

## Review (Narrative)

# Zika Virus

## How Much Do We Know About This Bug?

Allen E. Murphy, PhD; Garbsen Long, PhD

### SUMMARY

An epidemic disease called Zika virus has been reported to have gone viral in the Caribbean and also central and South America in the year 2015. One of the most disturbing concerns which comes along with this infection is that it is now more apparent that there is increased incidence of microcephaly in fetuses of mothers who are infected with Zika virus. The biggest Zika virus outbreak was reported in the month of October 2013 which lasted till March 2014 in French Polynesia, and numerous people whom presented the symptoms of acute phase Zika virus were tested negative. The Zika virus is basically transmitted to individuals when one is bitten by a contaminated mosquito generally found in tropical areas. The virus is transmitted by the *Aedes aegypti* mosquito. The virus has a place with the same family as Chikungunya, Dengue, Yellow fever, and West Nile. Be that as it may, not at all like a percentage of the previously stated viruses, there is as of now no antibody that can be utilized to forestall or even treat the contamination. As of not long ago, Zika virus was to a great extent a dark virus kept to Asia and Equatorial Africa. In the month of November 2015, preliminary evidence shows that with upsurge in neurological complications in adults and microcephaly in neonates of mothers infected during pregnancy. Strategies are recommended for preventing the infection by this notorious virus under different conditions. ■

**KEYWORDS** Zika virus; Mosquito; Microcephaly; Public health; Prevention

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**Author Affiliations:** Author affiliations are listed at the end of this article.

**Correspondence to:** Dr. Garbsen Long, PhD, Division of Public Health, The BASE, Chapel Hill, NC 27150, USA  
Email: g.long@basehq.org

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Zika virus is a member of Flaviridae virus family and genus Flavivirus. The virus is spread by daytime mosquitoes of the *Aedes* genus such as *A. albopictus* and *A. aegypti*. The virus' name originated from Zika forest in Uganda where the virus was isolated for the first time in 1947. The virus is related to yellow fever, dengue fever, Japanese encephalitis and a group of viruses in the Nile referred to as West Nile viruses. Like other flaviviruses, Zika virus is enveloped, single stranded, non-segmented and icosahedral. The virus constitutes positive-sense RNA genome which can be directly translated into viral proteins. There are two lineages of the Zika virus; the African and Asian lineages. The infection caused by the virus is called Zika fever and often doesn't cause any symptoms or just mild symptoms similar to dengue fever. The disease is primarily spread through a bite of an infected mosquito of the *Aedes* species. The most common symptoms manifested by people infected with Zika virus include joint pain, fever and red eyes (conjunctivitis). The symptoms being so mild, people often don't go to hospital and very rarely do they die from the disease. Many people also do not realize they have been infected, and once a person is infected he or she is more likely to develop immunity to future infections (1).

Since the first human cases were reported in 1952, outbreaks of the virus have been reported in Southeast Asia, tropical Africa and the Pacific Islands. *A. albopictus* and *A. aegypti*, the mosquito species that spread Zika virus, are the same species responsible for transmission of chikungunya and dengue viruses. These mosquitoes lay eggs in stagnant water in buckets, vases, flower pots and bowls near human habitats. The mosquitoes are aggressive especially during daytime but they can still bite at night. The mosquitoes get infected when they bite an already infected human and get to spread the virus to other people through biting.

A pregnant mother can transmit the virus to an unborn baby during the pregnancy. The mother can also pass the virus to her newborn baby around the time of birth. Up to date, there are no reports of Zika virus transmission through breast milk and mothers are therefore encouraged to breastfeed even in areas where Zika virus is endemic. There are other ways through which Zika virus can be spread despite through mosquito bites. An infected man can spread the virus to his sexual partners even before he develops symptoms (2). The virus is found in semen and remains viable much longer than in blood. The virus can be spread before,

during and after symptoms. There have been multiple reports of spread of the virus via blood transfusion in Brazil and the reports are currently under investigation. People living in areas with Zika virus outbreak and have not been already infected are at risk of infection but once they have been infected, they are likely to develop lifelong immunity to the virus.

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## EPIDEMIOLOGY

It has been known since the 1950s that the virus occurs within a narrow equatorial belt from Africa to Asia. During 2013-14 outbreaks in Oceania, the virus spread eastward across the Pacific to the Cook Islands, New Caledonia, French Polynesia and Easter Island. In 2015 the virus spread to Central America, Mexico, the Caribbean, and South America reaching pandemic levels. Transmission of Zika virus by *A. albopictus* was reported during an outbreak in Gabon in 2007 where it had just invaded the country becoming the primary vector for dengue virus and chikungunya concomitantly. The most cited carrier of Zika virus though is *A. aegypti* and the potential societal risk can be determined by the species global distribution. The distribution is expanding due to global travel and trade. *A. aegypti* is the most extensively distributed species recorded across all continents including Europe and North America. In Capitol Hill neighborhood of Washington D.C a population of mosquitoes capable of carrying the Zika virus was found genetic evidence showed the mosquitoes survived at least four winter periods in the region. The authors studying the mosquitoes concluded that the mosquitoes were capable of adapting to the northern climate.

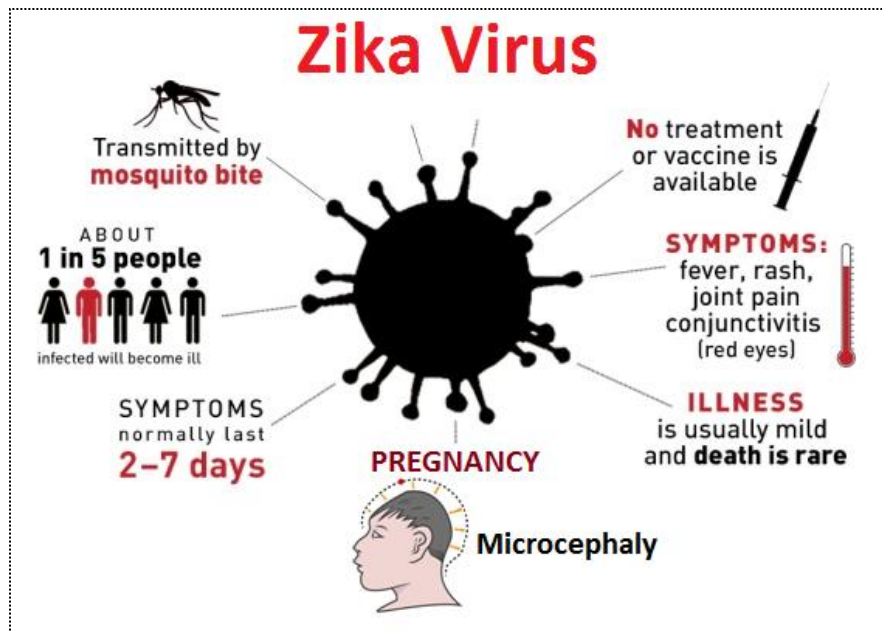
News reports have been drawing attention since 2015 to the spread of Zika virus in the Caribbean and Latin America. Barbados, Brazil, Bolivia, the Dominican Republic, Colombia, Ecuador, El Salvador, Guyana, Haiti, Panama, Mexico and Paraguay are some of the countries and territories identified as having experienced local Zika virus outbreaks and transmission. A major outbreak was reported in the Yap Islands in 2007 with 185 cases confirmed by polymerase chain reaction (PCR) or serology with 72 other cases suspected. This outbreak was the first one to be reported occurring outside Asia and Africa. Another large outbreak in French Polynesia was reported in 2013 and it was suspected to be from an independent introduction of Zika virus from Asia. The *Aedes hensilli* species mosquito was thought to be the

most predominant vector of the virus in the Yap Island outbreak despite the mode of introduction of the virus into the country still being uncertain. One of the possible ways of introduction could be through an infected human with a related strain to that of Southeast Asia.

In 2016 the World Health Organization declared a public health emergency of international concern because of increased neurological disorders including microcephaly in some of the areas affected by Zika virus (3). In the United States territories, local Zika virus transmission has been reported in the US Virgin Islands, Puerto Rico and America Samoa. No local mosquito-borne Zika virus transmissions have been reported in US states. With recent outbreaks however the numbers of Zika cases are expected to increase due to travelers visiting or returning to the United States. An estimated 80% of the cases are expected not to be diagnosed. These cases being imported could cause in local spread of Zika virus in the United States. The Centre of Disease Control is working other international public health stakeholders in partnership with state and local health units to control the spread of Zika virus and contain it completely.

## IMPACT OF ZIKA VIRUS ON HEALTH

Once a person is infected with Zika virus, some people will develop mild symptoms while others may not develop any symptoms at all. The most common symptoms of the infection include skin rash (exanthema) and mild fever which is normally accompanied by red eyes (conjunctivitis). Muscle pains, joint pains and general body malaise and weakness begin 2-7 days after an individual is bitten by an infected mosquito. Only one out of four infected people will develop symptoms. Among those who develop symptoms, the severity of the disease is usually mild lasting for a period of about 2-7 days.



These symptoms of Zika virus infection are similar to those of chikungunya or dengue fever, which are transmitted by the same type of mosquito (4).

Autoimmune complications and neurological symptoms are very rare and have only been described in Polynesia and recently in Brazil. The national health authorities in

Brazil observed an increase in Guillain-Barre syndrome coinciding with Zika virus infection as well as babies born with birth defects in northeast Brazil. Microcephaly has had increasing evidence associating it with Zika virus. Guillain-Barre syndrome (GBS) is an uncommon condition of the nervous system in which an individual's own immune system attacks the nerve cells resulting in muscle weakness and occasionally paralysis. Guillain-Barre syndrome is likely to be triggered by Zika virus in a small number of infections just as much it is by other infections. Patients with Guillain-Barre syndrome exhibit symmetrical muscle weakness in the arms and legs on both sides of the body. Muscles controlling facial movements and swallowing are also often affected and they become weak. In most serious of cases these muscles impair breathing requiring patients to use breathing tubes to assist in breathing. Symptoms of Guillain-Barre syndrome can last from a few weeks to several months and although some people recover from the condition, others sustain permanent damage and in 1 out of 20 cases people have died. Microcephaly is a birth defect in which babies are born with small heads and underdeveloped brains. More than 2500 babies are expected to be born with microcephaly in Brazil following the Zika virus pandemic that swept across the country. A pattern seems to be revealing after detection of Zika virus where after six months microcephaly and other fetal abnormalities come about (3).

During pregnancy, Zika virus is of great concern. The virus can cross the placenta and enter the amniotic fluid causing a mother to child transmission (5). The effect of Zika virus to the baby is intrauterine growth

restriction including abnormal development of the brain in fetuses increasing risk of miscarriage. An autopsy done to two babies in northeast Brazil showed the brain tissue to be positive for Zika virus by RT-PCR. Other studies in Rio de Janeiro revealed infection with Zika virus was associated with intrauterine fetal death, fetal growth restriction, placental insufficiency and central nervous system injury. According to recent World Health Organization's report, there is a strong link between Zika virus and microcephaly but there is no scientific evidence yet to prove it. Babies born with microcephaly develop a range of problems depending on how severe the condition is. Delays in development such as speech problems and other developmental milestones such as sitting, standing and walking are imminent. The babies will experience decreased ability to learn and perform daily functions of life due to intellectual disability. Other problems such as difficulty in swallowing, visual problems, hearing loss and seizures are bound to occur depending on severity of microcephaly. These problems are often lifelong.

The Center for Disease Control is still studying the link between Zika virus and birth defects and how to prevent them. Microcephaly can sometimes be diagnosed during pregnancy using ultrasound during late second trimester or early in the third trimester. Head circumference growth charts are used to diagnose microcephaly after birth up to 20 years.

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## DETECTION AND PREVENTION OF ZIKA VIRUS INFECTION

Clinical signs and symptoms are not sufficient to make the diagnosis of Zika fever due to overlap with other similar viruses endemic in that area. Routine complete hemogram tests chemistry appear normal in many patients. Diagnosis of Zika virus disease is based primarily on detection of viral RNA from clinical samples in ill patients (6). The virus can be detected during the first 3-5 days given the short viraemic period of the virus after the onset of symptoms. Viral RNA can still be detected in urine even 10 days after onset of the disease. Five days after the onset of disease, serological tests aim to detect Zika specific IgM antibodies in serum samples. Serological results are interpreted according to previous exposure and vaccination status. The CDC recommends screening pregnant women who have recently travelled to endemic areas even if they do not manifest any symp-

toms of the disease. Women living in endemic areas should be tested at the first prenatal visit as well as during the second trimester. Women with positive Zika virus infection results should have their fetuses monitored closely by ultrasound every three weeks to four weeks to detect any anatomical abnormalities. For infants, the CDC recommends molecular assays and serological testing such as IgM ELISA, RT-PCR and plaque reduction neutralization test (PRNT). Babies born by mothers who were potentially exposed or have positive blood tests, or congenital malformations should undergo further testing including thorough neurological examination, dysmorphic features, hepatomegaly, splenomegaly and rash or other skin lesions. Cranial ultrasound, eye examination and hearing evaluation are the other recommended tests (7).

Once a well evaluated diagnosis has been made, case management and treatment follows. There is no specific treatment or prophylactic vaccine available to manage Zika fever. Other differential diagnoses should be considered together with co-infection with other mosquito-borne diseases such as chikungunya, dengue fever and malaria (8). Treatment for Zika fever is based on symptomatic management ranging from pain relief, fever reduction to relief of pruritic rashes using antihistamines. Patients are prescribed plenty of rest, fluids to prevent dehydration and acetaminophen to reduce pain and relieve fever. Aspirin and other non-steroidal anti-inflammatory drugs (NSAIDs) are contraindicated to reduce the risk of hemorrhage. Patients on other medications are advised to consult their health service providers before taking additional medication.

Since there is no vaccine or prophylactic treatment available, prevention and control measures are key to managing the spread of Zika fever. Integrated vector management to reduce mosquito density is of primary importance. Activities to reduce mosquito breeding sites include draining stagnant waters and discarding containers with standing waters within living premises. Barrels, water containers, wells and water storage tanks should be tightly covered to prevent breeding of mosquitoes. Proper ventilation by wide use of windows and doors by the general population discourages breeding of mosquitoes inside houses. Elimination using aerial spraying with insecticides during an outbreak can be considered (9).

Prevention of Zika fever is also based on protection against being bitten by mosquitoes. When in risk areas, people should cover exposed skin by wearing long pants





and long sleeved shirts. The use of insect repellants is also recommended especially those containing picaridin or oil of lemon eucalyptus. If using sunscreen, people are advised to apply the sunscreen first before applying the repellent (10). People should also stay and sleep in well ventilated and air conditioned rooms. Mosquito nets can also be used in endemic areas to prevent mosquito bites.

Because Zika virus has been proven to be transmitted through sexual intercourse as one of the ways, men who have visited endemic areas are advised to use condoms or abstain from sex for six months after travel (2). Breastfeeding however is still recommended by the World Health Organization even by women with Zika fever (11). The CDC has issued travel alerts to pregnant women advising them to consider postponing travelling to endemic areas due to the link of Zika virus to babies being born with microcephaly. Male partners of pregnant women who are travelling to endemic areas are also cautioned to abstain from sex or use condoms to avoid putting their pregnant partners at risk (2). Travelers with severe chronic illnesses or with immune disorders should seek the advice of a doctor before travelling to learn about preventive measures they can take. Symptomatic patients should also take precaution measures to avoid spreading the disease to healthy humans. The CDC travel alerts included 37 countries as of March 2016 including 31 in north and South America, some islands in Oceania and Cape Verde islands in Africa.

## POTENTIAL TREATMENT OF ZIKA VIRUS

Zika virus, since its discovery in 1947 in the forests of Uganda, has become a major health concern for the whole globe. The virus is spread through mosquito bites by two species of mosquitoes namely *A. albopictus* and *A. aegypti*. Once someone is infected with the virus they may or may not develop symptoms and for those who do develop symptoms they are usually mild and people often don't go to hospital (12). A few cases have however been reported of patients suffering from Zika fever developing neurological complications. Zika virus has especially been linked to Guillain-Barre syndrome (GBS) which is a condition manifested by bilateral muscle weakness. Zika virus is especially a great concern during pregnancy due to the high likelihood of mother to child transmission (13). Babies born of mothers with Zika fever are at high risk of birth defects especially microcephaly. The CDC has therefore developed strategies to prevent initial contraction of the disease during pregnancy (14). Having established the various modes of transmission, the general public should be made aware of the precautions to take to avoid infection as well as to avoid spreading the infection if already infected (15). There is no specific treatment or prophylactic vaccines for Zika fever therefore emphasis is made on prevention. Prevention is mainly based on controlling mosquito populations capable of spreading the virus. Areas suitable for breeding of mosquitoes include stagnant waters, tanks, reservoirs and barrels containing water (16). To reduce the risk of infection such waters should be well covered or drained to prevent mosquitoes from breeding. Treatment for Zika fever involves symptomatic management since there is no any specific cure for the disease. Adequate rest, plenty of fluids, pain relief and reduction of fever constitute the basic management criteria for Zika fever (17). The World Health Organization has suggested priority should be to develop vaccines safe to use in pregnancy and women of childbearing age. As of January 2016, the Vaccine Research Center began working towards developing a vaccine for the Zika virus. Eighteen companies and institutions as of March 2016 were working to develop vaccines against Zika virus but none had yet achieved any significant results (18).

## CONCLUSIONS

With the spread of Zika virus, the worry about the virus is its disturbing association with microcephaly, a neuro-

logical issue coming about to infants recognizing an anomalous littler head. The resultant impact is serious formative issues and in compelling circumstances. Considering the way that there exists no antibody or specific treatment for the Zika virus, the best way to shield oneself from the virus is through taking precaution measures. For one thing, you can halt from setting out to territories with a dynamic infestation. Moreover, you ought to maintain a strategic distance from mosquito chomps by resting under a mosquito net. Furthermore, make it a propensity to wear since quite a while ago

sleeved shirts and long jeans that are sufficiently thick to keep a mosquito chomp. Last but not the least, guarantee that you stay in lodgings with screened windows and aerated and cooled rooms. On the off chance that you are now contaminated from the virus, the most ideal approach to keep individuals around you safe is through taking measures not to be nibbled by a mosquito. It is that important to considered us as the potential victims of the virus infection when we were exposed to the sucking mosquitoes. ■

## ARTICLE INFORMATION

**Author Affiliations:** Division of Public Health, The BASE, Chapel Hill, NC 27150, USA (Murphy, Long).

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