Acta Scientific Veterinary Sciences (ISSN: 2582-3183)

Volume 4 Issue 11 November 2022

Mini Review

Zika Virus Epidemiology: An Overview, India

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Received: August 19, 2022

Published: October 10, 2022

Abstract

Zika virus (ZIKV) is an arbovirus and is recognised to be present in multiple areas of Africa, Asia, and the Pacific Islands. ZIKV will continue to spread into more remote areas until new vaccines, antiviral medications, and vector control strategies are developed and put into practice. Additionally, most cases of the ZIKV infections are asymptomatic and can easily be misdiagnosed because the sole test for ZIKV is cross reactive with dengue antibodies. Furthermore, there is still a lot does not know about the virus especially its neurological complications in neonates. But as the anxieties about the world subsided, financing and attention waned. Also, due to the engagement of laboratories in COVID-19 diagnoses taking into account the succeeding waves of the pandemic, the same level of ZIKV public health surveillance could not be maintained after 2020. Thus, the aim of this review on ZIKV epidemiology was to provide the updated figure related to its infection especially in India that can highlight the fact that only active surveillance can be used to follow a disease like ZIKV disease and comprehend its effects on the healthcare system.

Keywords: Zika virus (ZIKV); Epidemiology; India; ICMR; Microcephaly

The Zika virus (ZIKV) is a single-stranded positive-sense RNA virus (ss + RNA) that is spread by mosquitoes and is a member of the Flaviviridae family. ZIKV, an arthropod-borne virus, entails other viruses, such as Yellow fever virus, West Nile virus, Japanese encephalitis virus, dengue type 1-4, and tick-borne encephalitis virus [1]. There are 03 separate ZIKV lineages, namely, African I, African II and Asian based on the genome sequencing of the envelope (E) and non-structural protein 5 (NS5) gene sequences [2]. These lineages may differ in their clinical manifestations and tendency for neurological consequences.

ZIKV is recognised to be present in multiple areas of Africa, Asia, and the Pacific Islands but at a comparatively small prevalence. Now because of the climate conditions conducive to *Aedes aegypti* and *Aedes albopictus* mosquito's population growth over an expanding geographical range facilitates the apparent global dispersion [3]. Additionally, the chance of infection spreading is still raised by growing globalisation, travel and trade. Furthermore, researchers identified that non-vector means of transmission, such as mother-to-child, blood transfusion, and sexual contact, have helped to the spread of the ZIKV infection [4]. The 13 nations had reported findings of non-vector person-to-person viral transmission as of March 2017 [5]. In India, it is mainly vector-borne and no cases were attributed to non-vector routes [6].

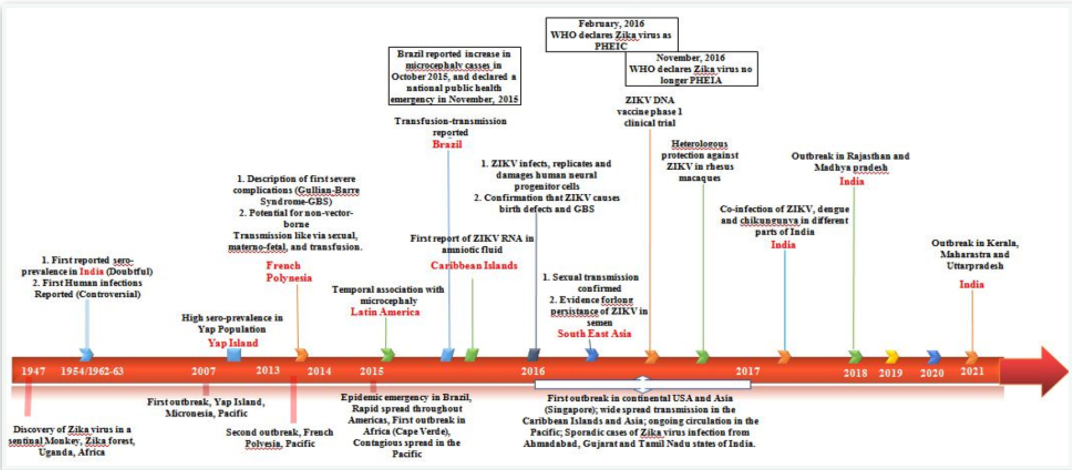

Figure 1: Timeline of ZIKV infection. The additions have been made in the timeline previously published by Baud., *et al.* [7].

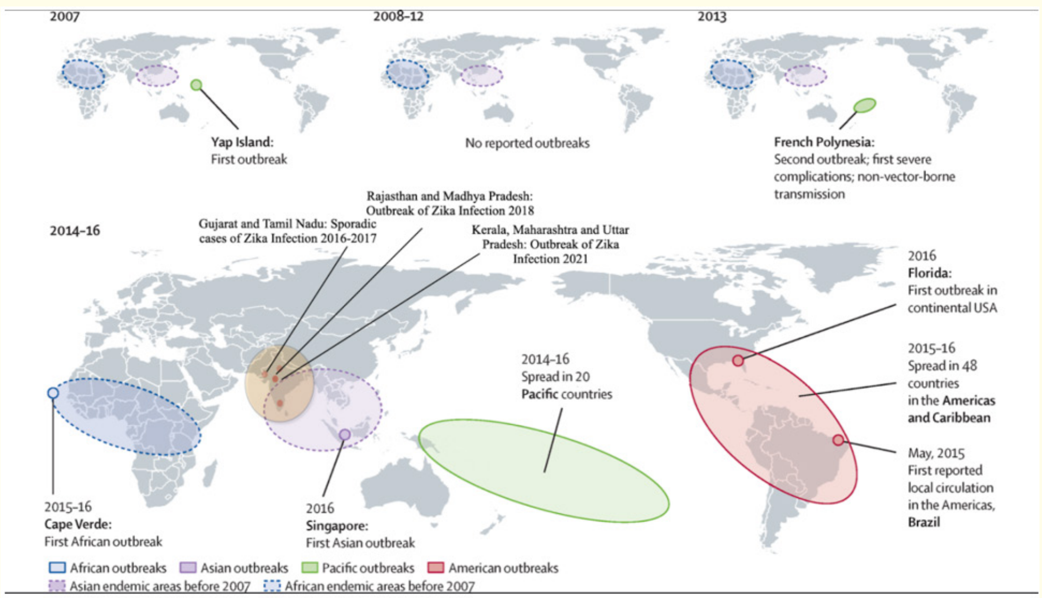

Figure 2: ZIKV outbreaks from 2007-2022. The additions have been made in the geographical presentation previously published by Baud., *et al.* [7].

The first human ZIKV infection was reported in Nigeria in 1954 and in 2007, there was a first outbreak recorded from Yap Island, a part of the Federated States of Micronesia. It was in 1966 when the ZIKV was isolated from the pool of *Aedes aegypti* mosquitoes thereby providing the first evidence of vector-borne transmission. Aedes mosquitoes are also the cause of regular, widespread large outbreaks of dengue and chikungunya. As of April 2022, ZIKV transmission has been reported from 93 countries and territories, while *Aedes aegypti* vectors are plentiful in 54 countries and territories, where ZIKV infection has not yet been observed [8,9]. There haven't been any recent ZIKV outbreaks anywhere in the world as of April 2022, however, there was a sizeable outbreak in India in November 2021 (Figure 1). Health professionals have cautioned that a fresh outbreak might occur at any time because it just takes one mutation for the virus to produce a new version which is what the world is facing with coronavirus [9] (Figure 1). Although India reported seroprevalence to ZIKV long before [10], laboratory-confirmed cases of ZIKV were discovered in 2016 in Ahmedabad, Gujarat, India [11]. As the ZIKV had an Asian lineage and no patients had any substantial prior travel history to an endemic area, it was hypothesised that the ZIKV that was causing the outbreaks in India was local in origin. Furthermore, polymerase chain reaction (PCR) testing during the Rajasthan outbreak established the virus' presence in the local *Aedes aegypti*, which was supported by the discovery that none of the 18,000 mosquitoes tested in Gujarat and Tamil Nadu in 2017 tested positive for ZIKV [12].

ZIKV's serological prevalence in India has been studied since the 1950s. In 1954, a study by the National Institute of Virology (NIV), Pune, found that 16.8% of samples examined from the Bharuch district had ZIKV antibodies. Although, the findings do not completely rule out the potential for cross-reactivity between ZIKV and other flaviviruses like dengue [10,13]. The ZIKV was declared a public health emergency of international concern (PHEIC) by WHO in February 2016 and that was based on exceptional neurological disorders, including microcephaly, problems described in Brazil and French Polynesia, and its spatial and temporal relationship with ZIKV cases. This led to the establishment of widespread monitoring operations in India by the Indian Council of Medical Research (ICMR) [14]. ZIKV-related consequences of infection during pregnancy are not yet fully known, so more research is required before drawing any firm conclusions. Although, the studies linked ZIKV infection to microcephaly that made the Emergency Committee (EC) of WHO believe that a strong longer-term technical mechanism was necessary to oversee the worldwide response. Thus, in November 2016, WHO changed its stance to read "ongoing challenge requiring a strong response, but no longer a public health emergency of global concern". Keeping this in view, the activities related to ZIKV continued by the ICMR to date. The ICMR aimed at participating in comprehensive monitoring and surveillance operations, including fortifying the virus research and diagnostic laboratories (VRDLs). Initiated in 2016 with 10 laboratories, the sentinel ZIKV surveillance expanded to 56 VRDLs in 2018 and 132 by 2021 [15]. Throughout the year, the trained VRDLs were advised to examine at least ten samples that had tested negative for Chikungunya and Dengue viruses for ZIKV [15,16]. The Rashtriya Bal Swasthya Karyakram (RBSK) is a significant effort that focuses on early detection and early intervention for kids from infancy to age 18 years old to address birth defects, deficits, diseases, and developmental delays thereby involving monitoring the cases of microcephaly as well. Additionally, the right procedures for monitoring travellers were put in place at ports and airports. Blood samples were tested for ZIKV after being found to be free of dengue and chikungunya. Due to these continuous surveillance efforts, the recent ZIKV outbreaks in Madhya Pradesh and Rajasthan were quickly detected and reported. In September 2018, Rajasthan received its first case report of ZIKV infection [17]. Approximately 3 km from the index case, containment measures were started in response to this. In addition to the already-existing laboratory surveillance, these initiatives included early case detection, entomological surveillance, and neurological complication case surveillance [17]. A total of 153 cases (50 male and 103 female) were recorded in Rajasthan in the subsequent two months, 63 of which were pregnant. Laboratory surveillance reported an additional six cases. In the state of Madhya Pradesh, 130 cases (34 male and 96 female) were found, 42 of which were pregnant [18]. The most probable reason for this outbreak was attributed to the water shortage in the area, which resulted in local practices involving storing water in the storeroom resulting in the proliferation of Aedes mosquitoes. It's also possible that the widespread usage of water coolers, which are Aedes mosquito breeding grounds, was to blame.

Conclusion

In nutshell, due to the engagement of all VRDLs in COVID-19 diagnoses taking into account the succeeding waves of the pandemic, the same level of ZIKV public health surveillance could not be maintained after 2020. The Dengue/Chikungunya virus negative samples from each of these VRDLs should be stored for potential ZIKV testing in the future. Before this study, the number of cases reported in Uttar Pradesh and Kerala in 2021 again highlighted the fact that only active surveillance can be used to follow a disease like ZIKV disease and comprehend its effects on the healthcare system [15]. In total, 16 Indian states and union territories have now reported ZIKV occurrence between 2017 and 2021 (Figure 1) [15].

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