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LETTER TO THE EDITOR

Bibliometric assessment of scientific production of literature on chikungunya

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Dear Editor,

During the last decade, chikungunya (CHIK) has emerged as a public health threat in Africa, the Indian Ocean region, Southeast Asia and the Pacific Islands and in Europe and Latin America [1,2]. In this last region in 2013, but particularly in 2014, epidemics in the Caribbean islands extended to continental countries, which then became endemic [2,3]. This emerging arboviral disease in the Americas, including local transmission in Florida and imported cases in other states, has generated great concern and had a significant impact on research and publications on the disease, as will be seen here.

To assess the current impact of chikungunya-related scientific production across the world, a bibliometric analysis was conducted using available information deposited at major biomedical and multidisciplinary journal-indexing databases, such as Science Citation Index (SCI), Scopus, Medline (using GoPubMed®), SciELO (Scientific Electronic Library Online), LILACS (Latin American Literature on Health Sciences) and Google Scholar. As our search strategy, data on indexed articles were retrieved from those databases using the term ''chikungunya'' as a main operator for analytical purposes.

Using SCI, 1734 articles were recovered (up to December 2014) (24.8% from the USA, 22.4% from France and 18.9% from India). Using Scopus, there were 2579 articles (16.5% from India, 9.5% from Réunion Island and 5.3% from Italy). Medline retrieved 2018 articles (14.1% from India, 12.5% from France and 12.1% from the USA). A search using SciELO retrieved only 13 articles (two from Brazil, two from France and two from Spain, among others), whereas LILACS had seven articles (five from Brazil, one from Australia and one from Colombia). Using Google Scholar, 15,800 records were found (54.9% from the USA, 44.7% from France and 42.6% from India) (Table 1). In addition, in 2014 alone, between 14% (Scopus) and 21% (Google Scholar) of the historical number of articles on chikungunya were published on Scopus and Google Scholar (Fig. 1). The formative event, as seen from these analyses, was probably the epidemic of CHIK in Réunion Island in 2005—2006 [4]. After 2005, the number of articles per year changed from less than 50 per year (at Medline during 1957—2005) to an increasing trend in next decade, climbing from eight in 2005 to 302 in 2014 (Fig. 1). If we consider France and Réunion Island together, this would make France the leader in research on CHIK (Table 1).

This study has demonstrated the leading role that the USA, India and France play in chikungunya research (Fig. 1). Between 1977 and 2014, 29 articles (1% of published research indexed on Scopus) were from the Institut Pasteur, Paris (18 in 2014), followed by the National Institute of Virology, India, with 27 articles (1.1%) (7 in 2014). The Centers for Disease Control and Prevention, USA, the U.S. Naval Medical Research Unit No. 3, Egypt, and the U.S. Naval Medical Research Unit No. 2, Jakarta, contributed 16 articles (0.6%) (10 in 2014) (Fig. 1). This is not surprising given that these countries have played an important role in fostering international cooperation on chikungunya research and control, and in the case of France, this is not surprising as Réunion Island is one of the overseas departments of France.

The large impact on scientific output in reference to chikungunya research reflects its global

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Table 1 Top 20 countries with scientific production on chikungunya research at SCI, Scopus and/or Medline (up to December 1, 2014).

Rank	Country	Number of articles	Database with highest number of articles
1	United States	430	SCI
2	India	425	Scopus
3	France	388	SCI
4	Réunion Island	244	Scopus
5	Italy	137	Scopus
6	Singapore	92	SCI
7	Australia	82	SCI
8	United Kingdom	82	SCI
9	Germany	79	SCI
10	Thailand	74	Scopus
11	Malaysia	61	Scopus
12	Congo	57	Scopus
13	Netherlands	41	SCI
14	Spain	39	SCI
15	Indonesia	39	Scopus
16	Sri Lanka	35	Scopus
17	Mauritius	34	Scopus
18	Sweden	33	SCI
19	Japan	32	SCI
20	Comoros	32	Scopus

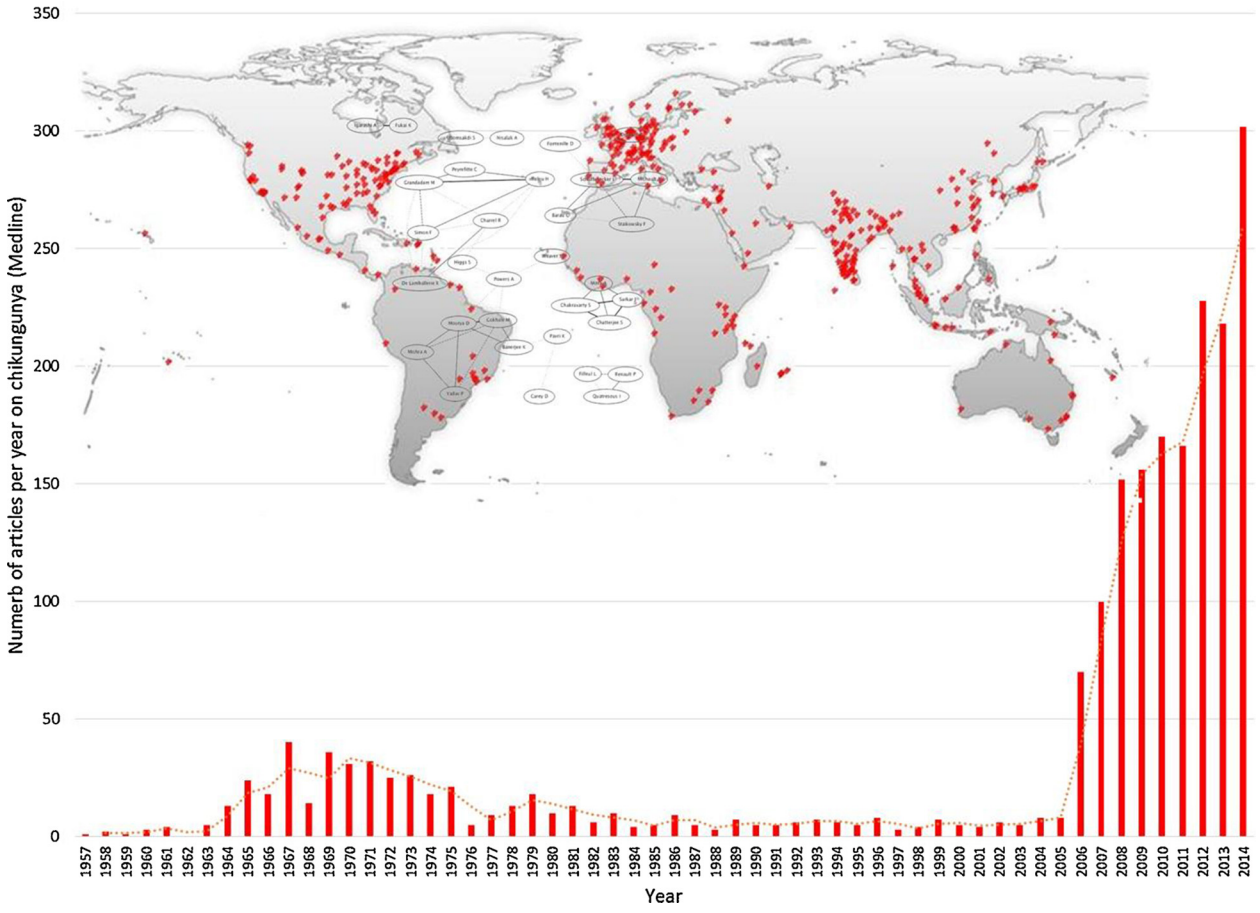

Figure 1 Major international research cooperation networks and trends in time of publication on chikungunya, 1957—2014
Source: from GoPubMed®.

influence as a potentially devastating disease. That said, the global map of scientific collaboration networks and production (Fig. 1) clearly demonstrates the prioritization in searches for a suitable vaccine as well as effective antivirals and drugs for treatment of chronic manifestations of CHIK.

One interesting fact is that although Latin America is experiencing the first epidemic of CHIK with both imported and autochthonous cases, due to the previous presence of *Aedes aegypti* transmitting dengue, there is still less research on CHIK from this region. There are 23 articles from Brazil at SCI, nine at Medline and 12 at Scopus, but there are many other countries, such as Venezuela and Colombia that, although they are highly endemic, little research on CHIK has emerged in response to the epidemics [2,3,5]. The results herein have demonstrated the ongoing expansion of clinical, epidemiological and virological literature in reference to CHIK. However, a real challenge for Latin America is posed given the expansion of this arboviral emerging disease. Concurrently, and of great relevance, is the sharp increase in the number of outputs related to vaccine candidates and the immunological aspects of CHIK. More cooperation between south—north and south—south, would be expected in regard to this tropical vector-borne disease (Fig. 1).

Bibliometric assessments in infectious diseases are of utmost importance, not only to correlate the needs for research in certain conditions such as CHIK but also, as shown here, to provide an accurate overview of scientific output over time and its future impact [6,7].

Finally, as has been stated, it is time to translate the research findings generated over the past decade into effective and palpable pharmaceutical products aimed at controlling tropical viruses with epidemic potential and to prioritize major interventions directed to reduce and control the negative impacts of infectious diseases such as CHIK [6,8].

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Competing interests

None declared.

Ethical approval

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