals where COVID-19 documents with at least a Nigerian institution affiliation, from January 1st, 2020 to July 20th, 2022, were published.	Number of COVID-19 document published (number of citations)
Pan African Medical Journal	114 (413)
American Journal of Tropical Medicine and Hygiene	38 (364)
PloS One	33 (240)
BMJ Global Health	25 (237)
Library Philosophy and Practice	24 (17)
Journal of Global Health	20 (72)
International Journal of Infectious Diseases	19 (386)
Scientific African	18 (44)
Frontiers in Public Health	17 (79)
Journal of Medical Virology	16 (244)
Top 10 Cited Papers (January 1st, 2020 to July 20th, 2022)	Name of author (s) with at least a Nigerian (research) institution affiliation
COVID-19: towards controlling of a pandemic. <i>Lancet</i> . 2020 Mar 28;395(10229):1015–1018. <a href="https://doi.org/10.1016/S0140-6736(2030673-5)">https://doi.org/10.1016/S0140-6736(2030673-5)</a> . (Citation = 745)	<b>Ihekweazu C</b> (Nigeria Centre for Disease Control)
Maternal and Neonatal Morbidity and Mortality Among Pregnant Women with and Without COVID-19 Infection: The INTERCOVID Multinational Cohort Study. <i>JAMA Pediatr</i> . 2021 Aug 1;175(8):817–826. <a href="https://doi.org/10.1001/jamapediatrics.2021.1050">https://doi.org/10.1001/jamapediatrics.2021.1050</a> . (Citation = 270)	<b>Galadanci H</b> (Bayero University Kano); <b>Aminu Kano Teaching Hospital</b> , <b>Ayede AI</b> (University of Ibadan), <b>Bako B</b> (Gombe State University, Gombe, Nigeria), <b>Etuk S</b> (University of Calabar), <b>Aminu MB</b> (Abubakar Tafawa Balewa University), <b>Usman MA</b> (Abdullahi Wase Teaching Hospital)
Defining and managing COVID-19-associated pulmonary aspergillosis: the 2020 ECMM/ISHAM consensus criteria for research and clinical guidance. <i>Lancet Infect Dis</i> . 2021 Jun;21(6):e149-e162. <a href="https://doi.org/10.1016/S1473-3099(2030847-1)">https://doi.org/10.1016/S1473-3099(2030847-1)</a> . (Citation = 238)	Medical Mycology Society of Nigeria; <b>Oladele RO</b> (University of Lagos)
COVID-19 vaccine acceptance and hesitancy in low- and middle-income countries. <i>Nat Med</i> . 2021 Aug;27(8):1385–1394. <a href="https://doi.org/10.1038/s41591-021-01454-y">https://doi.org/10.1038/s41591-021-01454-y</a> . Epub 2021 Jul 16. (Citation = 209)	<b>Adejojo O</b> (Busara Center for Behavioral Economics; University of Lagos), <b>Anigo D</b> (Busara Nigeria; Agricultural and Rural Development Secretariat).
More Than Smell-COVID-19 Is Associated With Severe Impairment of Smell, Taste, and Chemesthesis. <i>Chem Senses</i> . 2020 Oct 9;45(7):609–622. <a href="https://doi.org/10.1093/chemse/bjaa041">https://doi.org/10.1093/chemse/bjaa041</a> . Erratum in: <i>Chem Senses</i> . 2021 Jan 1;46. (Citation = 204)	<b>Abdulrahman O</b> (Federal University of Technology)
A critical analysis of the impacts of COVID-19 on the global economy and ecosystems and opportunities for circular economy strategies. <i>Resour Conserv Recycl</i> . 2021 Jan;164:105169. <a href="https://doi.org/10.1016/j.resconrec.2020.105169">https://doi.org/10.1016/j.resconrec.2020.105169</a> . (Citation = 196)	<b>Babatunde KA</b> (Al-Hikmah University),
Fake news and COVID-19: modelling the predictors of fake news sharing among social media users. <i>Telemat Inform</i> . 2021 Jan;56:101475. <a href="https://doi.org/10.1016/j.tele.2020.101475">https://doi.org/10.1016/j.tele.2020.101475</a> . Epub 2020 Jul 30. (Citation = 178)	<b>Apuke OD</b> (Taraba State University)
COVID-19 mental health impact and responses in low-income and middle-income countries: reimagining global mental health. <i>Lancet Psychiatry</i> . 2021 Jun;8(6):535–550. <a href="https://doi.org/10.1016/S2215-0366(2100025-0)">https://doi.org/10.1016/S2215-0366(2100025-0)</a> . Epub 2021 Feb 24. (Citation = 130)	<b>Kola L, Gureje O and Omigbodun O</b> (University of Ibadan), and <b>Ugo V</b> (Mentally Aware Nigeria Initiative)
Revisiting oil-stock nexus during COVID-19 pandemic: Some preliminary results. <i>International Review of Economics &amp;</i>	<b>Salisu AA</b> (University of Ibadan), <b>Ebuh GU and Usman N</b> (Central Bank of Nigeria)

**Table 3 (continued)**

Top 10 Journals where COVID-19 documents with at least a Nigerian institution affiliation, from January 1st, 2020 to July 20th, 2022, were published.	Number of COVID-19 document published (number of citations)
Finance. 2020 Sep;69:280–94. <a href="https://doi.org/10.1016/j.iref.2020.06.023">https://doi.org/10.1016/j.iref.2020.06.023</a> . (Citation = 121)	
Potential inhibitors of coronavirus 3-chymotrypsin-like protease (3CL <sup>pro</sup> ): an <i>in silico</i> screening of alkaloids and terpenoids from African medicinal plants. <i>J Biomol Struct Dyn</i> . 2021 Jun;39(9):3396–3408. <a href="https://doi.org/10.1080/07391102.2020.1764868">https://doi.org/10.1080/07391102.2020.1764868</a> . Epub 2020 May 18. (Citation = 117)	<b>Gyebi GA</b> (Salem University), <b>Ogunro OB</b> (KolaDaisi University), <b>Adegunloye AP</b> (University of Ilorin), <b>Ogunyemi OM</b> (Salem University), <b>Afolabi SO</b> (University of Ilorin)
Top 10 active authors in COVID-19 papers in Nigeria (Rank)	Number of Documents (Affiliation)
Adebisi, Y.A. (1st)	34 (University of Ibadan)
Aborode, A.T. (1st)	34 (Healthy Africans Platform)
Ihekweazu, C. (2nd)	21 (Nigeria Centre for Disease Control)
Ilesanmi, O.S. (2nd)	21 (University of Ibadan)
Folayan, M.O. (3rd)	20 (Obafemi Awolowo University)
Awotunde, J.B. (3rd)	20 (University of Ilorin)
Adiukwu, F. (4th)	15 (University of Port Harcourt)
Osibogun, A. (4th)	15 (University of Lagos)
Sam-Agudu, N.A. (4th)	15 (Institute of Human Virology)
Abayomi, A. (5th)	14 (Lagos State Ministry of Health)
Ogundokun, R.O. (5th)	14 (Landmark University)

documents with at least one Nigerian institution affiliation. The same journal was also the most cited in terms of published documents. There was no Nigerian journal among the top ten. The Nigerian Postgraduate Medical Journal was ranked 11th and the Nigerian Journal of Clinical Practice was ranked 32nd. This is a call to invest in strengthening local journals in Nigeria in order to achieve comparable indexing status and scientific standards to those of the world’s top journals. The most cited paper with at least a Nigerian institution affiliation was from the Nigeria Center for Disease Control, with 745 citations, while the most active authors were from the University of Ibadan (academic research institution) and Healthy African Platform (non-academic research organization), both with 34 research outputs. More information can be found in Table 3. Fig. 1 also shows the collaboration between Nigerian research institutions and the top 10 non-Nigerian countries in scientific output on COVID-19. These collaborations were mostly with researchers from the USA (n = 450 papers), followed by the UK (n = 444 papers).

Bibliometric studies offer intriguing methods for determining the scientific value of a particular field over time. To the best of our knowledge, this is Nigeria’s first bibliometric study of COVID-19 research output. However, our study has some limitations. Our analysis is solely based on Scopus-indexed papers up until the time of data extraction on July 20th, 2022. In addition, as with any other bibliometric study, we were dependent on the indexing quality of the Scopus database. PubMed and Web of Science, for example, were not included in the analyses because the Scopus database is considered the most accurate and complete database of articles published and citations. There is no flawless search query, and there is always the possibility of misclassification. However, we included measures as stated in the method section to minimize such errors. The ranking of institutions presented in our study was based on Scopus data. Due to the ever-changing nature of COVID-19 research, the number of documents and citations will fluctuate over time.

**4. Conclusion and recommendations**

Nigerian institutions are actively contributing to COVID-19 scientific knowledge advancement. For example, the first COVID-19 genomic sequencing in Africa was performed by Nigeria’s institutions [8].

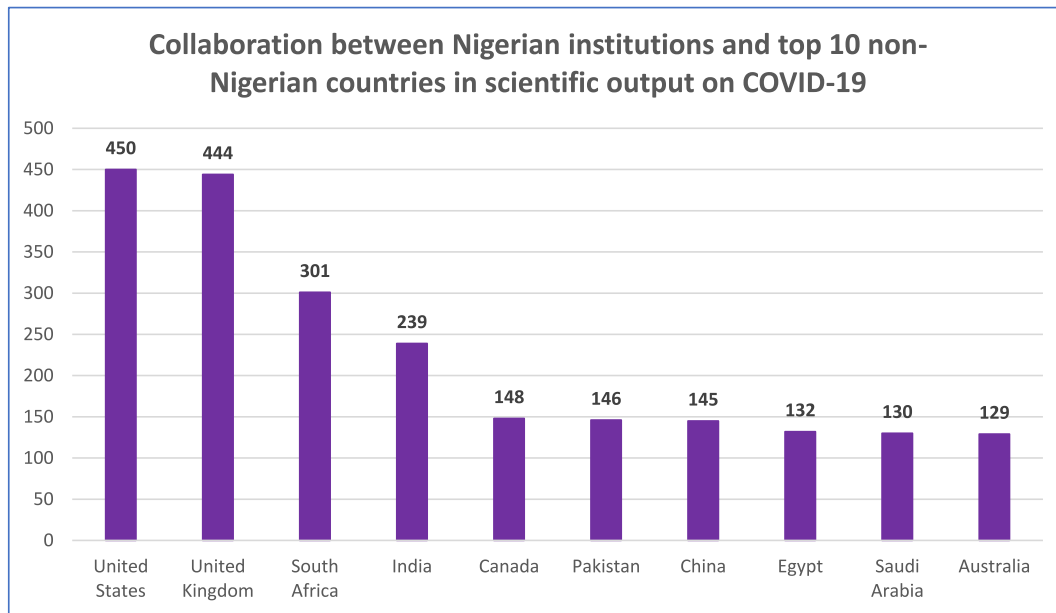


Fig. 1. Collaboration between Nigerian institutions and top 10 non-Nigerian countries in scientific output on COVID-19.

However, there is an urgent need to build the country’s research capacity and facilitate the application of scientific knowledge generated by its researchers, across all subject area, to contribute to development. Nigeria has a population of over 200 million people, investing in meaningful research is critical to its development. According to our findings, Nigeria contributed only 0.8% of the global COVID-19 research output. This is low, and it emphasizes that COVID-19 response is not always dependent on local data, but rather on adapting global policies and those of health institutions around the world. Developing local data to understand disease trends remains an important way for countries to respond appropriately to any public health emergencies. Nigeria needs to improve its capacity to respond to health issues, and investing in research is one important way to do so.

Amid the COVID-19 pandemic, federal and state academic universities, which represent the majority of academic research institutions in Nigeria, have gone on strike for an extended period of time. This demonstrates that Nigeria’s academic institutions are still underappreciated as key contributors to the country’s knowledge economy and development strategies. A university should be more than just a place for teaching and learning; it should be a major hub for the generation of valuable knowledge that can facilitate innovation and development. Nigeria needs knowledge economy which is evidence-driven. The COVID-19 pandemic has confirmed this, and national stakeholders must revitalize Nigerian universities so that they can meet the country’s development needs in terms of impactful knowledge generation.

**Ethical approval**

Not Required.

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None.

**Author contribution**

Yusuff Adebayo Adebisi developed the study method, extracted data and performed data analysis, wrote the first draft of the paper. Mkpouto Pius came up with the idea and contributed to the first draft of the paper and revised it. All the authors approved the paper for final publication.

**Registration of research studies**

- 1 Name of the registry: Not Applicable.
- 2 Unique Identifying number or registration ID: Not Applicable.
- 3 Hyperlink to your specific registration (must be publicly accessible and will be checked): Not Applicable.

**Guarantor**

Yusuff Adebayo Adebisi.

**Declaration of competing interest**

None.

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