Zika virus—a new and emerging threat

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Why all the interest in Zika virus?

• The Zika virus is likely to spread across nearly all of the Americas, the World Health Organization has warned.
• The infection, which causes symptoms including mild fever, conjunctivitis and headache, has already been found in 21 countries in the Caribbean, North and South America.
• It has been linked to thousands of babies being born with underdeveloped brains and some countries have advised women not to get pregnant.
• No treatment or vaccine is available.
Zika virus symptoms

- In the vast majority of cases, it causes no symptoms at all. Most people who get infected don't even realize it — and therefore never seek medical attention. They can, however, still transmit the disease if they are bitten by a mosquito that then bites someone else.
- Meanwhile, a minority of Zika patients — roughly 20% — show relatively minor symptoms: low-grade fever, sore body, and headache, as well as red eyes and a body rash.
- More rarely, this might include abdominal pain, nausea, and diarrhea. These symptoms usually appear two to 12 days after a bite and go away within a week.
- Severe disease requiring hospitalization is uncommon.
Skin rash due to Zika virus
What is microcephaly?

Microcephaly

- Symptoms include below-average head size
- Often caused by failure of brain to grow at normal rate
- Head circumference measuring **less than 31.5-32cm** at birth
- Affects **25,000 children** in US each year

Source: ADAM, WHO
It seems like microcephaly may just be the tip of the iceberg

• We’re also seeing that in some babies, the brains, which usually have wrinkles, are actually smooth. That’s a sign that development of the brain has been impaired. Several of them are also impaired with respect to vision and hearing.

• The preliminary evidence is that [some] babies who don’t have microcephaly may also have neurological lesions or birth defects that are not as obvious as microcephaly, but we need to rule out other causes of congenital infection to really make sure.
Zika Virus May Cause Rare Paralysis Syndrome

• Health officials are now investigating if the mosquito-borne Zika virus is linked to a rare paralysis syndrome called Guillain-Barre (GBS).

• GBS results when the immune system goes haywire and attacks the nervous system. It has been known to strike patients after they suffered from influenza or other viruses.

• GBS can be treated with infusions of plasma to help recalibrate the immune system, but that people can be paralyzed for weeks before the syndrome recedes.

• In the U.S., the syndrome affects approximately 3,000 to 6,000 people every year.
Where did it come from, and are we vulnerable to infection?

• The virus is native to Africa and was first found to be spreading in the Americas in Brazil in May 2015.

• The lack of any natural immunity in the Americas is thought to be helping the infection to spread rapidly.

• Around 80% of infections do not result in symptoms.
What We Know So Far About Sexual Transmission Of Zika Virus

• A patient acquired Zika virus in the U.S. through sex with a person who had traveled to a place where the virus is circulating

• The couple noticed that the husband's semen had been bloody for a few days before the wife felt sick

• The disease shows symptoms within 2 to 7 days of exposure, but SOME CASES MAY BE ASYMPTOMATIC.
CDC: Men who were in Zika areas should use condoms

• Men who have been to a Zika outbreak region should use condoms if they have sex with a pregnant woman — for the entire duration of the pregnancy.

• Men might consider abstaining or using condoms even during sex with a woman who isn't pregnant.
Is there a treatment?

• No.
• The C.D.C. does not recommend a particular antiviral medication for people infected with the Zika virus. The symptoms are mild – when they appear at all – and usually require only rest, nourishment and other supportive care.
Are you pregnant and worried about the Zika virus? Here’s what to do.

Pregnant women who traveled to an area with Zika virus transmission

- **With Zika symptoms** during or within two weeks of travel:
  - Blood-test mother for Zika infection
    - Positive
      - Fetal ultrasounds and amniocentesis for Zika virus testing
    - Negative
      - Fetal ultrasounds to detect microcephaly

- **No Zika symptoms** during or within two weeks of travel:
  - Fetal ultrasounds to detect microcephaly or calcification of the skull
    - Positive
      - Regular ultrasounds to detect microcephaly
    - Negative
      - Amniocentesis for Zika virus testing
Zika is transmitted by the bite of Aedes mosquitoes
Aedes aegypti and Aedes albopictus Mosquitoes

• 2 invasive (non-native) mosquito species have recently been found in several California cities and there is a potential for them to spread into other areas of CA.

• *Aedes aegypti* (the yellow fever mosquito) and *Aedes albopictus* (the Asian tiger mosquito).

• Unlike most native mosquito species, *Aedes aegypti* and *Aedes albopictus* bite during the day.
Officials think there could be more outbreaks in the US

Approximate distribution of *Aedes aegypti* mosquitoes

Approximate distribution of *Aedes albopictus* mosquitoes

SOURCE: CDC

Vox
Aedes aegypti and Aedes albopictus Mosquitoes Detection Sites in California, 2011-2015

Updated December 16, 2015

• Aedes aegypti
• Aedes albopictus

El Monte
South El Monte
Duarte
Arcadia
Temple City
Inland Empire
Monterey Park
Baldwin Park
Monrovia
La Puente
Avocado Heights*
Rosemead
Whittier*
Bradbury
South Whittier*
San Gabriel
Azusa
Covina
West Covina
Glendora
Los Angeles
Alhambra
Pico Rivera
La Cañada Flintridge

*Unincorporated Census-Designated Places
Local vector control districts brace for upcoming mosquito season

- Vector control districts ask public to participate in control effort by removing water containers used by mosquitoes for breeding
- The mosquito likes small containers of water, whether inside or outside. The females lay their eggs in the water, where they develop over several days.
- Just an ounce or two of water is enough for the insect.
- For pet water bowls, the districts ask that they be emptied, washed out and refilled a couple times a week so mosquitoes do not have time to develop.
California Department of Public Health Reminds Public to Guard Against Mosquito Bites

• Remove standing water
• Wear insect repellant when necessary (containing DEET, picaridin, IR3535, oil of lemon eucalyptus, or para-menthane-diol for long lasting protection)
• As of Jan. 29, 2016, there are 6 confirmed cases of Zika virus in CA, all of which were contracted when traveling in other countries
• Use air conditioning or window/door screens to keep mosquitoes outside.
How can Zika virus infection be diagnosed?

- A specific and sensitive one-step, reverse transcription polymerase chain reaction (RT-PCR) with an internal control (IC) was designed. 
  

- However, the virus is present in the blood only briefly, so a negative PCR on the blood sample does not rule out Zika infection.

- Diagnosis by serum antibody tests (serology) may be more reliable: IgM EIA or PRNT.
Diagnosis—Specimen Collection

Postulated virologic and host immune markers during ZIKV infection

Thank you to Michael Loeffelholtz and the Association of Public Health Laboratories
Algorithm for Zika virus serology

- First screen patient serum for antibody against flavivirus group by enzyme immunoassay (EIA)

- EIA to detect IgM antibody indicates recent infection

- If EIA is positive for IgM antibody to flavivirus, then perform more specific Zika virus plaque reduction neutralization assay (PRNT)
Diagnosing Zika infection: enzyme immunoassay

1. Viral antigen
2. Patient antibodies
3. Anti-human antibodies

Anti-human antibodies can be anti-IgM to detect recent infection.

Antibodies to other viruses like West Nile or dengue might cross-react.
Plaque reduction neutralization test (PRNT): how does it work?
Vaccine for Zika Virus May Be Years Away

• It could be years — maybe as long as a decade — before an effective product makes its way to the public.

• Scientists still learning about the virus, which until recently was viewed as relatively benign,

• Any vaccine must go through rigorous testing to ensure that it is safe and effective.
Zika vaccine, cont’d

- Two major vaccine makers, the British company GlaxoSmithKline and Sanofi Pasteur, a French manufacturer, are looking into the feasibility of developing a Zika vaccine
  - GlaxoSmithKline developed a vaccine for Ebola, which showed success in early clinical trials and is still being tested.
  - Last year, Sanofi received approvals for the world’s first vaccine for dengue, which is closely related to Zika