Zika Virus Vectors: 
**Aedes Mosquitoes**

- *Aedes* species mosquitoes
  - *Ae aegypti* more efficient vectors for humans
  - *Ae albopictus*

- Also transmit dengue and chikungunya viruses
- Lay eggs in domestic water-holding containers
- Live indoors and outdoors
- Aggressive daytime biters; can also bite at night
- Prefer to bite people
Zika Prevention Actions by Top 4, Middle 4, and Bottom 4 Rankings of Puerto Rican Pregnant Women (n=55)

- **TOP 4**: Most important and most able to put in practice (actions ranked 1-4)
- **MIDDLE 4**: Important and able to put in practice (actions ranked 5-8)
- **BOTTOM 4**: Least important and least able to put in practice (actions ranked 9-12)

Other Modes of Transmission

- Maternal-fetal
  - Intrauterine
  - Perinatal
- Sexual
- Laboratory exposure
- Theoretical
  - Blood transfusion
  - Organ or tissue transplantation
Zika Virus and Sexual Transmission

- Zika virus can be spread by a man to his sex partners

- Pregnant women with male partners who have or are at risk of Zika virus infection should abstain or use condoms for the duration of pregnancy
Microcephaly and Zika

What we know

- Small number of positive test results for Zika virus infection in infants with microcephaly
- Microcephaly pattern consistent with Fetal Brain Disruption Sequence
  - Based on photos/scans of a small number of affected infants from Brazil
  - Retrospective investigation in French Polynesia outbreak in 2013-2014
  - Infants with other intrauterine infections such as cytomegalovirus

What we don’t know

- Causal relation between Zika virus and microcephaly or other adverse pregnancy outcomes
- Full spectrum of phenotypes in affected infants
- Impact of timing of infection during pregnancy
- Impact of severity of maternal infection
- Magnitude of the possible risk of microcephaly and other adverse pregnancy outcomes
Pregnancy Outcomes and Zika Virus

- A range of other problems have been detected among fetuses and infants infected with Zika virus before birth including:
  - Absent or poorly developed brain structure
  - Defects of the eye
  - Impaired growth

- Although Zika has been linked with birth defects and other problems in infants, there is more to learn

- Researchers are collecting data to better understand the impact of Zika on mothers and their children
“Based on a growing body of preliminary research, there is scientific consensus that Zika virus is a cause of microcephaly and Guillain-Barré syndrome.”

“It has since become clear that transplacental infections occur & that these infections can cause severe damage to the development of the foetus’ central nervous system. What has not yet been established is how often maternal infections result in foetal infection, & congenital brain damage, & when during pregnancy the risk of adverse outcomes is highest. There is also a paucity of information regarding the spectrum of CNS damage caused by intrauterine infections,” ........
Between 22 October 2015 & 2 April 2016 a total of 6906 cases of microcephaly &/or CNS malformation were reported by Brazil. This contrasts with the period from 2001 to 2014, when an average of 163 microcephaly cases was recorded nationwide per year.

Table 2. Countries, territories and areas reporting microcephaly and /or CNS malformation cases potentially associated with Zika virus infection.

<table>
<thead>
<tr>
<th>Reporting country</th>
<th>Number of microcephaly and /or CNS malformation cases suggestive of congenital infections or potentially associated with a Zika virus infection</th>
<th>Probable location of infection</th>
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<tr>
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<tr>
<td>United States of America</td>
<td>1</td>
<td>Brazil</td>
</tr>
</tbody>
</table>
Figure 4. Distribution of microcephaly &/or CNS malformation cases suggestive of congenital infections in Brazil (1046 cases reported up to 6 April 2016)
“The prevalence of microcephaly in 15 states with laboratory-confirmed Zika virus transmission (2.8 cases per 10,000 live births) significantly exceeded that in four states without confirmed Zika virus transmission (0.6 per 10,000).”

(An analysis of 574 cases of microcephaly, detected through a newly established ad hoc microcephaly surveillance system.)
Fetal abnormalities were detected by Doppler ultrasonography in 12 of the 42 ZIKV-positive women (29%) & in none of the 16 ZIKV-negative women.

Adverse findings included fetal deaths, in utero growth restriction with or without microcephaly, ventricular calcifications or other CNS lesions, & abnormal amniotic fluid volume or cerebral or umbilical artery flow.

Figure 2. Week of Gestation at the Time of ZIKV Infection and Abnormal Ultrasonographic and Doppler Findings.
Association between Zika virus and microcephaly in French Polynesia, 2013–15: a retrospective study

Simon Cauchemez, Marianne Besnard, Priscillia Bompard, Timothée Dub, Prisca Guillemette-Artur, Dominique Eyrolle-Guignot, Henrik Salje, Maria D Van Kerkhove, Véronique Abadie, Catherine Garel, Arnaud Fontanet*, Henri-Pierre Mallet*

“We did a retrospective analysis of a large Zika virus outbreak in French Polynesia in 2013–14, based on four datasets that provided information on all cases of microcephaly, the weekly number of consultations for suspected infection with Zika virus, seroprevalence for Zika virus antibodies, & the number of births during the outbreak. Use of mathematical models enabled us to provide strong statistical support for the association between Zika virus infection & microcephaly .......... We estimated that the number of microcephaly cases associated with Zika virus was 95 (95% CI 34–191) per 10 000 women infected in the first trimester.” (~ 1% risk)
Present local cases: Cabo Verde has reported, as of 5 April 2016, 206 confirmed cases of Zika virus.
Because ZIKV is an emerging disease, response efforts are complicated by limited understanding of disease dynamics. To this end, we develop a novel state- and class-structured compartment model for ZIKV. Our model shows that the risk of prenatal ZIKV exposure should decrease dramatically following the initial wave of disease, reaching almost undetectable levels in endemic systems.

Figure 1 Predicted ZIKV dynamics, showing the number of women who experience a ZIKV infection during pregnancy as a function of the number of years since ZIKV arrival in the country or region. For this figure, we assume our intermediate transmission scenario (see Supplemental Information II). The inset shows the total number of ZIKV cases during the first year of the epidemic.