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# A Review on Zika Virus



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## ABSTRACT

Name of Zika virus comes from the Zika Forest of Uganda, from where this virus was first isolated in 1947. This Zika virus is a member of virus family *Flaviviridae* and the genus *Flavivirus*, transmitted by daytime-active *Aedes* mosquitoes, such as *A. aegypti* and *A. albopictus*. Zika virus is related to yellow fever, dengue, Japanese encephalitis, and West Nile virus. It is transmitted through Vector, Sexual and during pregnancy. Many governments have taken precaution for the tourist who are coming from the infected country. CDC has declared a specific guideline for tourist people also for pregnant women. In this article discussion about Zika virus, its transmission, precautions during travel, cause, preventive measures are given. Companies which are engaged in the production of vaccine are also enlisted. Countries which are not infected should adopt a various protecting measure to protect their people. Until the development of a vaccine, people should be aware of this virus and protect themselves from daytime active mosquito attack and should use the mosquito net or repellent.

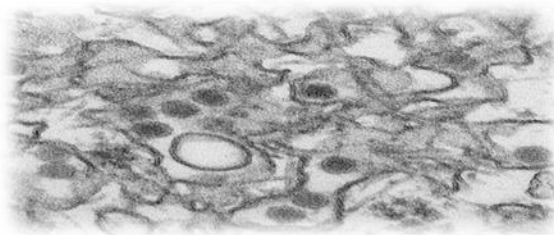
## INTRODUCTION

Zika virus is a member of the virus family *Flaviviridae* and the genus *Flavivirus*, transmitted by daytime-active *Aedes* mosquitoes, such as *A. aegypti* and *A. albopictus*. Name comes from the Zika Forest of Uganda, from where this virus was first isolated in 1947.<sup>1</sup> Zika virus is related to yellow fever, dengue, Japanese encephalitis, and West Nile virus.<sup>2</sup> This infection is known as Zika fever, often causes no or only mild symptoms, similar to a mild form of dengue fever.<sup>2</sup> Since the 1950s, it has occurred within a narrow equatorial belt from Africa to Asia. The virus spread eastward across the Pacific Ocean between 2013 and 2014 to French Polynesia, New Caledonia, the Cook Islands, and Easter Island, and in 2015 to Mexico, Central America, the Caribbean, and South America, where the Zika outbreak has reached pandemic levels.<sup>4</sup> As of 2016, the illness cannot be prevented by drugs or vaccines.<sup>3</sup> In month of February 2016, there is evidence that Zika fever in pregnant women is associated with abnormal brain development in their fetuses through mother-to-child transmission of the virus, which may result in miscarriage or microcephaly<sup>5,6,7</sup>

## VIROLOGY

The Zika virus belongs to *Flaviviridae* and the genus *Flavivirus* and is thus related to yellow fever, dengue, Japanese encephalitis, and West Nile viruses. *Flaviviridae* is a family of viruses. Humans and other mammals serve as natural hosts. They are primarily spread through arthropod vectors. The family gets its name from the Yellow Fever virus, the type virus of *Flaviviridae*; *flavus* means yellow in Latin.<sup>8</sup> Zika virus is enveloped with structural, non-structural protein, icosahedral and has a nonsegmented, a single-stranded, positive-sense RNA genome. This virus is most closely related to the Spondweni virus and is one of two viruses in the Spondweni virus class<sup>9,10</sup>. The following image (image 1.1) show the structure of Zika Virus

Electron micrograph of Zika virus. Virus particles are 40 nm in diameter, with an outer envelope and a dense inner core (source: CDC)



(Image 1.1)

Virus classification Group: Group IV (+)ssRNA Family: *Flaviviridae*

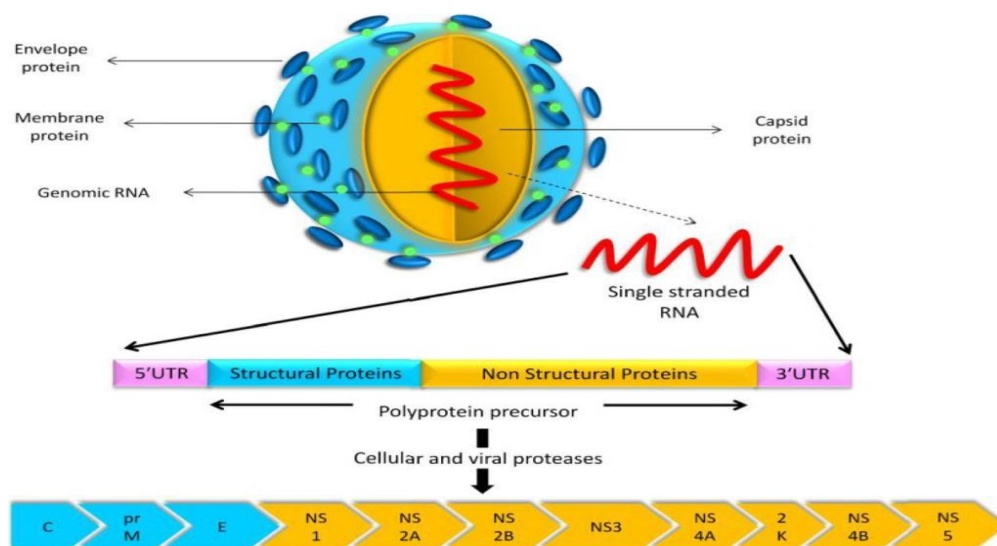
Genus: *Flavivirus* Species: Zika virus

There are two lineages of the Zika virus: the African lineage, and the Asian lineage.<sup>11</sup> Phylogenetic studies indicate that the virus spreading in the America is most closely related to the Asian strain, which circulated in French Polynesia during the 2013 outbreak.<sup>11,12</sup> The complete genome sequence of the Zika virus has been published.<sup>13</sup> Western Hemisphere Zika virus is found to be 89% identical to African genotypes.<sup>14</sup>

### **Structural Specification of Zika Virus.**

Zika virus is enveloped and icosahedral and has a nonsegmented, a single-stranded, positive-sense RNA genome. It is most closely related to the Spondweni virus<sup>[42,43]</sup>

The Zika virus is a positive-sense single-stranded RNA molecule 10794 bases long<sup>[43]</sup>. It contains two non-coding regions known as the 5' NCR and the 3' NCR. The open reading frame of the Zika virus is as follows: 5'-C-prM-E-NS1-NS2A-NS2B-NS3-NS4A-NS4B-NS5-3' and codes for a polyprotein that is subsequently cleaved into capsid (C), precursor membrane (prM), envelope (E), and non-structural proteins (NS). NS1, NS3, and NS5 are large, highly conserved proteins while the NS2A, NS2B, NS4A, and NS4B proteins are smaller, hydrophobic proteins. The structure of ZIKA follows that of other flaviviruses. It contains a nucleocapsid approximately 25-30nm in diameter surrounded by a host-membrane derived lipid bilayer that contains envelope proteins E and M. The virion is approximately 40nm in diameter with surface projections that measure roughly 5-10nm.<sup>[44]</sup>



(Image 1.2) The detailed structure of ZIKA virus <sup>[42]</sup>

## TRANSMISSION:

The vertebrate hosts of this virus were primarily monkeys in a so-called enzootic - mosquito-monkey-mosquito cycle, with only occasional transmission to humans. Infrequently, other arboviruses have become established as a human disease and spread in a mosquito-human-mosquito cycle, like the yellow fever virus and the dengue fever virus and the chikungunya virus <sup>15</sup>.

## VECTOR:

The Zika virus is transmitted by daytime-active mosquitoes as its vector. It is primarily transmitted by the female *Aedes aegypti* <sup>16</sup>. Other variety of arboreal mosquito species are the *Aedes* genus, such as *A. africanus*, *A. apicoargenteus*, *A. furcifer*, *A. hensilli*, *A. luteocephalus* and *A. vittatus* <sup>17</sup>. Transmission by *A. albopictus*, the tiger mosquito, was reported from a 2007 urban outbreak in Gabon where it had newly invaded the country and become the primary vector for the concomitant chikungunya and dengue virus outbreaks. <sup>18</sup> There is concern for autochthonous infections in urban areas of European countries infested by *A. albopictus* because the first two cases of laboratory-confirmed Zika virus infections imported into Italy were reported from viremic travelers returning from French Polynesia. <sup>19</sup>

### **Sexual transmission:**

In February 2016, there are three reported cases indicating that Zika virus could possibly be sexually transmitted.<sup>20</sup> The ZIKA natural transmission cycle involves mosquitoes, especially *Aedes spp.*<sup>21</sup> But perinatal transmission and potential risk for transfusion-transmitted ZIKA infections have also been demonstrated<sup>22,23</sup>

During pregnancy:

Zika virus RNA was detected in the amniotic fluid of two pregnant women whose fetuses had microcephaly, indicating that the virus had crossed the placenta and could have caused a mother-to-child infection<sup>24</sup>

### **Vaccine Developed:**

Effective vaccines exist for several flaviviruses. Vaccines for yellow fever virus, Japanese encephalitis, and tick-borne encephalitis were introduced in the 1930s while the vaccine for dengue fever only became available for use in the mid-2010s.<sup>25,26,27</sup> An Indian company, Bharat Biotech International, reported in early February 2016 that it was working on vaccines for the Zika virus.<sup>28</sup> The company claimed that it had two vaccine candidates, one live and other a recombinant type. It also had filed a global patent in June 2015 for its vaccine that is to be called as the Zikavac.<sup>29</sup>

### **Geographical virus transmission:**

#### **Virus isolation in monkeys and mosquitoes, 1947:**

This virus was first isolated in April 1947 from a rhesus macaque monkey that had been placed in a cage in the Zika Forest of Uganda, near Lake Victoria, by the scientists of the Yellow Fever Research Institute.<sup>30</sup>

The following image (image 1.3) from CDC shows distribution of Zika virus all over the world

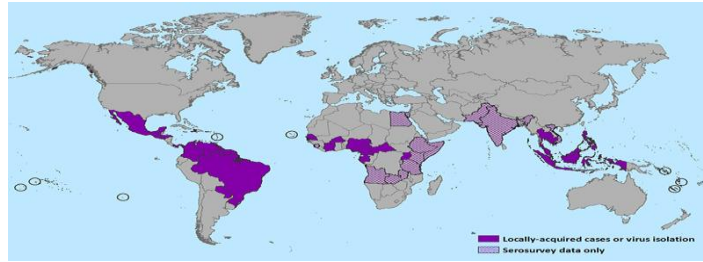


Image1.3

### First evidence of human infection, 1952:

Zika virus had been known to infect humans from the results of serological surveys in Uganda and Nigeria. A serosurvey of 84 people of all ages showed 50 had antibodies, with all above 40 years of age being immune.<sup>31</sup> A 1952 research study conducted in India had shown a "significant number" of Indians tested for Zika had exhibited an immune response to the virus, suggesting it had long been widespread within human populations.<sup>32</sup> Spread in equatorial Africa and to Asia, 1951–1981 there were only 14 confirmed human cases of Zika virus infection from Africa and Southeast Asia.<sup>33</sup>

Image 1.3 Shows the transfer of Zika virus all over the world

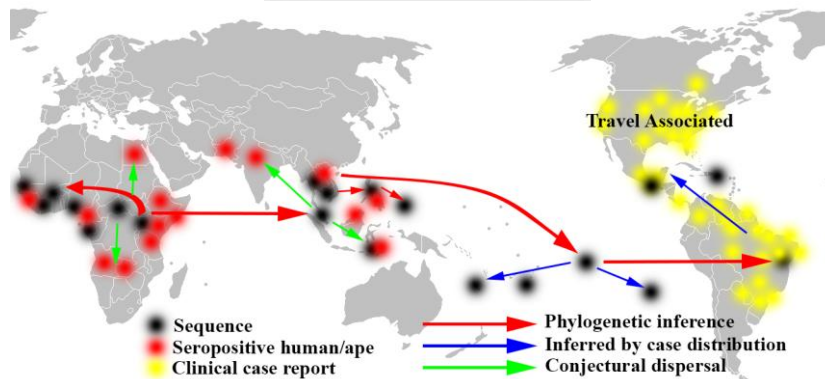


Image 1.4

### Action taken by many countries for Zika virus

January 2016, the U.S. Centers for Disease Control and Prevention (CDC) issued travel guidance on affected countries, including the use of enhanced precautions, and guidelines for pregnant women including considering postponing travel.<sup>34,35</sup> Other government agencies soon issued



similar travel warnings,<sup>36,37,38</sup> While Colombia, the Dominican Republic, Ecuador, El Salvador, and Jamaica advised women to postpone getting pregnant until more is known about the risks.<sup>37,39</sup>

## **PREVENTIVE MEASURE FOR ZIKA VIRUS**

- 1) Wear long-sleeved shirts and long pants.
- 2) Stay in places with air conditioning or that use window and door screens to keep mosquitoes outside.
- 3) Sleep under a mosquito bed net if you are overseas or outside and are not able to protect yourself from mosquito bites.

### **Baby or child:**

Do not use insect repellent on babies younger than 2 months of age.

Dress your child in clothing that covers arms and legs. Cover crib, stroller, and baby carrier with mosquito netting.

Do not apply insect repellent onto a child's hands, eyes, mouth, and cut or irritated skin.

### **Adults:**

Spray insect repellent onto your hands and then apply to a child's face.

Treat clothing and gear with permethrin or purchase permethrin-treated items.

Treated clothing remains protective after multiples of washings. See product information to learn how long the protection will last. If treating items yourself, follow the product instructions carefully.<sup>40,41.</sup>

## **RESULT**

From above data, we can conclude that Zika virus is traveling in many parts of world. Zika virus is transmitted by daytime-active mosquitoes as its vector which are *Aedes aegypti*. It is transmitted through Vector, Sexual and during pregnancy from mother to child. Many governments have taken precaution about traveling people from the infected country. CDC has declared a specific guideline for tourists and pregnant women.

## CONCLUSION

From the above information, it is understood that Zika virus is transmitted by daytime-active mosquitoes as its vector. This virus can transmit from sexual contact, mother to child transfer having an effect on the child. The new vaccine is under development by company. Until the development of a vaccine and its approval to vaccinate people, everyone should be aware of this virus and protect themselves from daytime active mosquito using the mosquito net or repellent.

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