

Where did Zika virus come from?

Zika virus (ZIKV) was first discovered in 1947 in the Zika Forest of Uganda. Shortly thereafter, it was isolated from mosquitoes in the area and then humans in 1968. ZIKV is a flavivirus similar to yellow fever, dengue, Japanese encephalitis, and West Nile virus (WNV). The disease had only been detected in Central Africa and throughout Southeast Asia until associated with a disease outbreak on Yap Island, in the South Pacific in 2007. From there, it spread to South America with human cases beginning in 2014.

How does the virus spread?

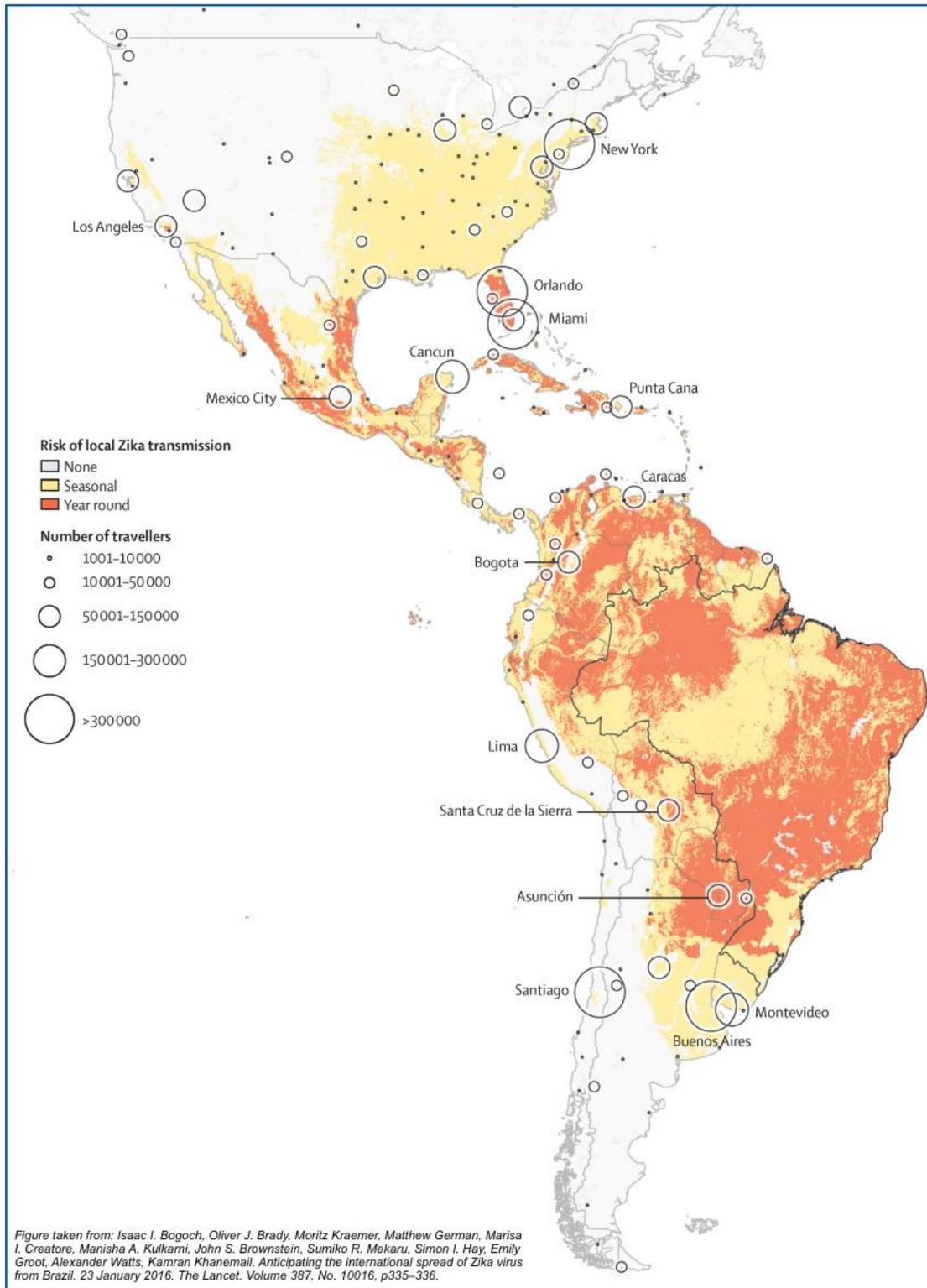
ZIKV does not appear to require an animal reservoir, like WNV, which is perhaps a factor in the rapid spread throughout the Americas. Non-infected mosquitoes are able to acquire the virus after feeding directly on infected humans. Without a "middle man" in the endemic cycle of ZIKV, the virus can spread quite rapidly where abundant, competent vector mosquitoes and humans are present together. Today, there is active transmission of the virus throughout South and Central America and the Caribbean Islands. Please refer to Figure 1.

Figure 1



Figure 2 displays the anticipated spread of Zika virus from the current Brazil outbreak.

Figure 2



Cases within the United States of America

Currently, all US cases have been imported* from individuals visiting infected areas of Latin and South America. It is highly likely that new imported cases will continue to surface in the media, with individuals not symptomatic until their return to the states.

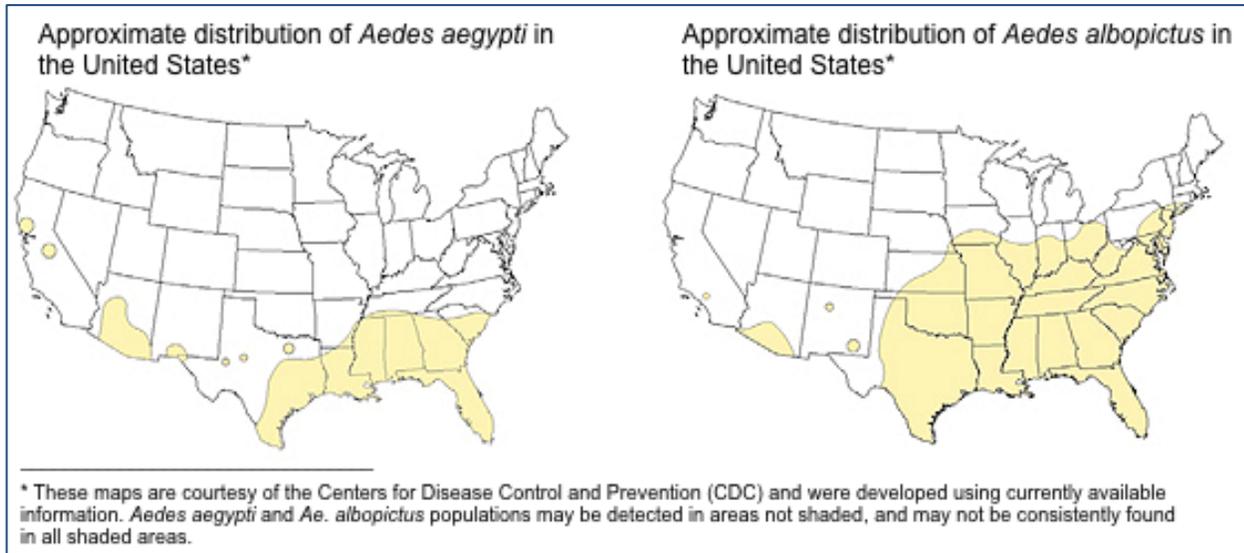
*Note: There have been 2 cases of ZIKV infection in the US that are suspected to have been sexually transmitted. The evidence for sexual transmission is circumstantial. In each instance, an individual had traveled outside the US and developed symptoms of ZIKV infection upon return. Their spouses also reported symptoms of infection, although they had no travel history. In both cases direct contact, including sexual contact, with the previously infected partner occurred. Hence, sexual transmission is implicated as the most likely route of transmission.

Mosquito Vectors of Zika virus

ZIKV is transmitted by *Aedes* mosquitoes. However, in the Americas, it has only been linked to transmission by *Aedes aegypti*. *Ae. aegypti* is a container-breeding species that is also responsible for the transmission of dengue virus, yellow fever virus and chikungunya virus. Recently, in Senegal and again in Gabon, the virus was detected in *Aedes albopictus* (the Asian tiger mosquito) and it is likely that *Ae. albopictus* could vector the virus in the Americas. Elsewhere in Africa and Southeast Asia, it has been isolated from several species of *Aedes* that are not found anywhere in the US.

Ae. Aegypti, the yellow fever mosquito, is a medium-sized blackish mosquito easily distinguished from *Ae. albopictus* by a silvery-white "lyre-shaped" pattern of scales on its scutum. Although there are some distinct differences in the habits of these species, both species are peridomestic species found not far from human dwellings – particularly abundant in towns and cities. They are primarily early morning or late afternoon feeders, but females can also take a blood meal under artificial illumination at night. *Aedes aegypti* is reported to fly only a few hundred yards from breeding sites. Larvae can be found in a variety of artificial containers including buckets, tires, cans, flower pots, etc.

Both *Ae. aegypti* and *Ae. albopictus* are limited in their distribution in the US. Therefore, it is unlikely that ZIKV will become a disease that is circulating throughout the US – like WNV. Please refer to Figure 3 for a map depicting each mosquito's US distribution.

Figure 3

Symptoms of Zika infection

Typically, people with ZIKV infection begin showing symptoms with a mild headache. Within a day or two, a maculopapular rash may appear and can cover many parts of the body (arms, hands, face, chest). Following the rash, people generally report continued fever, malaise, and body aches. Other symptoms can include diarrhea, constipation, abdominal pain, and dizziness. These symptoms typically last from 4-7 days. The incubation period of the virus (the time from infected mosquito bite to symptoms) is approximately 3-12 days. However, 60% - 80% of individuals infected with the pathogen remain asymptomatic.

Treatment of Zika Infection

Like most mosquito-borne viruses, there is no prophylaxis, treatment, or vaccine to protect against ZIKV infection. Treatment is considered symptomatic and supportive, including rest and the use of acetaminophen to relieve fever. Patients should also be advised to drink plenty of fluids to replenish fluid lost from sweating, vomiting, and other insensible losses.

If anyone has traveled to a known endemic area recently and are displaying any of the symptoms described above, they should consult their physician immediately. Diagnostic tests for ZIKV infection include a standard PCR test on acute-phase serum samples, which detects viral RNA, and other tests to detect specific antibodies against the virus in serum. An ELISA has also been developed by the CDC to detect immunoglobulin (Ig) M to ZIKV.

Concerns with Pregnancy and Perinatal Infections

One of the reasons this mosquito-borne disease is generating great concern is the potential ability of the virus to cross the placenta. Such an occurrence may result in the birth defect microcephaly, which causes underdevelopment of the head and brain. The primary data supporting its involvement in birth defects is tied to Brazil's dramatic increase of microcephaly, with nearly 4,000 cases documented in recent months. However, at this point in time, the link between ZIKV and infant microcephaly is poorly understood.

A very recent study demonstrating 2 cases of fetal microcephaly, as diagnosed via amniocentesis and subsequent PCR confirmation for ZIKV, most likely represent the first diagnoses of intrauterine transmission of the virus. Because of this, the CDC and WHO have issued warnings, as a precautionary measure, while they continue to search for further scientific data supporting intrauterine transmission.

Preventing Zika Infection

As always, we urge residents to reduce mosquito-breeding on the property by discarding or draining sources of standing water. Additional preventive measures, especially by pregnant women, are recommended during the daytime when *Ae. aegypti* are most active. Individuals that are traveling, or planning to travel, to countries where ZIKV or other mosquito-borne viruses are found, are urged to visit www.cdc.gov/zika/prevention and take the precautions as listed by the CDC.

Controlling *Aedes aegypti/albopictus* and Zika virus

In order to properly contain a disease, outbreak efforts must target the mosquito vector as well as target community involvement initiatives. VDCI recommends a 4-pronged approach for an effective control strategy that is designed to target all phases of the mosquito's life cycle:

(1) Public Education – Focusing on the removal of mosquito breeding source.

Given that these mosquito vectors live in and around urban settings, laying eggs in water-holding containers, community understanding of the sources of these mosquitoes and how to properly “mosquito-proof” their homes is critical. Furthermore, educational pieces that encourage individuals and families to seek prompt medical care when Zika virus is detected in a community should be distributed. Outreach to neighbors, work colleagues, and members of social clubs can reinforce messages disseminated through the mass media.

VDCI has developed numerous brochures, door hangars and fact sheets for various mosquito-borne diseases. In conjunction with door-to-door larvicide efforts, these materials can be delivered to homes and residents throughout affected neighborhoods.

(2) Surveillance – Seeking to understand a vector’s presence.

It is important to determine the mosquito distribution, density, and species composition throughout the target area. Furthermore, it will provide direct evidence of an increased transmission risk of Zika virus.

VDCI uses multiple traps to capture weekly samples of mosquitoes in various stages of their lifecycle. This complete surveillance approach is crucial for the efficient and precise control efforts in residential areas.

(3) Larval Mosquito Control – Focusing on the application of environmentally safe larvicides for the control of immature mosquitoes.

When mosquito larvae are detected in an area, trained and experienced ground crews preferentially apply treatments to all areas of standing water, stagnant pools, and water-holding containers. Only insecticides approved by the Environmental Protection Agency (EPA) for the control of mosquitoes should be used for all control applications.

Our crews work in two person teams to canvass a neighborhood. Appropriate habitats are inspected and, when appropriate, treated via backpack and hand-delivered applications of larvicide.

(4) Adult Mosquito Control – Targeted application of products for the effective reduction of pestiferous and disease-causing mosquitoes.

Truck-mounted and aerial ULV applications are often used to control adult mosquitoes. These methods have limited efficacy against the primary targets of Zika virus, due to the flight behavior of the *Ae. aegypti* and *Ae. albopictus*.

VDCI recommends the deployment of two person teams to conduct targeted ULV applications combined with residual “barrier” applications via backpack applicators to mosquito harborage areas near homes and other structures. When combined with our larvicide efforts, these applications have proven highly effective at significantly reducing local populations of *Ae. albopictus*.

VDCI is here to help!

VDCI is committed to public education and spreading awareness throughout the U.S. about the dangers of mosquito-borne diseases and their preventability, with the overarching goal of reducing the illness and fatality statistics in 2016. Our dedicated and experienced staff works tirelessly to prevent the spread of mosquito-borne diseases in all of the contracts we service. If you would like more information about any aspect of mosquito surveillance, disease testing, or adult control, please contact Vector Disease Control International (VDCI) and we will help you get started immediately.