

TECHNOLOGY MONITORING ON THERAPEUTIC AND VACCINE PATENTS FOR ZIKA VIRUS INFECTION

Viveiros-Rosa, S.G^{1*}; Santos, W.C¹;

¹Federal Fluminense University, Mario Viana Street, 523, Santa Rosa, Niterói, Rio de Janeiro, Brazil

*{sandrogvr@gmail.com }

Introduction

Zika virus (ZIKV) is transmitted throughout bites of *Aedes aegypti* (Linnaeus) and *Aedes albopictus* (Skuse) mosquitoes [1,2]. Although ZIKV infection may remain in most cases asymptomatic or with light symptoms, in 2018, the Pan-American Health Organization informed a total of 3,715 cases confirmed of the congenital ZIKV syndrome (CZS) infection in the Americas from 2015 – 2017 [3], with 99 cases in the USA and 2952 cases in Brazil, the most affected country. CZS includes microcephaly, eye abnormalities, craniofacial disproportion, and/or articular deformities [1]. In addition, from 2015 to 2019, 402 fetal, neonatal, and pediatric deaths occurred due to ZIKV infection in Brazil [4].

Currently, there are no vaccines or drugs approved for the treatment of ZIKV infection [1,2]. Several clinical trials have started with antibodies and vaccines, the majority in Phase I clinical trials. Only one vaccine has begun Phase II trials in humans: a DNA vaccine (VRC-ZKADNA090), sponsored by the National Institute of Allergy and Infectious Diseases (NIAID) of the USA [2].

Material and Methods

Pharmaceutical patents are a great source of technological information and a fundamental tool used by the pharmaceutical industry [2]. So, we used *Clarivate Analytics Integrity* to search for patents on vaccines and other treatments for ZIKV infection. The search was performed on December, 2020, with the descriptor [zika] at the simple search field. The data extracted here was converted into graphics using the Windows software Excel.

Results and Discussion

We identified 300 patents, published between the years 2015 and 2020 and regarding five technological categories (**FIGURE 1**): vaccines, antibodies, new medical uses for existing compounds, new compounds, and gene or immunologic therapy techniques (**FIGURE 2**). As ZIKV outbreaks have been better controlled, and are not easy to be predicted, the development of appropriate treatment or vaccine is compromised due to the difficulty of testing in the absence of infected people [5]. One other aspect influencing this decline in the number of patent publications may be due to the secrecy period between the patent application and publication, which can vary for some reasons, for example, from 18 to 30 months depending on the way an international patent is filed, by the Paris Convention or TRIPS.

The USA is the country with the most applicants and its Department of Health is the major applicant, with most of its applications on vaccine technology (**FIGURE 3**) in partnership with universities (e.g. Emory University), pharmaceutical companies (e.g. Takeda), and federal Institutes like the Walter Reed Army Institute of Research (WRAIR). This information is relevant because the NIAID is the largest sponsor of ZIKV vaccine trials [2]. So, considering that the US government injected US\$ 1.1 billion as a budget for ZIKV infection response [6], this patent profile associated with the sponsorship of clinical trials, demonstrates that the US Government has a complex strategy concerning the combat of this virus. On the other hand, Brazil, the most strongly affected country by CZS and ZIKV deaths, has invested almost R\$ 1,2 billion in several activities, including research and development of vaccines against ZIKV [7], but only one

patent for a vaccine was applied by the University of Campinas (UNICAMP), an attenuated ZIKV fused with outer membrane vesicles, derived from *Neisseria meningitides*, nanoencapsulated with adjuvants.

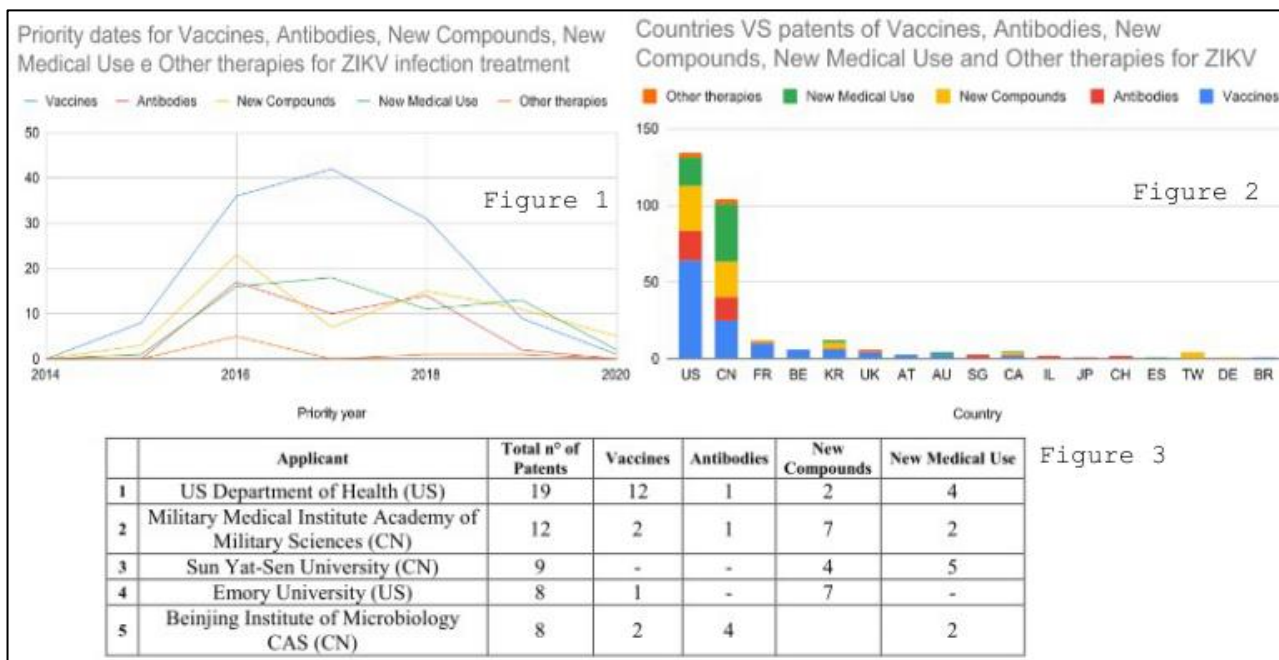


Figure 1: Patents filled by year and by technology; **Figure 2:** Patents filled by contry and by technology; **Figure 3:** Table with the five largest patent applicants in the world seven largest patent bureaus.

Conclusion

The USA is the country with most patent applications retrieved involving ZIKV medications, mostly held by the US Department of Health, which is also the greater patent applicat in the field with highest patents retrieved, vaccine technologies. This could be motivated by their great investment and coordination between different sectors. However, as the number of cases in the Americas has strongly declined since 2017, the number of patent applications has also decreased in the same period.

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