

Africa's contribution to the science of the COVID-19/SARS-CoV-2 pandemic

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INTRODUCTION

'Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world', said Louis Pasteur. Over 200 years after this statement, scientists of various disciplines worldwide are today racing against time to understand a new infecting virus, SARS-CoV-2, in order to develop safe and effective interventions to control a raging pandemic. Scientists typically work quietly at a planned pace, but the COVID-19 pandemic altered the priority, methodology and speed by which science is conducted, communicated and translated.¹ Haste to find answers could yield unusable or untrustworthy results, which is an early lesson of this paradigm shift.² Paradoxically, the scientific and technological advancements of the 21st century offer assurance for a fast end to the pandemic, but on the other hand, the globalised communication infrastructure fosters anxiety in the population. Global transmission of SARS-CoV-2 was initially facilitated by fast transport movements, while high-speed internet enabling 24 hours live streaming of news and ubiquitous social media transmitted fear and misinformation, including fake news and hoaxes, which promote erroneous practices that increase the spread of the virus.³

The SARS-CoV-2 outbreak started suddenly in November 2019, and by March 2020, the WHO declared it a pandemic. The first confirmed case in Africa was reported in February 2020. By June, projections suggested that Africa could be the next epicentre because of weak health systems, slow response and limited success of lockdown and social distancing interventions in many countries.⁴ Although, opinions vary about the different patterns of SARS-CoV-2 spread in Africa compared with that in the global north.⁵ At the current rate, it appears that the virus is spreading more slowly and potentially with a less severe outcome in Africa despite the limitations of research data.⁵ Thus, African scientists need to generate more epidemiologic evidence on SARS-CoV-2 and all areas of science to fill the data gap that will help explain the African

Summary box

- ▶ Compared with other parts of the world, the spread of COVID-19 in Africa appears to be different and potentially with a less severe outcome; Africans publishing on COVID-19 in Africa is important for creating locally relevant knowledge to address the pandemic.
- ▶ Africans contributed just 3% of the global share of 36 326 indexed publications on SARS-CoV-2/COVID-19 at 10 months into the pandemic.
- ▶ There were two dominant African COVID-19 publication coauthorship clusters mainly involving South Africa, Egypt and Nigeria; these link to over 100 African and non-African countries.
- ▶ African research groups should intensify and sustain intracontinental collaboration to generate a more accurate picture of what is going on in Africa as the pandemic evolves.
- ▶ Active research in Africa that culminates in collaborative networks within the continent will be a means to impact on preparedness for future emerging infections.

situation and develop suitable interventions considering that a one size fits all response is unlikely to work for different settings.⁶

Scientific publications have been the medium of disseminating knowledge to scientists and the public for centuries. Rapid communication of knowledge by scientists and diverse stakeholders is vital for timely translation into solutions that could mitigate the multidimensional impact of COVID-19.⁷ We hypothesised that African scientists could independently create locally relevant knowledge as the COVID-19 pandemic disrupts international networks and systems. Therefore, in this review, we aimed to describe African contributions to the science of COVID-19 during the initial 10 months of the pandemic.

MEASURING AFRICA'S CONTRIBUTION TO COVID-19 SCIENTIFIC LITERATURE

Our search term listed all the African countries and the eligible publications comprised

of all indexed 'COVID-19 or SARS-CoV-2' literature with any author reporting single or multiple affiliations to organisations located in an African country. We searched Scopus (n=1130), Web of Science (n=707) and PubMed (n=987) databases in all fields for eligible documents published between 1 November 2019 and 4 August 2020. Scopus was used for detailed bibliometric analysis because it covers a wider journal range than PubMed and Web of Science, of help both in keyword searching and citation analysis, and its citation analysis is faster and includes more articles.⁸ Using countries as the unit of analysis, we compared global publication characteristics of documents with an African institutional affiliation. The global and African scientific productivity and impact were assessed using the h-index, which expresses the number of articles (h) that have received at least h citations.

Additionally, bibliometric mapping and network visualisation tool, VOSviewer,⁹ was used to analyse contents of the titles, abstracts and keywords of the extracted publications from Scopus, and we visualise the results as a bubble map. The font size of the countries in the bubble map indicates the frequency of occurrence of an authors' institution (multiple appearances in a single publication count as one) in COVID-19 publications. Two countries are nearer to each other if they cooccurred (had coauthorship) in COVID-19 publications more frequently. The coauthorship relationship connects countries (visualised as nodes) on a document (visualised as lines). Clusters of related countries visualised as a variety of colours represent different collaboration networks and coauthorship clusters of COVID-19 publications involving Africans and non-Africans.

THREE PER CENT OF THE GLOBAL COVID-19 PUBLICATIONS WERE CONTRIBUTED BY 42 AFRICAN COUNTRIES

Globally, a total of 36 326 documents on SARS-CoV-2 covering 27 subject areas were published 10 months into the pandemic in August 2020 (table 1). Forty-two African countries produced 1130 documents (cited 2923 times), representing 3% of the global share of COVID-19 publications. The global h-index of COVID-19 publications is 260 (of all documents considered for the h-index, 260 have been cited at least 260 times), while the h-index for Africa is 42. The global and African distribution of COVID-19 publications were comparable by access type (open access: global, 82%; Africa, 82%), publication status (final: global, 72%; Africa, 74%) and document type (article, letter, review and editorial: global, 49%, 20%, 11% and 9%; Africa, 49%, 18%, 13% and 8%). Africans published in 4 (English, 97.6%; French, 2%; Spanish, 0.3%; Arabic, 0.1%) out of the 27 languages represented in the COVID-19 literature. The most represented subject areas were medicine (global, 76%; Africa, 68%), biochemistry, genetics and molecular biology (global, 10%; Africa, 11%), social sciences (global, 8%; and Africa, 9%), immunology and microbiology (global,

7%; Africa, 9%). African-authored COVID-19 articles were published in 159 journals and almost a 10th was in three journals; South African Medical Journal (n=43, 4%), Lancet (n=27, 2%) and International Journal of Infectious Diseases (n=21, 2%).

Sixty-five per cent of the published documents by Africans on COVID-19 were from just three countries: South Africa, Egypt and Nigeria (figure 1A). South Africa, Egypt and Nigeria top the gross domestic product (GDP) ranking for Africa and account for 67% of reported COVID-19 in the continent (figure 1B), which could explain the high number of COVID-19 publications in these countries. There were two dominant African COVID-19 publication coauthorship clusters (figure 2) mainly involving these three countries. A coauthorship cluster linking South Africa and Nigeria with USA, UK and many of the sub-Saharan African countries, while, a second coauthorship cluster links Egypt to North African, Middle Eastern and Mediterranean countries. There are three other peripheral coauthorship clusters linked to the two dominant coauthorship clusters involving 107 countries across the world. Our results show that publications bearing Africans as first authors constitute 57% of COVID-19 publications with at least one African author. A quarter of the COVID-19 publications by Africans stated a foreign funding sponsor. We also found that 572 (out of 1130) published documents on COVID-19 by Africans have coauthors from institutions in the USA, UK and Italy (figure 1C).

Over the last 2 years, the annual scientific publication count by Africans is 26 077 in 2018 and 28 158 in 2019 (Scopus). In contrast, the tally for the first 8 months of 2020 is 19 856 publications. This period coincides with the beginning of the COVID-19 pandemic that triggered a sudden and intense scientific productivity aimed at its mitigation across the world. African and global institutions responded to the pandemic by altering priorities and allocating more resources to focus on SARS-CoV-2 research and development of interventions; these results are being documented and published. Consequently, there is an unprecedented increase of scientific publications, preprints and citations about COVID-19 in less than a year, greater than the H1N1 and Ebola outbreaks within the same period in the last two decades (figure 1D). Post outbreaks, H1N1 and Ebola publication rates appear to peak, followed by a sustained publication output with an average publication count of 5630 and 3182 articles per year for H1N1 (2010 to 2020) and Ebola (2015 to 2020). We expect the same pattern of sustained publication output of COVID-19 publication for several years because of delays in the publication production process and the overwhelming effect of this novel virus on human society and its systems. However, this sustained publication rate is expected to peak with time in view of the unprecedented international research funding calls to understand the pandemic and mitigating its health impacts in low and middle-income countries contexts.

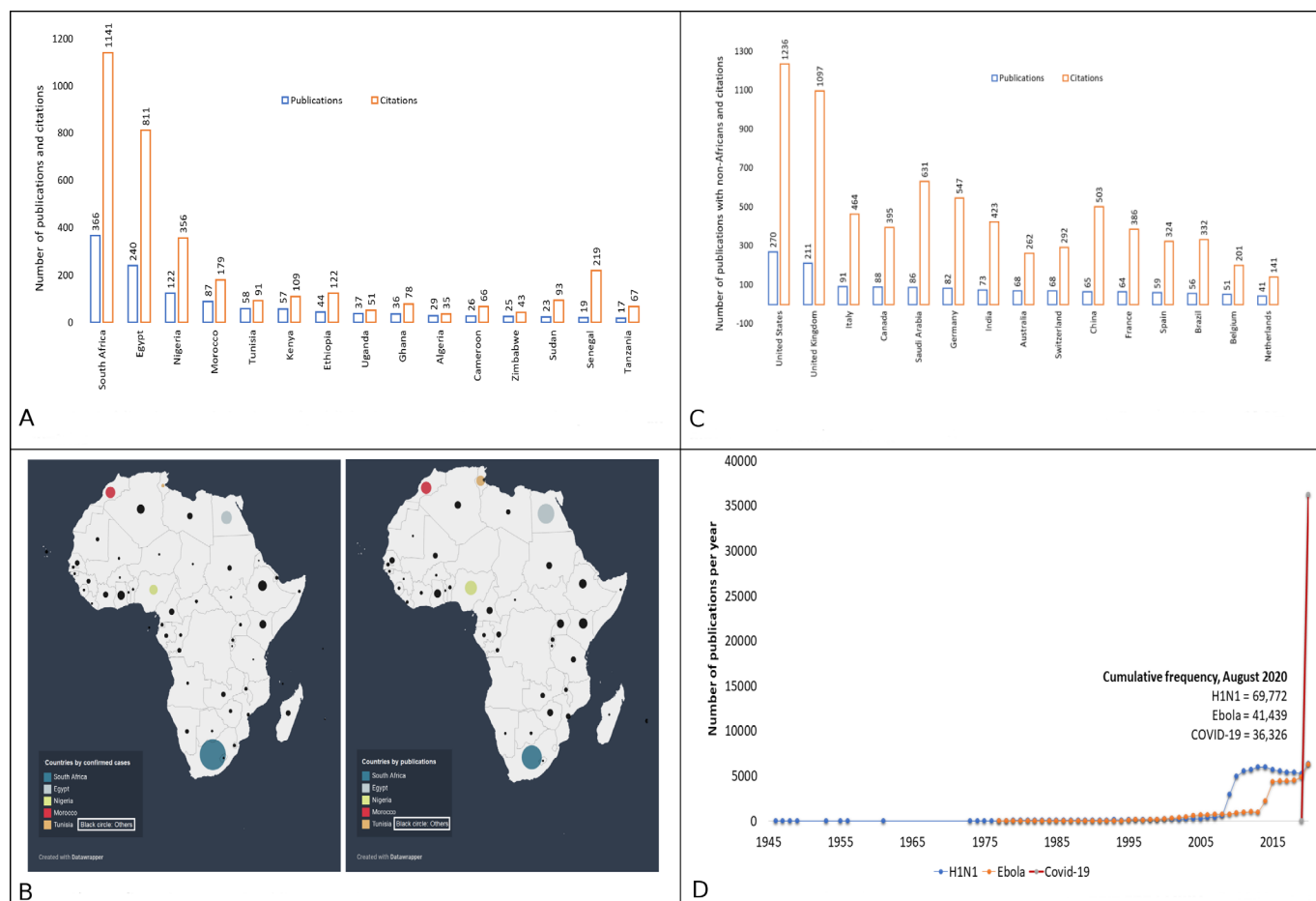


Figure 1 (A) Publications and citations of published COVID-19 documents of top 15 African countries. (B) COVID-19 publications and citations of top 15 non-African countries coauthored with Africans, August 2020. (C) Confirmed cases and publications of COVID-19 in Africa, August 2020. (D). Trend of worldwide publications on H1N1, Ebola and COVID-19, 1946–2020.

THE COVID-19 PANDEMIC AS A USEFUL MODEL FOR IMPROVING RESEARCH PRODUCTIVITY IN AFRICA

Our observation reaffirms previously documented increases in publication output recorded for Africa over the last two decades,¹⁰ when the national gross domestic product was identified as the only independent predictor. Prior to the rising incidence of emerging infections in Africa, the contributions of Africans in global scientific publications were limited and might be attributed to poor investments in capacity building and research in African institutions. With increasing deployment of international resources during epidemic outbreaks that is equally encouraging African governments to contribute to matching funds for research and services, African health researchers are poised to play critical leadership roles in research and clinical trials on COVID-19 in the continent. The current COVID-19 clinical trial landscape shows more than 3017 clinical trials implemented globally as of August 2020, and foreign organisations fund most of the 30 (1%) in various stages in Africa.¹¹ The US National Institutes of Health funding opportunities and Global Effort on COVID-19 Health Research of the UK National Institute for Health Research, for example,

are aimed to support applied health research that will address COVID-19 knowledge gaps prioritising epidemiology, clinical management, infection control and health system responses. The responses to such calls by African research institutions will expect to see an unparalleled increase in African contribution to scientific literature.

African contributions to COVID-19 literature was assessed in this study using the largest abstract and citation databases of peer-reviewed publications, including scientific journals, books and conference proceedings.⁸ The COVID-19 publication rate is rapidly evolving, and it might be too early to assess the cumulative impact of COVID-19 literature on overall scientific output. Our search strategy did not cover the preprint servers because of the possibility of double counting the preprint articles and their published versions indexed in the databases we used for our analysis. Although, preprints do not affect existing publication and citation metrics in Scopus. The h-index (citation count) might not be precise since there is not enough time for published articles to be cited, or the published COVID-19 documents archived in the databases could have been used a lot during the pandemic period. We do not expect a significant effect



COVID-19 pandemic is a useful model for improving research productivity in general. Our findings indicated a robust African capacity to generate locally relevant knowledge and innovations for Africa.^{12 13} For example, an African-led group reviewed several hypotheses to explain the low morbidity and mortality of COVID-19 in Africa.¹⁴ African research groups are in an excellent position to intensify and sustain intracontinental collaboration to more accurately describe what goes on in Africa as the pandemic evolves. Based on our findings, we posit that African governments should increase research resource allocations needed to build trust for academic institutions that will rapidly catalyse the contribution of African-led research in infectious diseases. African researchers have the potential to focus on understanding why SARS-CoV-2 morbidity and mortality rates are lower in Africa as well as to explore the safety, effectiveness, hesitancy or acceptability, affordability and logistics of COVID-19 vaccination in the African setting. Answers to these questions would help authorities plan for mass vaccination now that viable vaccines are starting to be approved for use. The long-term collaboration of African scientists necessitates the continuous implementation of strategies for boosting scientific productivity in Africa, not only for SARS-CoV-2 but also for all sciences.¹⁵

The COVID-19 pandemic has caused a pressing need to generate reliable and relevant evidence for a robust and sustainable global response. The African experience presents both challenges and opportunities for research and development. Despite the unusual circumstances such as inadequate research funds and lower capacity, African scientists have made valuable contributions to the science of COVID-19. The severe health system disruption and the selective attention and diversion of resources to COVID-19 could adversely affect other health and research priorities. Nonetheless, the attention and interest of multiple stakeholders on COVID-19 could increase funding and collaboration opportunities for African researchers. The COVID-19 research landscape should call for an introspection of Government resource allocation and support for African research. The unprecedented initiative by African researchers to contribute to the knowledge of COVID-19 is a testimony that the growth of world-class competitive research by Africans can impact on the continents health landscape if governments give it the required attention.

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