Zika Virus
PlatformQHealth

Joanne Cono, MD, ScM
Director
Office of Science Quality
Office of the Director
Centers for Disease Control and Prevention
April 6, 2016

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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

***Aedes aegypti* mosquito**

***Aedes albopictus* mosquito**

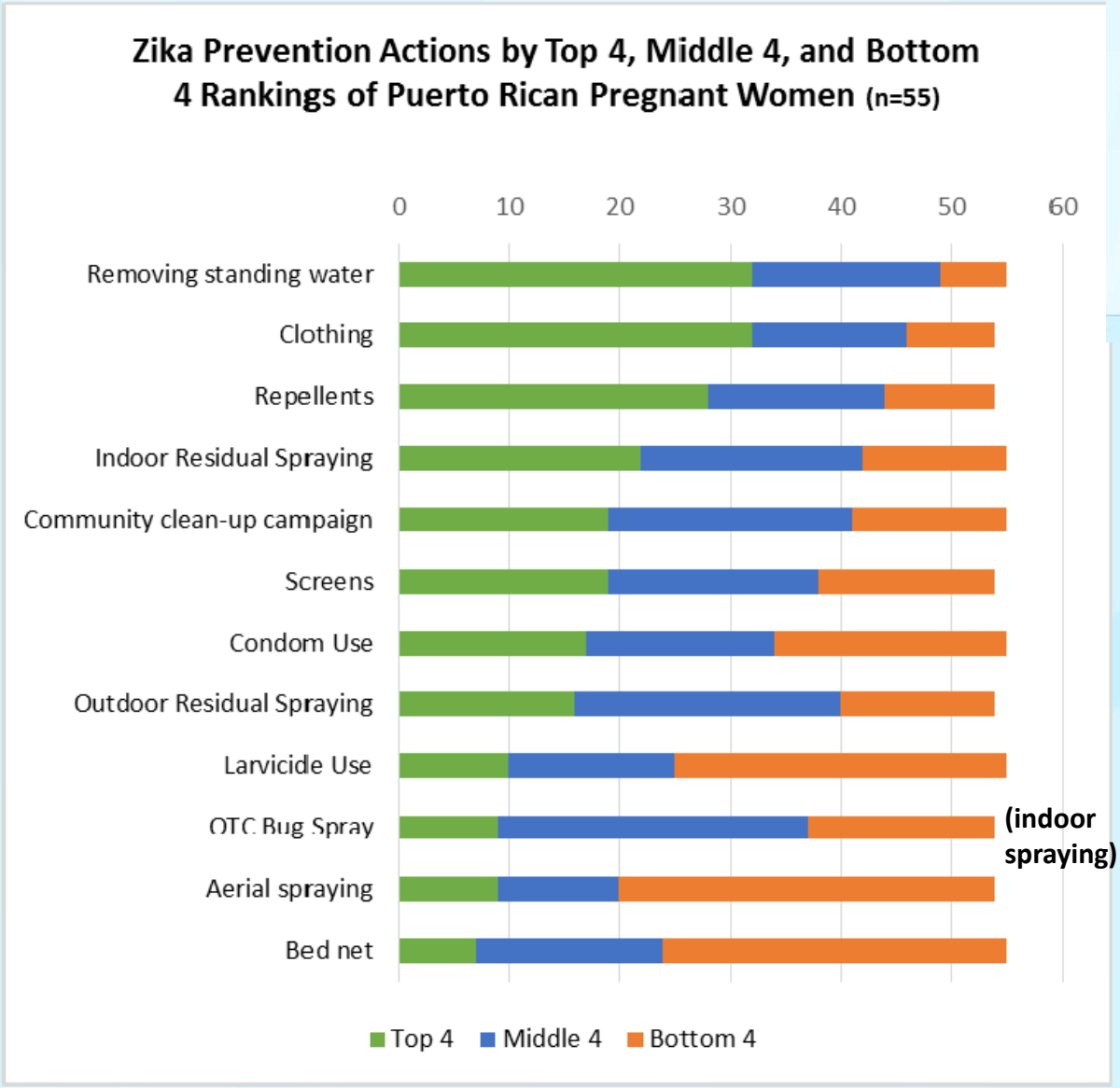
Puerto Rican Pregnant Women's Assessment of Vector Control Strategies and Personal Protective Behaviors for Zika prevention

Preliminary Report

Christine E. Prue, MSPH, Ph.D,
Associate Director for Behavioral Science

International Risk Communication Partners Group
April 11, 2016

National Center for Emerging and Zoonotic Infectious Diseases



- **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)

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Neglected tropical diseases

- Neglected tropical diseases
- About us
- Diseases
- Preventive chemotherapy and transmission control
- Innovative and intensified disease management
- Vector ecology and management

Mosquito (vector) control emergency response and preparedness for Zika virus

18 March 2016 | Geneva

Summary

On 14–15 March 2016 the WHO Vector Control Advisory Group (VCAG) reviewed five potential vector control tools and existing tools for use in the context of the response to the Zika virus outbreak, including: (1) mosquito control of human pathogens in adult vectors (*Wolbachia*); (2) mosquito control through genetic manipulation (OX513A); (3) sterile insect technique; (4) vector traps; and (5) attractive toxic sugar baits.

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Further reading

- Vector Ecology and Management (VEM)
- Vector Control Advisory Group on new tools (VCAG)
- Protecting the health and safety of workers in emergency vector control of *Aedes* mosquitoes

English | Es

www.who.int/neglected_diseases/news/mosquito_vector_control_response/en/

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Zika Resources: For Health Authorities

Surveillance

- Zika virus (ZIKV) Surveillance in the Americas: Interim guidance for laboratory detection and diagnosis

Vector Control

- WHO Pesticide Evaluation Scheme: "WHOPES"
- Integrated vector management (IVM) directory of resources
- Equipment for vector control – Specification guidelines, revised version; 2010
- Dengue Guidelines for diagnosis, treatment, prevention and control; 2009
- Pesticides and their application for the control of vectors and pests of public health importance, Sixth Edition; 2006
- Space spray application of insecticides for vector and public health pest control; 2003

Zika Resources

- Missions to support countries
- Events
- Epidemiological Alerts and Updates
- Case Definitions
- Technical Reports and Guidelines
- Countries with local transmission
- Communication Materials
- Resource Mobilization

www.paho.org/hq/index.php?option=com_content&view=article&id=11601&Itemid=41694&lang=en

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Other Modes of Transmission

- Maternal-fetal
  - Intrauterine
  - Perinatal
- Sexual
- Laboratory exposure
- Theoretical
  - Blood transfusion
  - Organ or tissue transplantation

The Subcommittee on Arbovirus Laboratory Safety of the American Committee on Arthropod-Borne Viruses. Laboratory safety for arboviruses and certain other viruses of vertebrates. Am J Trop Med Hyg 1980;29:1359–81.
European Centre for Disease Prevention and Control. Rapid risk assessment: Zika virus epidemic in the Americas: potential association with microcephaly and Guillain-Barre syndrome. Stockholm, Sweden: European Centre for Disease Prevention and Control; 2015.

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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

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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

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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

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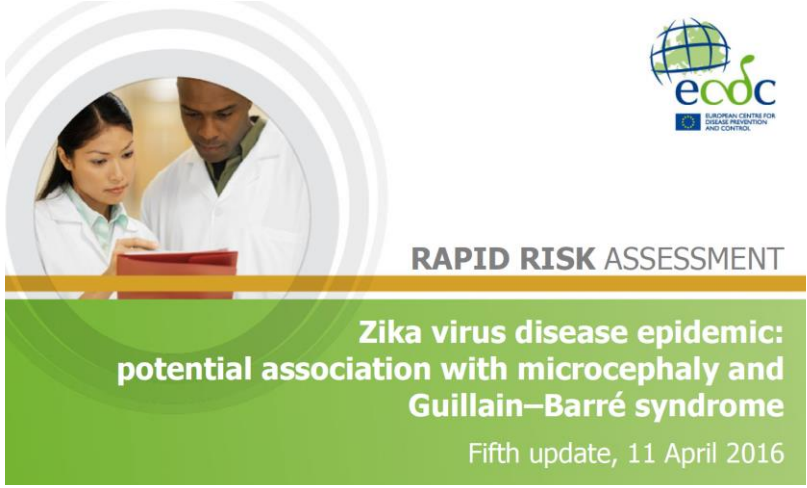
ZIKA VIRUS MICROCEPHALY AND GUILLAIN-BARRÉ SYNDROME

SITUATION REPORT
7 APRIL 2016

"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," ……..

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ZIKA VIRUS MICROCEPHALY AND GUILLAIN-BARRÉ SYNDROME

SITUATION REPORT
7 APRIL 2016

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

Reporting country	Number of microcephaly and /or CNS malformation cases suggestive of congenital infections or potentially associated with a Zika virus infection	Probable location of infection
Brazil	1046	Brazil
Cabo Verde	2	Cabo Verde
Colombia	7	Colombia
French Polynesia	8	French Polynesia
Martinique	3	Martinique
Panama	1	Panama
Slovenia [6]	1	Brazil
United States of America [7]	1	Brazil

"Between 22 October 2015 & 2 April 2016 a total of 6906 cases of microcephaly &/or central nervous system (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."

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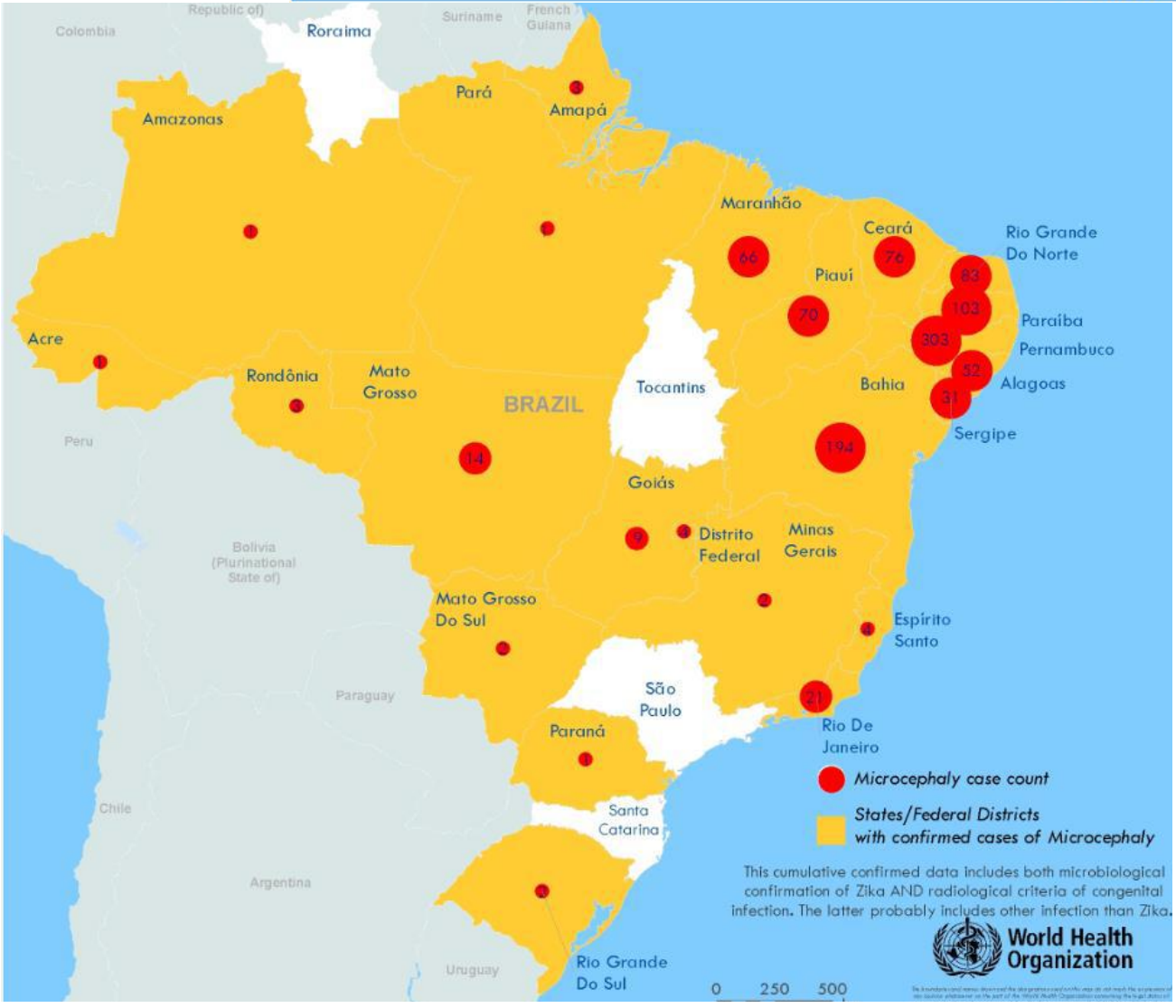
ZIKA VIRUS MICROCEPHALY AND GUILLAIN-BARRÉ SYNDROME

SITUATION REPORT 7 APRIL 2016

Figure 4. Distribution of microcephaly &/or CNS malformation cases suggestive of congenital infections in Brazil (1046 cases reported up to 6 April 2016)



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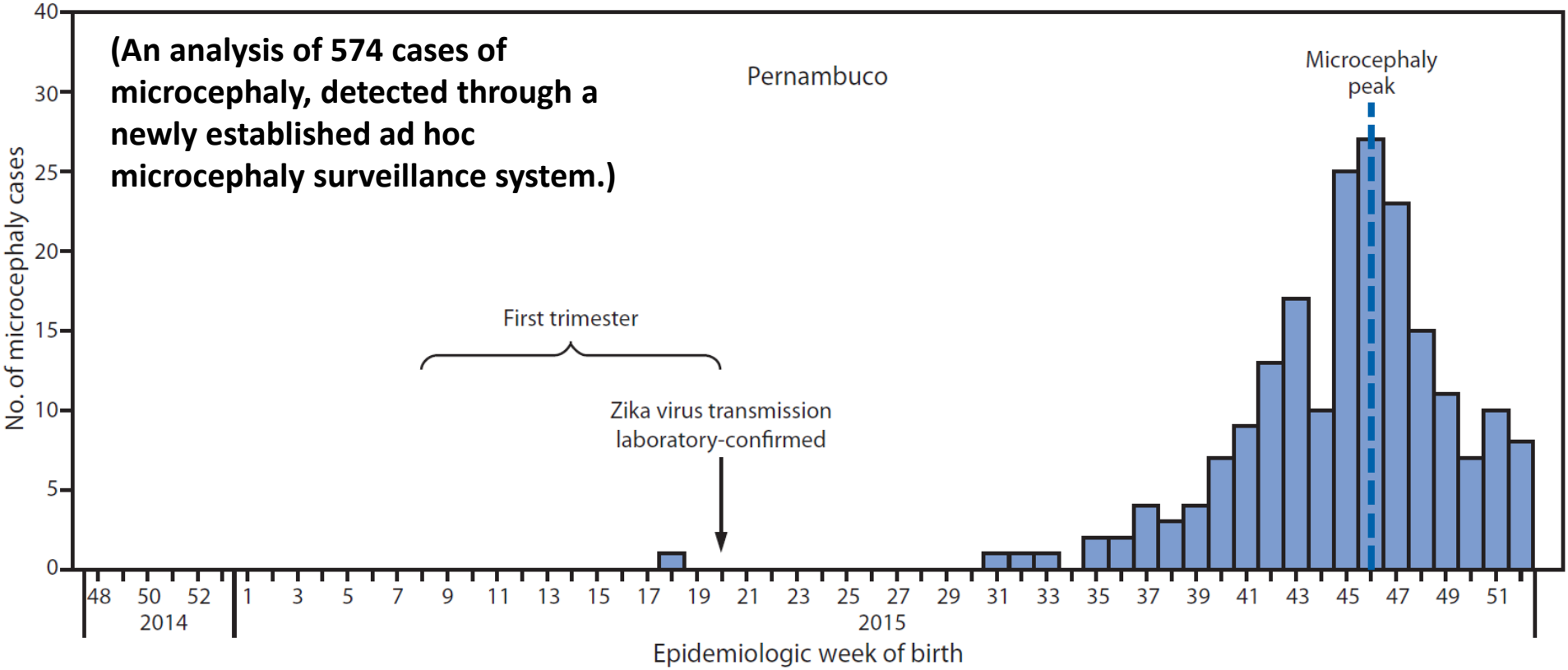
Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Early Release / Vol. 65
March 8, 2016

"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)."

Increase in Reported Prevalence of Microcephaly in Infants Born to Women Living in Areas with Confirmed Zika Virus Transmission During the First Trimester of Pregnancy — Brazil, 2015

Wanderson Kleber de Oliveira, MSc[1]; Juan Cortez-Escalante, MD[2]; Wanessa Tenório Gonçalves Holanda De Oliveira, MSc[1]; Greice Madeleine Ikeda do Carmo, MSc[1]; Cláudio Maierovitch Pessanha Henriques, MD[1]; Giovanini Evelim Coelho, PhD[1]; Giovanny Vinícius Araújo de França, PhD[1]

FIGURE 2. Number of reported cases of microcephaly* in full-term† newborns following laboratory-confirmed Zika virus transmission§ – Pernambuco, Paraíba, and Bahia states, Brazil, 2015



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ORIGINAL ARTICLE

Zika Virus Infection in Pregnant Women in Rio de Janeiro — Preliminary Report

Patrícia Brasil, M.D., Jose P. Pereira, Jr., M.D., Claudia Raja Gabaglia, M.D., Luana Damasceno, M.S., Mayumi Wakimoto, Ph.D., Rita M. Ribeiro Nogueira, M.D., Patrícia Carvalho de Sequeira, Ph.D., André Machado Siqueira, M.D., Liege M. Abreu de Carvalho, M.D., Denise Cotrim da Cunha, M.D., Guilherme A. Calvet, M.D., Elizabeth S. Neves, M.D., Maria E. Moreira, M.D., Ana E. Rodrigues Baião, M.D., Paulo R. Nassar de Carvalho, M.D., Carla Janzen, M.D., Stephanie G. Valderramos, M.D., James D. Cherry, M.D., Ana M. Bispo de Filippis, Ph.D., and Karin Nielsen-Saines, M.D.

March 4, 2016 | DOI: 10.1056/NEJMoa1602412

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.

(Prospective cohort study)

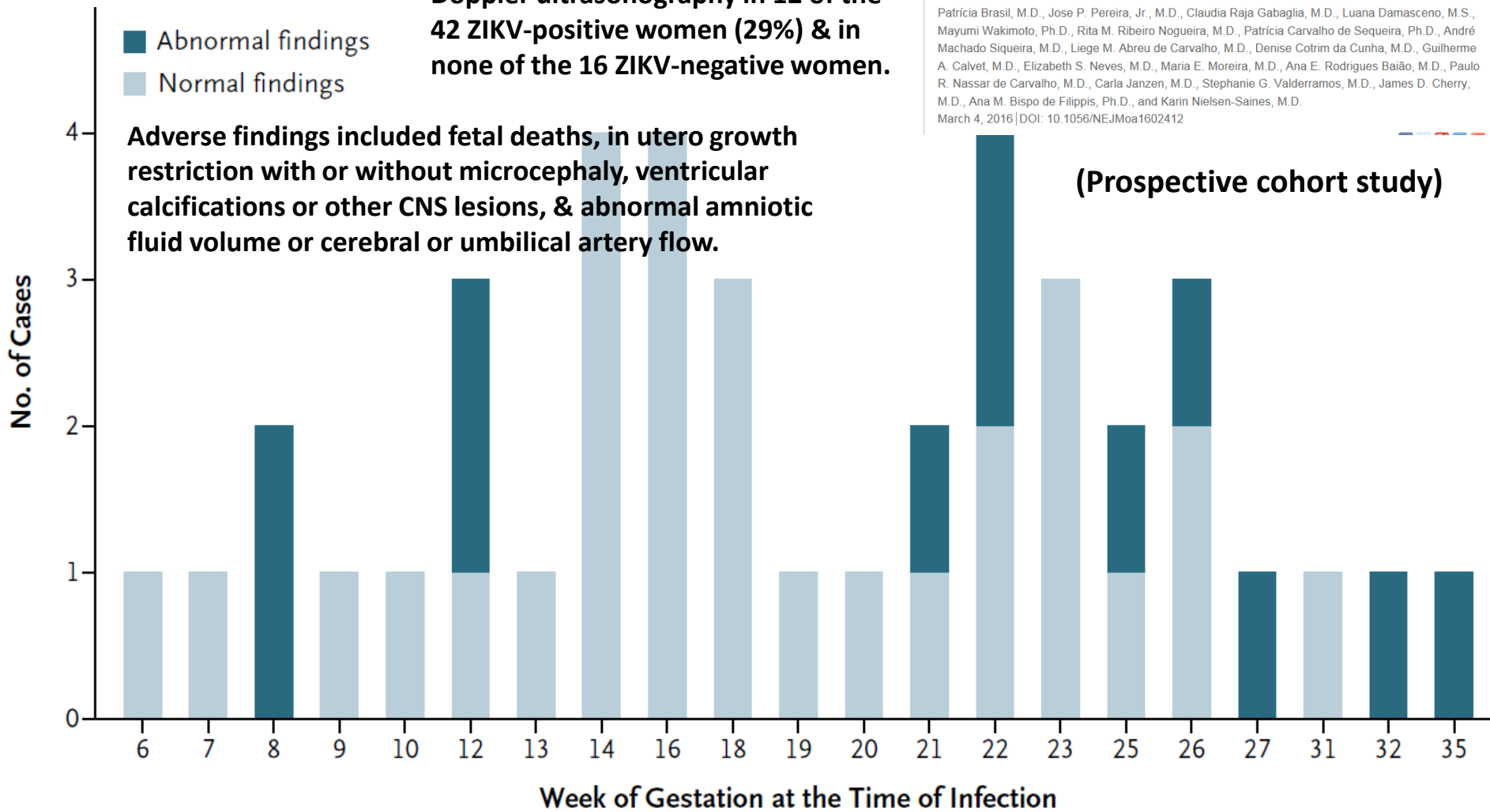

Figure 2. Week of Gestation at the Time of ZIKV Infection and Abnormal Ultrasonographic and Doppler Findings.

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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**

www.thelancet.com **March 15, 2016**

"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)

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Zika Virus Risk Assessment in the WHO African region

A Technical Report

February 2016

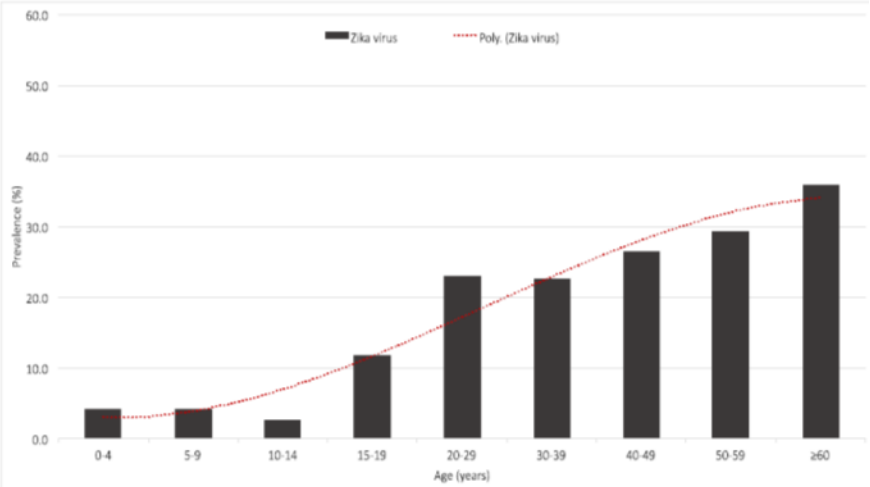
World Health Organization Africa

Present local cases: Cabo Verde has reported, as of 5 April 2016, 206 confirmed cases of Zika virus.

Zika virus transmission potential

- 1 Presence of Aedes aegypti only (1)
- 2 Local cases of dengue and chikungunya (33)
- 3 Serological evidence only (7)
- 4 Past local cases (8)
- 5 Present local cases (1)

Figure 3 Results of a serological survey conducted in Kenya in 1966-1968 showing the age pattern of exposure to Zika virus infections in Kenya. The graphs suggest possible acquisition of immunity in older ages (Source: Geser et al 1970[5]). Caution is required when interpreting this serological data due to cross-reactivity with other arboviruses.



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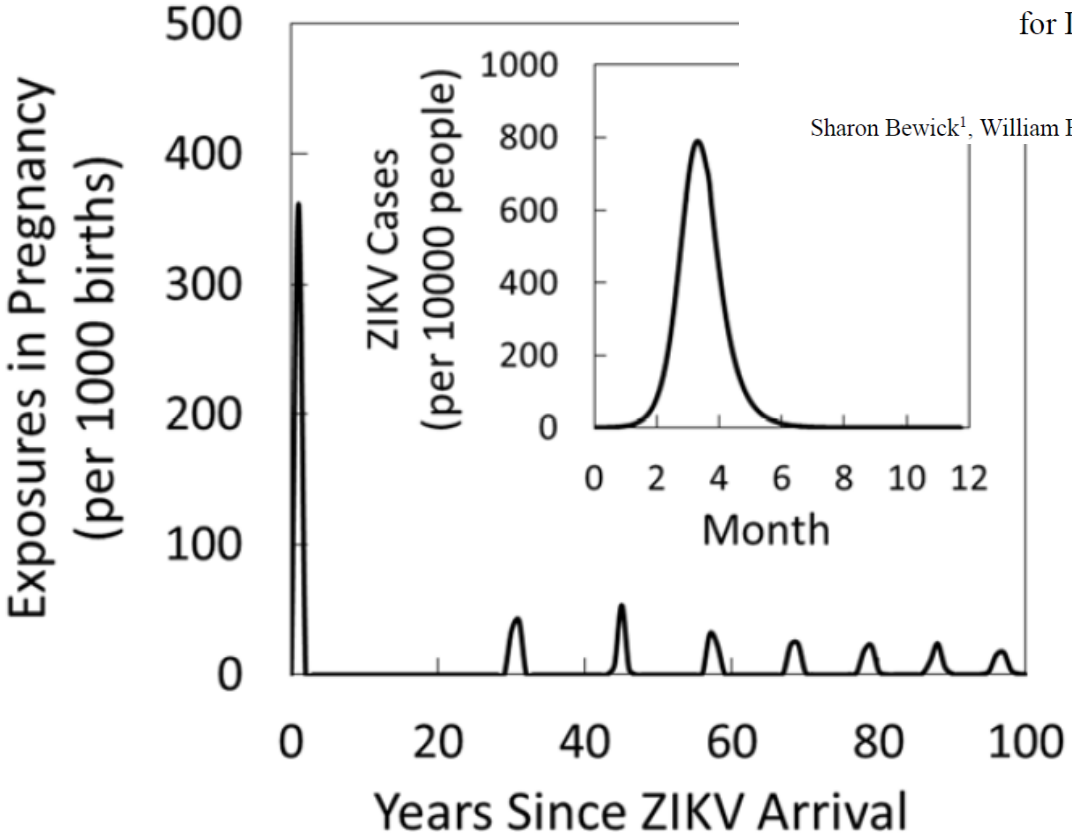
Zika Virus: Endemic Versus Epidemic Dynamics and Implications for Disease Spread in the Americas

Sharon Bewick[1], William F. Fagan[2], Justin Calabrese[2], Folashade Agusto[3,*]



"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.