Zika outbreak

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Zika Virus

- Single-stranded, enveloped RNA virus
- Family Flaviviridae, genus Flavivirus
- Closely related to dengue, yellow fever, Japanese encephalitis and West Nile viruses
- Transmitted to humans primarily by Aedes mosquito species

Source: CDC

Structure of Zika Virus

- The virion is approximately 40 nm in diameter with surface projections that measure roughly 5-10 nm.
- Nucleocapsid is 25-30 nm in diameter surrounded by a host-membrane derived lipid bilayer.
- Enveloped
- Icosahedral
- Contains envelope proteins E and M
**Zika Virus**

- Zika Virus (ZIKV) is mosquito-borne emerging flavivirus. Its infection is caused by the bite of an infected Aedes mosquito, usually causing mild fever, rash, conjunctivitis, and muscle pain.

**Group:** Group IV \((\pm)\) ssRNA  
**Family:** Flaviviridae  
**Genus:** Flavivirus

**Species:** Zika virus

**Genome of Zika Virus**

- Non-segmented, single-stranded, positive-sense RNA genome
- 10794 bases long with two non-coding regions flanking regions known as the 5′ NCR and the 3′ NCR.

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Image of a diagram showing the genomic polyprotein and its components.

**The 3.8 Å Resolution Cryo-EM Structure of Zika Virus**

D Sirohi, RJ Kuhn et al.

- Structure largely similar to that of other flaviviruses, except for notable difference in region of E glycoprotein that may be used for attachment to host cells.
Epidemiology of Zika Virus

- The virus was first isolated in 1947 from a rhesus macaque in the Zika Forest of Uganda.
- It was later identified in humans in 1968 for the first time in Nigeria.
- The first major outbreak, with 185 confirmed cases, was reported in 2007 in the Yap Islands.
- The first cases confirmed in Brazil was in May 2015 and the country is currently experiencing the largest epidemic ever recorded with 440,000 to 1,300,000 suspected cases reported by the Brazilian health authorities.
- There are 3174 cases and 38 deaths from microcephaly in Brazil as of 21 October 2015.
- There has been total death of 152 as of 21 October 2015 in the world.
- **Affected Countries:** Barbados, Bolivia, Brazil, Colombia, the Dominican Republic, Ecuador, El Salvador, French Guiana, Guatemala, Guadeloupe, Guyana, Haiti, Honduras, Martinique, Mexico, Panama, Paraguay, Puerto Rico, Saint Martin, Suriname, and Venezuela.
Transmission of Zika Virus

- Zika can be spread through
  - Mosquito bites (mosquito, mainly Aedes aegypti in tropical regions, Aedes albopictus).
  - From a pregnant woman to her fetus. In 2015, Zika virus RNA was detected in the amniotic fluid of two fetuses, indicating that it had crossed the placenta.
  - Sex with an infected person.
  - Laboratory exposure.
  - Zika may be spread through blood transfusion.
  - No reports of infants getting Zika through breastfeeding.

Pathogenesis of Zika Virus

- Incubation period in mosquitoes is about 10 days.
- The vertebrate hosts of the virus are primarily monkeys and humans.
- The pathogenesis of the virus is hypothesized to start with an infection of dendritic cells near the site of inoculation, followed by a spread to lymph nodes and the bloodstream. Flaviviruses generally replicate in the cytoplasm, but Zika virus antigens have been found in infected cell nuclei.
What are the symptoms?

Clinical presentation

Incubation period
• Onset of symptoms is 3 to 12 days after infection

Viraemic period
• Short viraemic period allowing for direct virus detection
  3 to 5 days after onset of symptoms

Symptoms
• Rash with/without fever and with the following signs and/or symptoms:
  – arthralgia/arthritis
  – conjunctivitis (non-purulent/hyperaemia)
  – general fatigue

Most of the infections remain asymptomatic
(approx. 80%)

For people with symptoms, the most common symptoms of Zika are
• Fever
• Rash
• Joint pain
• Conjunctivitis (red eyes)

Other symptoms include
• Muscle pain
• Headache

Rash, swollen joints, and conjunctival hyperemia
Potential complications

Microcephaly in foetuses and newborns

- Zika virus has been associated with severe congenital central nervous system malformations and microcephaly
- Zika virus can be spread from a pregnant woman to her foetus. Pregnant women are under follow-up in several affected countries to establish the risk of infecting the foetus

Guillain-Barré syndrome

- Temporal association between Zika outbreaks and increases in the incidence of Guillain-Barré syndrome observed in French Polynesia, Brazil, Venezuela, El Salvador and Colombia.
- Strong evidence is emerging in the scientific literature about the association of Zika with microcephaly and GBS.
How can Zika affect pregnancies?

- Infection with the virus appears to be linked to the development of unusually small heads and brain damage in newborns (microcephaly).
- The most dangerous time is thought to be during the first trimester of Pregnancy—when some women do not realize they are pregnant. Experts do not know how the virus enters the placenta and damages the growing brain of the fetus.
- Infection during pregnancy can cause microcephaly and other severe brain defects.
- Linked to other problems, such as miscarriage, stillbirth, and birth defects

**Congenital Zika syndrome**

- Associated with 5 types of birth defects not seen or rarely seen with other infections during pregnancy
  - Severe microcephaly (small head size) resulting in a partially collapsed skull
  - Decreased brain tissue with brain damage
  - Damage to the back of the eye with a specific pattern of scarring and increased pigment
  - Limited range of joint motion, such as clubfoot
  - Too much muscle tone restricting body movement soon after birth
Does Zika cause Guillain-Barré syndrome (GBS)?

- GBS is an uncommon sickness of the nervous system in which a person’s own immune system damages the nerve cells, causing muscle weakness, and sometimes, paralysis.
- GBS is strongly associated with Zika but only a small proportion of people with recent Zika infection get GBS.
- CDC is continuing to investigate the link between GBS and Zika to learn more.
Acute Myelitis Due to Zika Virus Infection
S Mécharles, A Lannuzel, et al.

- 15-year-old girl in Guadeloupe, French West Indies with high concentrations of Zika virus in serum, urine, and cerebrospinal fluid

Zika Virus Associated with Meningoencephalitis
G Carteaux, I Leparc-Goffart et al.

- 81-year-old man in France with meningoencephalitis following cruise in the Pacific (area of New Caledonia, Vanuatu, the Solomon Islands, and New Zealand)
- CSF positive for Zika virus, by PCR and culture

REUTERS
April 10, 2016

Brazilian Scientists Find New Zika-linked Brain Disorder in Adults

- Autoimmune syndrome called **acute disseminated encephalomyelitis (ADEM)** seen in two patients with Zika virus infection

- Findings presented at the American Academy of Neurology meeting in Vancouver
Diagnosis of Zika Virus

Sample: Blood, Saliva, Urine.

PCR: It is useful in the first 3-5 days after the onset of symptoms. It helps in the direct detection of Zika virus RNA or specific viral antigens in clinical specimens.

Serology Test: It detect the presence of antibodies but are useful only after five days.

Diagnostics

Detection of viral RNA
- RT-PCR during the viraemic period between day 3 and 5 after onset of symptoms (serum and saliva)
- Detection in urine up to 10 days after onset.
- Specific investigation: amniotic and cerebrospinal fluids and tissues (e.g. placenta).

Serology: Zika-specific IgM antibodies
- IgM antibodies against Zika virus detectable from day 5 after onset of symptoms.
- Detection of Zika-specific IgM antibodies requires confirmation by plaque-reduction neutralisation tests because of cross-reactivity with antibodies against other flaviviruses.
- Vaccination status and infections with other flaviviruses must be considered when interpreting the results.
Treatment and Care

- There is no specific medicine or vaccine for Zika virus infection. However, vaccine development is underway in several countries.
- Treat the symptoms.
- Resting under a bed net to avoid onward transmission.
- Drink fluids to prevent dehydration.
- Do not take aspirin or other non-steroidal anti-inflammatory drugs (NSAIDS) due to increased risk of haemorrhage if dengue has not been ruled out.
- Take acetaminophen (Tylenol®) to reduce fever and pain.
- Admission of complicated cases in hospital for close monitoring and supportive care, e.g. ICU/ventilation for GBS cases.
**Prevention and Control of Zika Virus**

Zika is primarily spread through the bite of an infected Aedes aegypti or Aedes albopictus mosquito. Take steps to protect yourself and others.

Protect yourself from mosquito bites.

**During the first week of illness, Zika virus can be found in blood.** The virus can be passed from an infected person to a mosquito through bites. An infected mosquito can spread the virus to other people.

- Avoid travel to areas with an active infestation.
- Travelers should take the basic precautions to protect themselves from mosquito bites.
- During outbreaks, health authorities may advise that spraying of insecticides be carried out.
- Reducing mosquito populations and avoiding bites, which occur mainly during the day.
- Eliminating and controlling Aedes aegypti mosquito breeding sites reduces the chances that Zika will be transmitted.
Wear long sleeves and long trousers to create a barrier between you and mosquitoes.

Cover used water storage containers. Empty unused containers & plant drip trays. Remove rubbish from your yard. Dislodge eggs from vases, containers, plant drip trays.

- Use window and door screens.
- Use air conditioning when possible.
- Once a week, empty, scrub, turn over or throw out items that hold water.
- If you have mosquitoes inside your home, use an indoor insect fogger or indoor insect spray.
  - When using insecticides, always follow label directions.
Prevention – Mosquito reduction

Integrated vector management

- Intersectoral collaboration and efficient public communication strategies to ensure community participation are required for sustainable vector control

Reduction of mosquito breeding sites:
- removal of all open containers with stagnant water in and surrounding houses on a regular basis or, if that is not possible, treatment with larvicides
- tight coverage of water containers, barrels, wells and water storage tanks
- wide use of window/door screens by the population

During an outbreak, limitation of adult mosquitoes through aerial spraying with insecticides can be considered

Prevention – Transmission reduction

Protection against mosquito bites
- *Aedes* mosquitoes bite during the daytime both indoors and outdoors. Personal protection measures should therefore be applied during the day

Personal protection measures:
- using appropriate mosquito repellents and wearing long-sleeved shirts and long trousers
- sleeping or resting in screened or air-conditioned rooms, otherwise use insecticidal treated mosquito nets, even during the day
- repellent use must be strictly done in accordance with the instructions indicated on the product label.
For babies and children
- Dress your child in clothing that covers arms and legs.
- For children older than 2 months, use insect repellent on exposed skin.
- Cover crib, stroller, and baby carrier with mosquito netting.

Applying insect repellent for babies and children
- Do not apply repellent onto hands, eyes, mouth, and cut or irritated skin.
- Adults: Spray onto your hands and then apply to a child’s face.
- Do not use insect repellent on babies younger than 2 months old.
- Do not use products containing oil of lemon eucalyptus or para-menthane-diol on children younger than 3 years old.
PREVENTION
PREVENTING SEXUAL TRANSMISSION
About sexual transmission

- Zika can be passed through sex from a person who has Zika to his or her sex partners.
  » Sex includes vaginal, anal, and oral sex and the sharing of sex toys.
  » Zika can be passed through sex before symptoms start, during, and after symptoms end.
  » It can be passed even if the infected person does not have symptoms at the time or never develops symptoms.

- Zika virus can stay in semen longer than in vaginal fluids, urine, and blood.

Protect your partner

• Condoms can reduce the chance of getting Zika from sex.
  « Includes male and female condoms.
  « Condoms should be used from start to finish, every time during vaginal, anal, and oral sex and the sharing of sex toys.
PREVENTION
Traveling

Travel guidance for pregnant women

If you are pregnant, do not travel to areas with Zika. Pregnant women should talk with their healthcare provider and consider postponing nonessential travel to countries in CDC’s special travel considerations for Southeast Asia. If you must travel, talk to your doctor or other healthcare provider before your trip.
THANK YOU