What has been researched about monkeypox? a bibliometric analysis of an old zoonotic virus causing global concern

Alfonso J. Rodríguez-Morales[1,2,3,4,5], **Yeimer Ortiz-Martínez**[6,7] **and D. Katterine Bonilla-Aldana**[1,2,3,4]

1) *Grupo de Investigación Biomedicina, Faculty of Medicine, Fundación Universitaria Autónoma de las Américas, Pereira, Risaralda, Colombia,* 2) *Committe on Tropical Medicine, Zoonoses and Travel Medicine, Colombian Association of Infectious Diseases (ACIN), Bogota, Colombia,* 3) *Faculty of Medicine, Fundación Universitaria de las Américas, Sede Pereira, Pereira, Risaralda, Colombia,* 4) *Institución Universitaria Visión de las Américas, Pereira, Risaralda, Colombia,* 5) *Master of Clinical Epidemiology and Biostatistics, Universidad Cientifica del Sur, Lima, Peru,* 6) *Department of Internal Medicine, 469618 Universidad Industrial de Santander, Bucaramanga, Colombia and* 7) *Faculty of Health Sciences, 28000 Universidad de Sucre, Sincelejo, Colombia*

Keywords: Monkeypox, orthopoxvirus, outbreak, poxviridae, zoonotic

Original Submission: 24 May 2022; **Accepted:** 25 May 2022

Article published online: 31 May 2022

Corresponding author: Alfonso J. Rodríguez-Morales, Universidad Cientifica del Sur, Lima, Peru.

E-mail: arodriguezmo@cientifica.edu.pe

Monkeypox has recently emerged as a cause of global concern, particularly in Europe, even leading to the World Health Organization (WHO) to hold an emergency meeting on May 20, 2022, to discuss the recent outbreak and its implications [1]. Monkeypox is a DNA orthopoxvirus endemic in Africa [2]. That is a zoonotic virus, primarily transmitted from animals, especially from some rodent species, usually leading to mild self-limited infections manifesting with fever and rash. The list of countries affected by this poxvirus is growing, most of them in Western Europe but even in Latin America, with Argentina reporting suspected cases. But, a question around this zoonosis is how much has been researched and published internationally about it.

A bibliometric analysis was done, using available information retrievable in 4 bibliographical databases to assess the status of monkeypox-related literature worldwide. PubMed, Scopus, CrossRef, and Google Scholar, using the application Publish or Perish® v.8, were examined, using the term "monkeypox" at the article title as the primary search operator, up to December 31, 2021.

Only 439 monkeypox related articles were indexed in Scopus, 425 in PubMed, and 454 in CrossRef up to December 31, 2021. The median of articles from 1964-to 2021 was 4, 3, and 2, respectively. Since 1964, the most critical year for change in the number of articles was 2003 (Figure 1), with the US Outbreak. From 2003 to 2021, the median of articles increased to 16, 16, and 19, respectively. Nevertheless, the highest number of articles on monkeypox was 2020 at CrossRef with 37 (Figure 1). The top countries with more publications are the USA (253), Switzerland (34), and Congo (27) (Figure 1), corresponding to institutions such as the US CDC (107), the WHO (40), the US Army Medical Research Institute of Infectious Diseases (36), the NIAID among others (Figure 1).

At Scopus and CrossRef, the H-index of the topic is relatively low, with a value of 56 and 53, respectively (Figure 1). The highest cited article has 387 citations so far, at Scopus and CrossRef, the description of the 2003 US Outbreak, compromising 11 cases of confirmed monkeypox infection [3]. This article has been cited in 198 articles indexed in PubMed. A piece to be revisited during the ongoing 2022 multicountry outbreak. Just between January 1st and June 15, 2022, 93 articles are available now in PubMed; double than in 2003 (50), the year with highest number of article before 2022.

As far as we are concerned about monkeypox as a threat, we also can realize now, with the current findings, that still there is a lack of the research on this emerging zoonotic virus, even compared to other emerging pathogens (e.g. SARS-CoV-2, Zika, chikungunya) [4–6]. For example, for chikungunya, up to 2014, there were 5.8 times more articles in Scopus (2579) than for monkeypox up to 2021 [6]. An issue noticed is that half of the publications came out during the last 14 years (after 2008), which can be explained partly by the fact that before, most cases occurred only in African countries [7,8]. This bibliometric assessment indicates the need for more research on this reemerging virus, which is currently expected due to the ongoing outbreak.

https://doi.org/10.1016/j.nmni.2022.100993

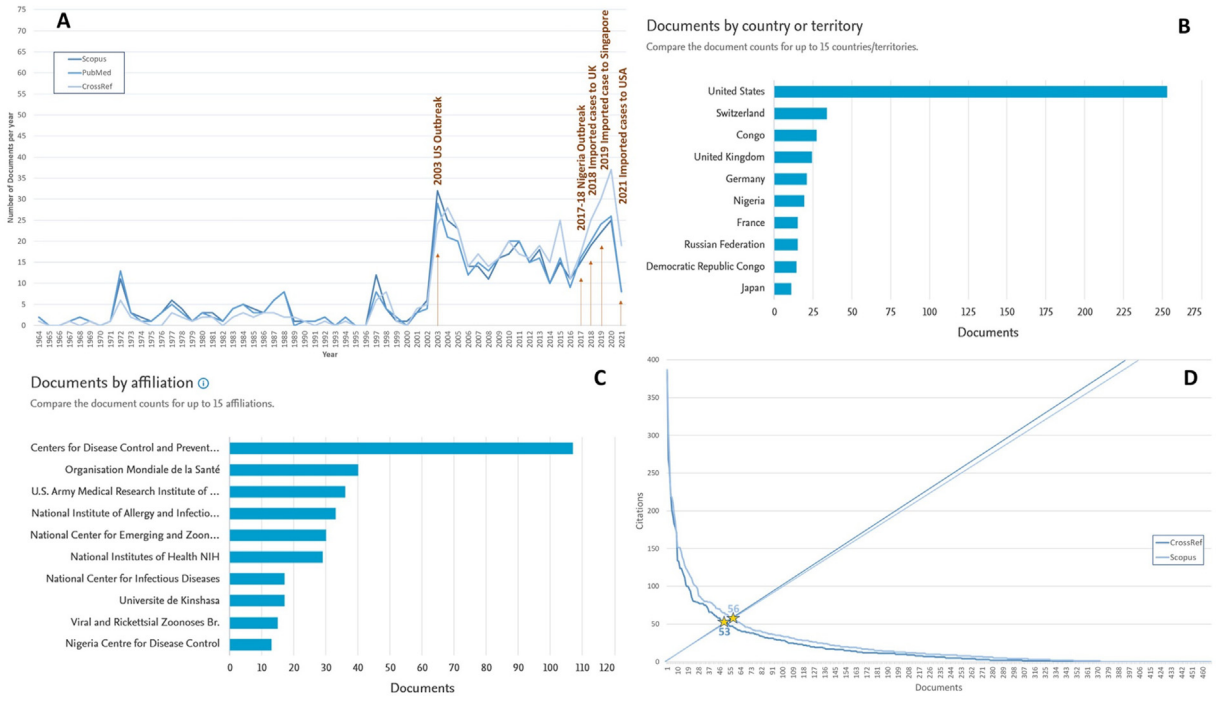

FIG. 1. Research trends by year (A), geographical origin (B), institutions (C), and H index (D), on Monkeypox, from 1964 to 2021, at Scopus, PubMed, and CrossRef.

Conflicts of interest

A. J. Rodriguez-Morales, reports being a medical advisor of Abbott Diagnostics, Amgen, Roche, and Takeda for Latin America, outside the submitted work. The rest of the authors declare no conflict of interest.

References

[1] WHO. WHO working closely with countries responding to Monkeypox. URL: https://www.who.int/news/item/20-05-2022-who-working-closely-with-countries-responding-to-monkeypox. [Accessed 23 May 2022].

[2] Fenollar F, Mediannikov O. Emerging infectious diseases in Africa in the 21st century. New Microbes New Infect 2018 September 21;26:S10–8. https://doi.org/10.1016/j.nmni.2018.09.004. PMID: 30402238; PMCID: PMC6205565.

[3] Reed KD, Melski JW, Graham MB, Regnery RL, Sotir MJ, Wegner MV, Kazmierczak JJ, Stratman EJ, Li Y, Fairley JA, Swain GR, Olson VA, Sargent EK, Kehl SC, Frace MA, Kline R, Foldy SL, Davis JP, Damon IK. The detection of monkeypox in humans in the Western hemisphere. N Engl J Med 2004 January 22;350(4):342–50. https://doi.org/10.1056/NEJMoa032299. PMID: 14736926.

[4] Bonilla-Aldana DK, Quintero-Rada K, Montoya-Posada JP, Ramírez-Ocampo S, Paniz-Mondolfi A, Rabaan AA, Sah R, Rodríguez-Morales AJ. SARS-CoV, MERS-CoV and now the 2019-novel CoV: have we investigated enough about coronaviruses? - a bibliometric analysis. Travel Med Infect Dis 2020 Jan-Feb;33:101566. https://doi.org/10.1016/j.tmaid.2020.101566. Epub 2020 Jan 30. PMID: 32007621; PMCID: PMC7129460.

[5] Martinez-Pulgarin DF, Acevedo-Mendoza WF, Cardona-Ospina JA, Rodríguez-Morales AJ, Paniz-Mondolfi AE. A bibliometric analysis of global Zika research. Travel Med Infect Dis 2016 Jan-Feb;14(1):55–7. https://doi.org/10.1016/j.tmaid.2015.07.005. Epub 2015 Jul 29. PMID: 26257029.

[6] Vera-Polania F, Muñoz-Urbano M, Bañol-Giraldo AM, Jimenez-Rincón M, Granados-Álvarez S, Rodriguez-Morales AJ. Bibliometric assessment of scientific production of literature on chikungunya. J Infect Public Health 2015 Jul-Aug;8(4):386–8. https://doi.org/10.1016/j.jiph.2015.03.006. Epub 2015 Apr 28. PMID: 25937447.

[7] McConnell S, Herman YF, Mattson DE, Huxsoll DL, Lang CM, Yager RH. Protection of rhesus monkeys against monkeypox by vaccinia virus immunization. Am J Vet Res 1964 Jan;25:192–5. PMID: 14103224.

[8] Ladnyj ID, Ziegler P, Kima E. A human infection caused by monkeypox virus in Basankusu Territory, Democratic Republic of the Congo. Bull World Health Organ 1972;46(5):593–7. PMID: 4340218; PMCID: PMC2480792.