

Zika Virus Screening in the Kenyan Olympic Team Attending the 2016 Olympic Games in Brazil

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Abstract

The 2016 Olympic Games happened at the time of heightened fears of Zika virus (ZIKV) that was causing microcephaly in newborns in Brazil. To avert or track introduction of ZIKV in Kenya, the Ministry of Health developed a public health response that involved screening of the Kenyan contingent before and after traveling to Brazil. Of the 92 team members that were screened, all but one tested negative for ZIKV IgM and IgG. The sero-positive individual had high IgM serum titers before and after travel to Brazil. When tested for potential antibody cross-reactivity to other flaviviruses that have been reported in Kenya, the sample showed high IgM cross-reactivity to West Nile, Tick-Borne Encephalitis and Yellow Fever Virus. Our data support the low risk predictions of acquiring ZIKV that were made before the Games and will help inform risk assessments for personnel traveling to endemic regions under similar circumstances in the future.

Keywords

Zika Virus Screening

1. Introduction

Zika virus (ZIKV) is transmitted mainly by *Aedes* mosquitoes, which also transmit other flaviviruses such as dengue (DENV), yellow fever (YFV) and West Nile (WNV) viruses. The virus was first documented in 1947 when it was isolated from a sentinel rhesus monkey in the Zika forest, Uganda and thereafter in mosquitoes [1] [2] [3]. Following this discovery, a human serosurvey in the

same area revealed a 6.1% specific sero-reactivity to ZIKV. Subsequent human and animal serosurveys have suggested that ZIKV is endemic to Africa and Asia. From Africa, the virus is thought to have spread to Asia. In the 1970's, individual cases of active Zika virus infection were detected in certain parts of South-east Asia like Pakistan, India, Malaysia and Indonesia.

In 2007, the first epidemic of ZIKV was reported in the Island of Yap, Micronesia. The second outbreak was reported in 2013 in French Polynesia [3] [4]. These outbreaks were attributed to bites of the daytime-active *Aedes* mosquitoes. The recent South American outbreak that was first detected in Brazil in early 2015 is thought to have spread from Asia and has spread throughout the Western Hemisphere, with autochthonous transmission reported in at least 48 countries and territories in the Americas. Continued transmission was reported elsewhere in the world as well, in diverse locations such as Singapore, Micronesia, Angola, Cabo Verde and Guinea-Bissau [5]. The outbreak has been linked with birth of babies with microcephaly as a result of ZIKV infection during pregnancy, as well as complications such as Guillain-Barré syndrome in adults. Due to the explosive spread of the virus and its association with microcephaly [6], WHO declared the outbreak in Brazil a Public Health Emergency of International Concern (1 Feb 2016) [7]. Lessons learnt from the recent outbreak in South America indicated that persistence of the virus in the semen could account for cases that occur without a known source of infection. Military personnel are at risk for infection when traveling to endemic areas, although risk is difficult to quantify in the absence of targeted studies of immunologically naive travelers to ZIKV endemic zones.

The 2016 Summer Olympics was scheduled from 5 to 21 August 2016 in Rio de Janeiro, Brazil. At the time, the possibility that the Olympic games would facilitate the spread of the virus on return of the teams to their homelands, particularly in regions where *Aedes* mosquitoes are prevalent, raised considerable concern [8] [9] [10], although other analyses suggested that the risks were overstated [11] [12] [13] [14] [15]. In light of this concern, and to avert or track introduction of ZIKV in Kenya, Ministry of Health developed a public health response plan that involved screening of Olympians before and after travel to Brazil.

2. Methods

Kenyan Olympic athletes were requested to provide a blood sample before departure to Brazil and within two weeks after their return to Kenya. All participants gave informed consent that was written if the participant was literate or denoted by fingerprint if the illiterate that were also signed by an independent witness. Scientific and ethical approvals for the study were obtained from the Walter Reed Institute of Army Research Human Subject Protection Committee (WRAIR protocol #2343).

Ten mL of whole blood was collected and processed to provide 5 mL of sera from each of the 92 Olympians (included accompanying officials) and an aliquot

tested for antibodies to ZIKV using IgM and IgG ELISA kits (Euroimmun, Lubeck, Germany). Any positive samples were further tested for antibody cross-reactivity to other flaviviruses, including WNV, tick-borne encephalitis (TBEV), and YFV.

3. Results

Of 92 participants, 31 (33.7%) were adult females and the rest were adult males (>18 years). One individual showed high IgM titers before (OD = 0.687 at 450 nm) and after travel to Brazil (OD = 1.90) compared to 0.062 for negative control and 0.924 for the positive control. The sample was unreactive by IgG. The serum samples were subsequently tested for potential antibody cross-reactivity to other flaviviruses that have been reported in Kenya. The samples had high IgM titers to WNV, TBEV, and YFV.

4. Discussion

The absence of sero-conversion to ZIKV amongst the Kenyan Olympians supports the low risk predictions that were made before the Olympic games [11] [12] [13]. A shortcoming of this study is lack of confirmatory testing such as neutralization assay on the lone subject that had high IgM titers to ZIKV. We believe this to have been a case of cross-reactivity to other flaviviruses, as evidenced by positive ELISA results for WNV, TBEV, and YFV. These results are consistent with other reports, including lack of identified cases by the World Health Organization. However, as ZIKV infection is often asymptomatic in healthy adults, it is important to follow up with specific laboratory testing to determine true infection rates, not just apparent infections. Unfortunately, few such studies were conducted. As with our study, screening of Spanish Olympic team members did not detect any evidence of ZIKV transmission [16]. These data are relevant to developing realistic risk assessments for personnel traveling to endemic areas. Such risk assessments need to take into consideration seasonality of vector populations, current circulation of pathogens, immunity in local populations, and availability of effective countermeasures.

One of the limitations of this paper is lack of adequate sociodemographic and co-morbidities data such as vaccination history before travel, pregnancy status or intention to conceive in the months following visit to Brazil, Zika counseling before the games, symptoms during or after the games.

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Ethical Statement

The study protocol was approved by the Human Subject Protection Branch of the Walter Reed Army Research Institute (WRAIR #2343).

Disclaimer

Material has been reviewed by the Walter Reed Army Institute of Research. There is no objection to its presentation and/or publication. The opinions or assertions contained herein are the private views of the author, and are not to be construed as official, or as reflecting true views of the Department of the Army or the Department of Defense. The investigators have adhered to the policies for protection of human subjects as prescribed in AR 70-25.

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