



22nd Annual Chicago Infection Control Conference

June 9, 2017

Emily Petersen, MD

Lead, US Zika Pregnancy Registry Team

Zika Response

Centers for Disease Control and Prevention

All planners, editors, faculty and reviewers of this activity have no relevant financial relationships to disclose. This presentation was created without any commercial support.

Learning Objectives

At the conclusion of this course participants will be able to

- **Enable the learner to gain knowledge of emerging healthcare-associated infections pathogens.**
- **Identify effective infection control strategies to mitigate spread of multi-drug resistant organisms.**
- **Raise awareness of emerging disease threats and identify appropriate diagnostic testing, reporting and prevention methods.**
- **Raise awareness of local public health issues including opioid epidemic and immigrant health.**

To obtain credit you must:

- » **Be present for the entire session**
- » **Complete an evaluation form**
- » **Return the evaluation form to staff**

Certificate will be sent to you by e-mail upon request.

In support of improving patient care, [Insert name of Joint Accredited Provider] is jointly accredited by the Accreditation Council for Continuing Medical Education (ACCME), the Accreditation Council for Pharmacy Education (ACPE), and the American Nurses Credentialing Center (ANCC), to provide continuing education for the healthcare team.

Rush University Medical Center designates this live activity for a maximum of 6.25 AMA PRA Category 1 Credit(s)[™]. Physicians should claim only credit commensurate with the extent of their participation in the activity.

ANCC Credit Designation – Nurses

The maximum number of hours awarded for this CE activity is 6.25 contact hours.

Rush University designates this live activity for 6.25 Continuing Education credit(s).

This activity is being presented without bias and without commercial support.

Rush University is an approved provider for physical therapy (216.000272), occupational therapy, respiratory therapy, social work (159.001203), nutrition, speech-audiology, and psychology by the Illinois Department of Professional Regulation.



An Update on Zika Virus as a Cause of Microcephaly and Other Birth Defects



Emily Petersen, MD
Lead, US Zika Pregnancy Registry Team
Pregnancy & Birth Defects Task Force
CDC Zika Virus Response

22nd Annual Chicago Infection Control Conference
Chicago, Illinois
June 9, 2017



U.S. Department of
Health and Human Services
Centers for Disease
Control and Prevention

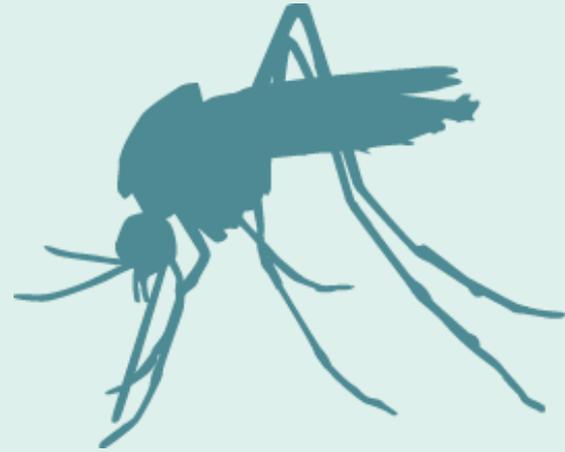
First Time in History...

“Never before in history has there been a situation where a bite from a mosquito could result in a devastating malformation.”

– Dr. Tom Frieden, former CDC Director
Fortune, April 13, 2016

“...the last time an infectious pathogen (rubella virus) caused an epidemic of congenital defects was more than 50 years ago...”

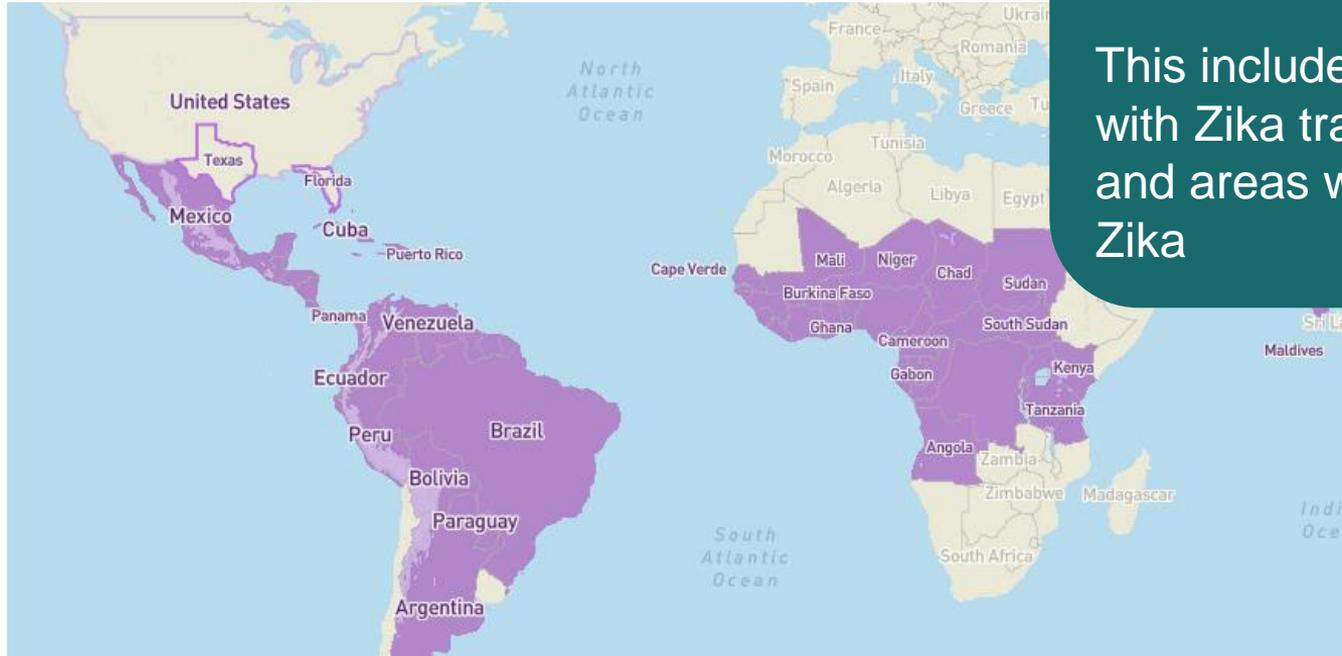
– *New England Journal of Medicine*, April 13, 2016



Where is Zika Now?

Zika is a risk in 100 countries and territories

This includes areas with Zika travel notices and areas with endemic Zika

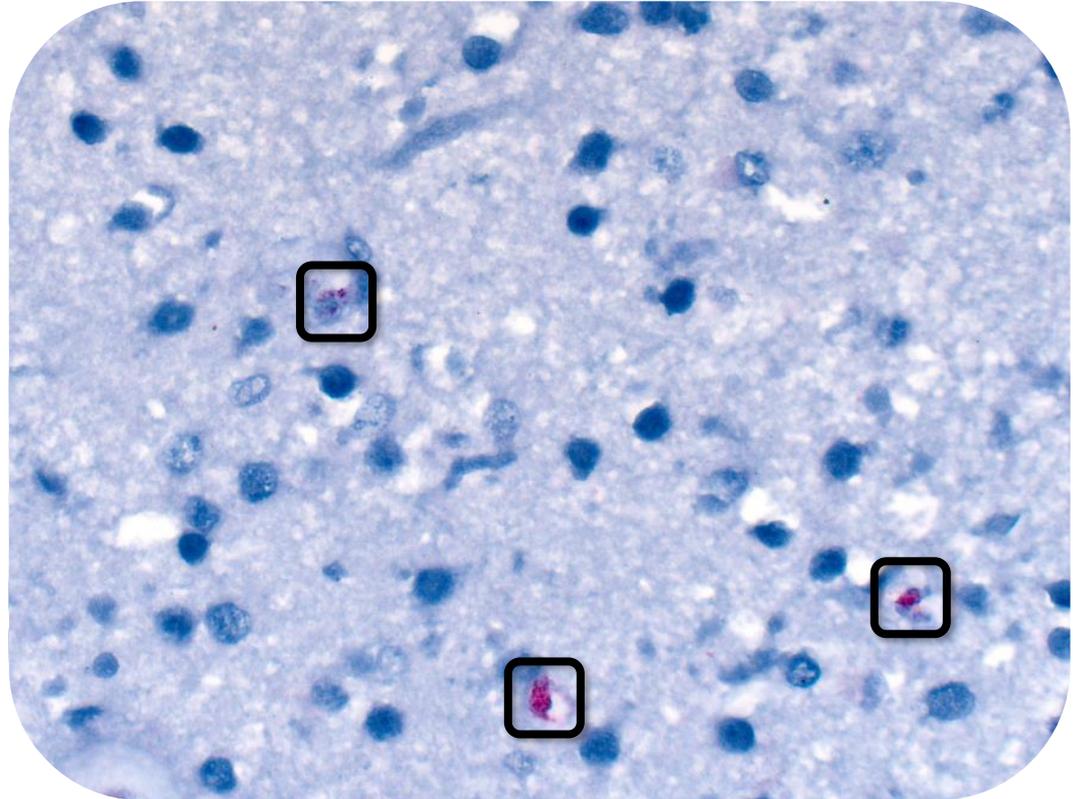


As of June 8, 2017

<http://www.cdc.gov/zika/geo/active-countries.html>

Zika Virus Detected in Reproductive Tissues

- Evidence of Zika virus in
 - Amniotic fluid
 - Placenta
 - Brain
 - Products of conception



Zika Virus is a Cause of Microcephaly

Criteria for Proof of Human Teratogenicity



Criterion	Criterion Met?
1. Proven exposure to agent at critical time(s) during prenatal development	Yes
2. Consistent findings by ≥ 2 high-quality epidemiologic studies	Partially
3. Careful delineation of clinical cases	Yes
4. Rare environmental exposure associated with rare defect	Yes
5. Teratogenicity in experimental animals {important but not essential}	No
6. Association should make biologic sense	Yes
7. Proof in an experimental system that the agent acts in an unaltered state	NA

Questions about Zika Virus & Pregnancy

- Does Zika virus infection cause adverse pregnancy and birth outcomes?
- What is the level of fetal/infant risk of birth defects from a maternal Zika virus infection?
- When during pregnancy does Zika virus infection pose the highest risk to the fetus?
- What is the full range of potential health problems that Zika virus infection may cause?



Surveillance of Pregnant Women, Fetuses, and Infants

US Zika Pregnancy Registry



Zika Active Pregnancy Surveillance System (Puerto Rico)



Proyecto Vigilancia de Embarazadas con Zika (Colombia)



U.S. Zika-Related Birth Defects Surveillance



US Zika Pregnancy Registry

- **Purpose**

To monitor pregnancy and infant outcomes in pregnancies with laboratory evidence of possible Zika virus infection and to inform clinical guidance and public health response

- Estimate number of infants with birth defects
- Provide data to inform phenotype of congenital Zika syndrome
- Help ensure infants are linked to care

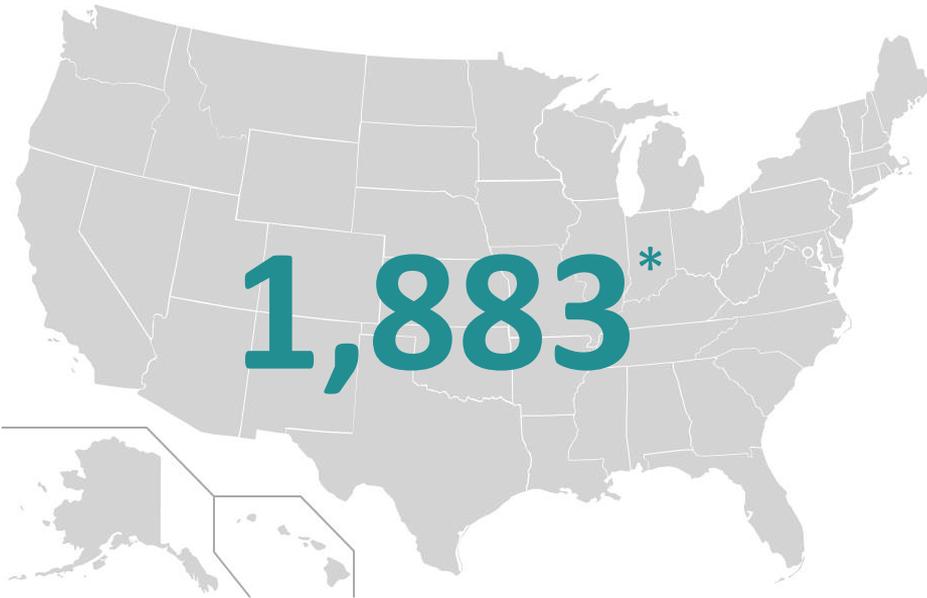


US Zika Pregnancy Registry: Inclusion Criteria

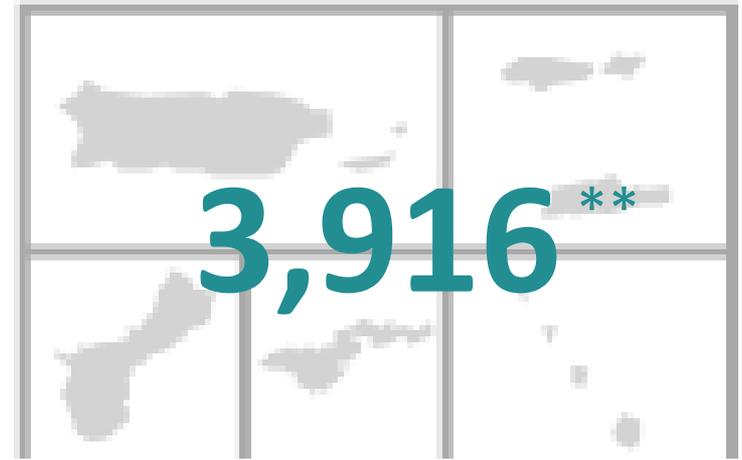
- **Who is included:**
 - » Pregnant women in the United States with laboratory evidence of possible Zika virus infection (regardless of whether they have symptoms) and their exposed infants
 - » Infants with laboratory evidence of congenital Zika virus infection (regardless of whether they have symptoms) and their mothers



Pregnancies with Laboratory Evidence of Possible Zika Virus Infection



Pregnant women with any laboratory evidence of possible Zika virus infection in the **50 US States and DC**



Pregnant women with any laboratory evidence of possible Zika virus infection in **US Territories**

*Includes aggregated data reported to the [US Zika Pregnancy Registry](#) as of May 23, 2017

**Includes aggregated data from the US territories reported to the [US Zika Pregnancy Registry](#) and data from Puerto Rico reported to the [Zika Active Pregnancy Surveillance](#) as of May 23, 2017

Pregnancy Outcomes

- Number of completed pregnancies with or without birth defects:
1,579
- Of these
 - » **72** liveborn infants born with a birth defect consistent with congenital Zika infection
 - » **8** pregnancy losses affected by a birth defect consistent with congenital Zika infection



*As of May 23, 2017

Zika Virus & Pregnancy

- Does Zika virus infection cause adverse pregnancy and birth outcomes?
- What is the level of risk from Zika virus infection during pregnancy?
- When during pregnancy does Zika virus infection pose the highest risk to the fetus?
- What is the full range of potential health problems that Zika virus infection may cause?



JAMA | Original Investigation

Birth Defects Among Fetuses and Infants of US Women With Evidence of Possible Zika Virus Infection During Pregnancy

Margaret A. Honein, PhD; April L. Dawson, MPH; Emily E. Petersen, MD; Abbey M. Jones, MPH; Ellen H. Lee, MD; Mahsa M. Yazdy, PhD; Nina Ahmad, MD; Jennifer Macdonald, MPH; Nicole Ewert, MS; Andrea Bingham, PhD; Sascha R. Ellington, MSPH; Carrie K. Shapiro-Mendoza, PhD; Tillolope Oduyebo, MD; Anne D. Fine, MD; Catherine M. Brown, DVM; Jamie N. Sommer, MS; Jyoti Gupta, MPH; Philip Cavicchia, PhD; Sally Slavinski, DVM; Jennifer L. White, MPH; S. Michele Owen, PhD; Lyle R. Petersen, MD; Coleen Boyle, PhD; Dana Meaney-Delman, MD; Denise J. Jamieson, MD; for the US Zika Pregnancy Registry Collaboration

- Among pregnancies in the United States with laboratory evidence of possible Zika virus infection
 - » **6%** of fetuses or infants had birth defects potentially related to Zika virus
 - » Similar proportion of pregnancies with birth defects (**≈6%**) among symptomatic and asymptomatic pregnant women
 - » Among women with infection in the 1st trimester of pregnancy, birth defects reported in **11%**

Box. Birth Defects Potentially Related to Zika Virus Infection During Pregnancy and Monitored by the US Zika Pregnancy Registry for Enhanced Surveillance

Brain Abnormalities With and Without Microcephaly

Confirmed or possible congenital microcephaly^a

Intracranial calcifications

Cerebral atrophy

Abnormal cortical formation (eg, polymicrogyria, lissencephaly, pachygyria, schizencephaly, gray matter heterotopia)

Corpus callosum abnormalities

Cerebellar abnormalities

Porencephaly

Hydranencephaly

Ventriculomegaly/hydrocephaly (excluding "mild" ventriculomegaly without other brain abnormalities)

Fetal brain disruption sequence (collapsed skull, overlapping sutures, prominent occipital bone, scalp rugae)

Other major brain abnormalities including intraventricular hemorrhage in utero (excluding postnatal intraventricular hemorrhage)

Neural Tube Defects and Other Early Brain Malformations

Neural tube defects including anencephaly, acrania, encephalocele, spina bifida

Holoprosencephaly (arhinencephaly)

Eye Abnormalities

Microphthalmia/anophthalmia

Coloboma

Cataract

Intraocular calcifications

Chorioretinal anomalies involving the macula (eg, chorioretinal atrophy and scarring, macular pallor, gross pigmentary mottling and retinal hemorrhage; excluding retinopathy of prematurity)

Optic nerve atrophy, pallor, and other optic nerve abnormalities

Consequences of Central Nervous System Dysfunction

Congenital contractures (eg, arthrogryposis, clubfoot, congenital hip dysplasia) with associated brain abnormalities

Congenital deafness documented by postnatal audiological testing

^a Live births: measured head circumference (adjusted for gestational age and sex) less than the third percentile at birth or, if not measured at birth, within first 2 weeks of life. Pregnancy loss: prenatal head circumference more than 3 SDs below the mean based on ultrasound or postnatal head circumference less than the third percentile. Birth measurements are evaluated using the Intergrowth-21st standards (<http://intergrowth21.ndog.ox.ac.uk/>) based on measurements within 24 hours of birth.

Vital Signs: Update Previous Estimates

Morbidity and Mortality Weekly Report

Vital Signs: Update on Zika Virus–Associated Birth Defects and Evaluation of All U.S. Infants with Congenital Zika Virus Exposure — U.S. Zika Pregnancy Registry, 2016

Megan R. Reynolds, MPH¹; Abbey M. Jones, MPH¹; Emily E. Petersen, MD²; Ellen H. Lee, MD³; Marion E. Rice, MPH^{1,4}; Andrea Bingham, PhD⁵; Sascha R. Ellington, MSPH²; Nicole Evert, MS⁶; Sarah Reagan-Steiner, MD⁷; Titilope Oduyebo, MD²; Catherine M. Brown, DVM⁸; Stacey Martin, MSc⁹; Nina Ahmad, MD¹⁰; Julu Bhatnagar, PhD⁷; Jennifer Macdonald, MPH¹¹; Carolyn Gould, MD⁹; Anne D. Fine, MD³; Kara D. Polen, MPH¹; Heather Lake-Burger, MPH⁵; Christina L. Hillard, MA¹; Noemi Hall, PhD^{6,12}; Mahsa M. Yazdy, PhD⁸; Kamesha Slaughter, MPH¹; Jamie N. Sommer, MS¹⁰; Alys Adamski, PhD¹; Meghan Raycraft, MPH¹; Shannon Fleck-Derderian, MPH^{4,13}; Jyoti Gupta, MPH¹¹; Kimberly Newsome, MPH¹; Madelyn Baez-Santiago, PhD¹; Sally Slavinski, DVM³; Jennifer L. White, MPH¹⁰; Cynthia A. Moore, MD, PhD¹; Carrie K. Shapiro-Mendoza, PhD²; Lyle Petersen, MD⁹; Coleen Boyle, PhD¹⁴; Denise J. Jamieson, MD²; Dana Meaney-Delman, MD¹³; Margaret A. Honein, PhD¹; U.S. Zika Pregnancy Registry Collaboration

Key Vital Signs Findings

- 972 completed pregnancies with evidence of Zika in 2016:
 - » **5%** with possible Zika had birth defects
 - » **10%** with confirmed Zika had birth defects
 - » **15%** with confirmed Zika in the 1st trimester had birth defects



Vital^{CDC}signs™

www.cdc.gov/vitalsigns/zika-babies



Baseline Prevalence of Birth Defects Observed with Zika

- Used data from birth defects surveillance systems in Massachusetts, North Carolina, and Atlanta, Georgia, during pre-Zika outbreak years (2013–2014)
- Compared with data from US Zika Pregnancy Registry
- Prevalence of Zika-related birth defects before Zika outbreak in the Americas:

3 out of every 1,000 births

- Proportion of infants with birth defects among completed pregnancies with confirmed Zika virus infection (2016):

24 out of every 250 completed pregnancies

Estimated

**30-fold
increase**

in Zika-related birth defects in pregnancies with confirmed Zika infection compared with pre-Zika years

Pregnancy Outcomes After Maternal Zika Virus Infection During Pregnancy — U.S. Territories, January 1, 2016–April 25, 2017

Carrie K. Shapiro-Mendoza, PhD¹; Marion E. Rice, MPH^{2,3}; Romeo R. Galang, MD²; Anna C. Fulton, MPH²;
Kelley VanMaldeghem, MPH²; Miguel Valencia Prado, MD⁴; Esther Ellis, PhD⁵; Magele Scott Anesi, MPH⁶; Regina M. Simeone, MPH²;
Emily E. Petersen, MD¹; Sascha R. Ellington, MSPH¹; Abbey M. Jones, MPH²; Tonya Williams, PhD⁷; Sarah Reagan-Steiner, MD⁸;
Janice Perez-Padilla, MPH⁹; Carmen C. Deseda, MD⁴; Andrew Beron, MPH, MLS⁵; Aifili John Tufa, MPH¹⁰; Asher Rosinger, PhD^{11,12};
Nicole M. Roth, MPH²; Caitlin Green, MPH²; Stacey Martin, MSc⁹; Camille Delgado Lopez, MPH⁴; Leah deWilde⁵; Mary Goodwin, MA, MPA¹;
H. Pamela Pagano, DrPH¹; Cara T. Mai, DrPH²; Carolyn Gould, MD⁹; Sherif Zaki, MD⁸; Leishla Nieves Ferrer, MPH⁴; Michelle S. Davis, PhD⁵;
Eva Lathrop, MD²; Kara Polen, MPH²; Janet D. Cragan, MD²; Megan Reynolds, MPH²; Kimberly B. Newsome, MPH²; Mariam Marcano Huertas⁴;
Julu Bhatangar, PhD⁸; Alma Martinez Quiñones, MPH⁴; John F. Nahabedian, MS²; Laura Adams, DVM⁹; Tyler M. Sharp, PhD⁹;
W. Thane Hancock, MD¹³; Sonja A. Rasmussen, MD¹⁵; Cynthia A. Moore, MD, PhD²; Denise J. Jamieson, MD¹; Jorge L. Munoz-Jordan, PhD⁹;
Helentina Garstang, DCHMS¹⁶; Afeke Kambui, MPH¹⁰; Carolee Masao, DCHMS¹⁷; Margaret A. Honein, PhD²; Dana Meaney-Delman, MD¹⁴;
Zika Pregnancy and Infant Registries Working Group

Zika Virus & Pregnancy

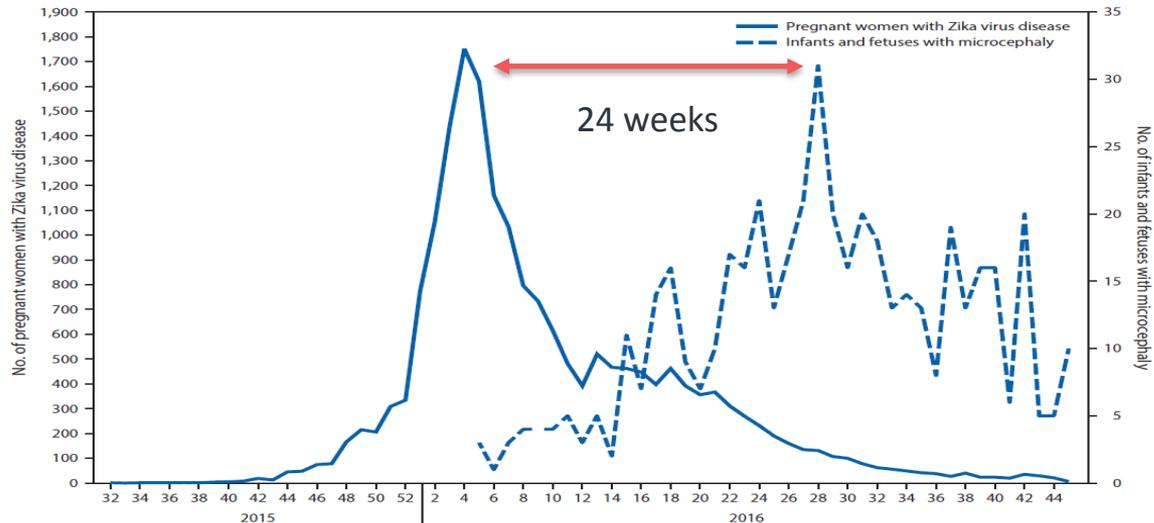
- Does Zika virus infection cause adverse pregnancy and birth outcomes?
- What is the level of risk from a Zika virus infection during pregnancy?
- When during pregnancy does Zika virus infection pose the highest risk to the fetus?
- What is the full range of potential health problems that Zika virus infection may cause?



Period of Highest Risk to the Fetus

- Remains a key question
- 1st and 2nd trimester infections have been associated with children with birth defects; unknown if 3rd trimester poses lesser or perhaps different risks (growth restriction, stillbirth)

FIGURE 1. Date of symptom onset of reported cases of Zika virus disease among pregnant women* and date of birth of infants or of pregnancy loss for fetuses with reported microcephaly† — Colombia, August 9, 2015 (epidemiologic week 32)–November 12, 2016 (week 45)



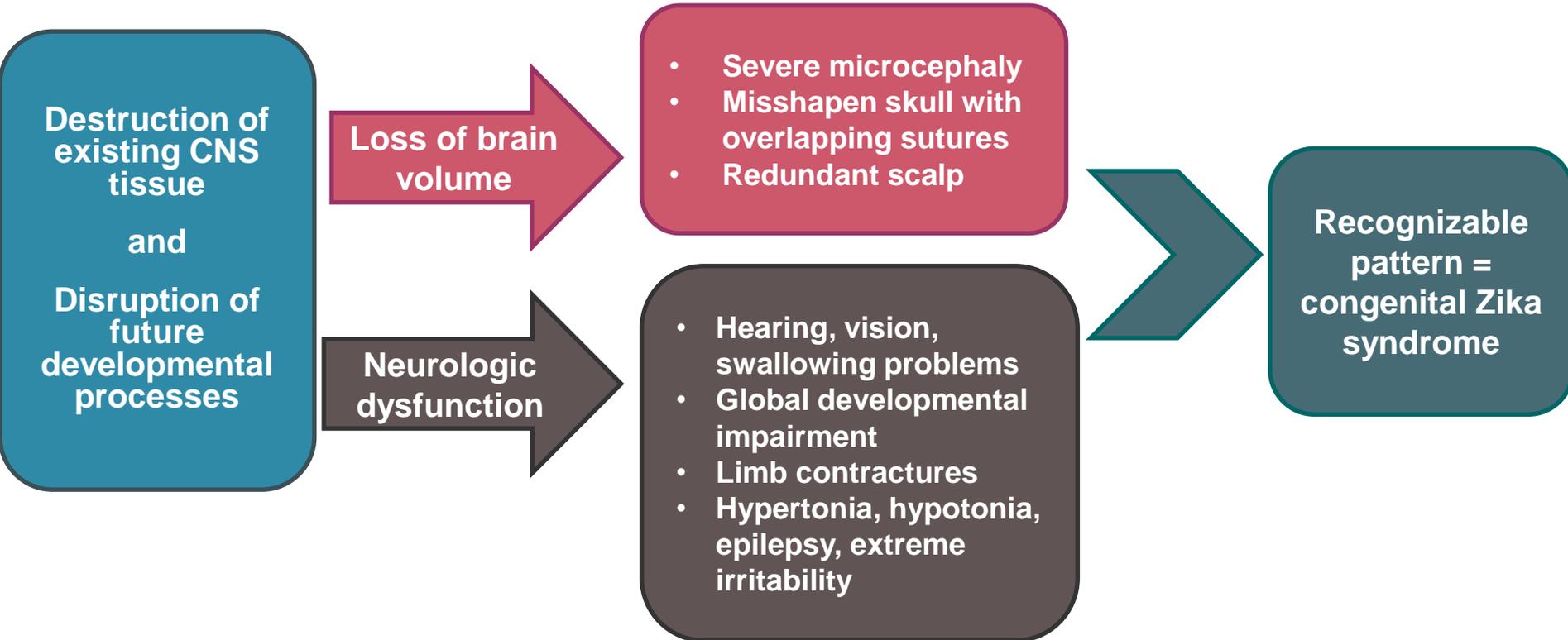
https://www.cdc.gov/mmwr/volumes/65/wr/mm6549e1.html?s_cid=mm6549e1_w

Zika Virus & Pregnancy

- Does Zika virus infection cause microcephaly and other serious birth defects?
- What is the level of risk from a Zika virus infection during pregnancy?
- When during pregnancy does Zika virus infection pose the highest risk to the fetus?
- What is the full range of potential health problems that Zika virus infection may cause?



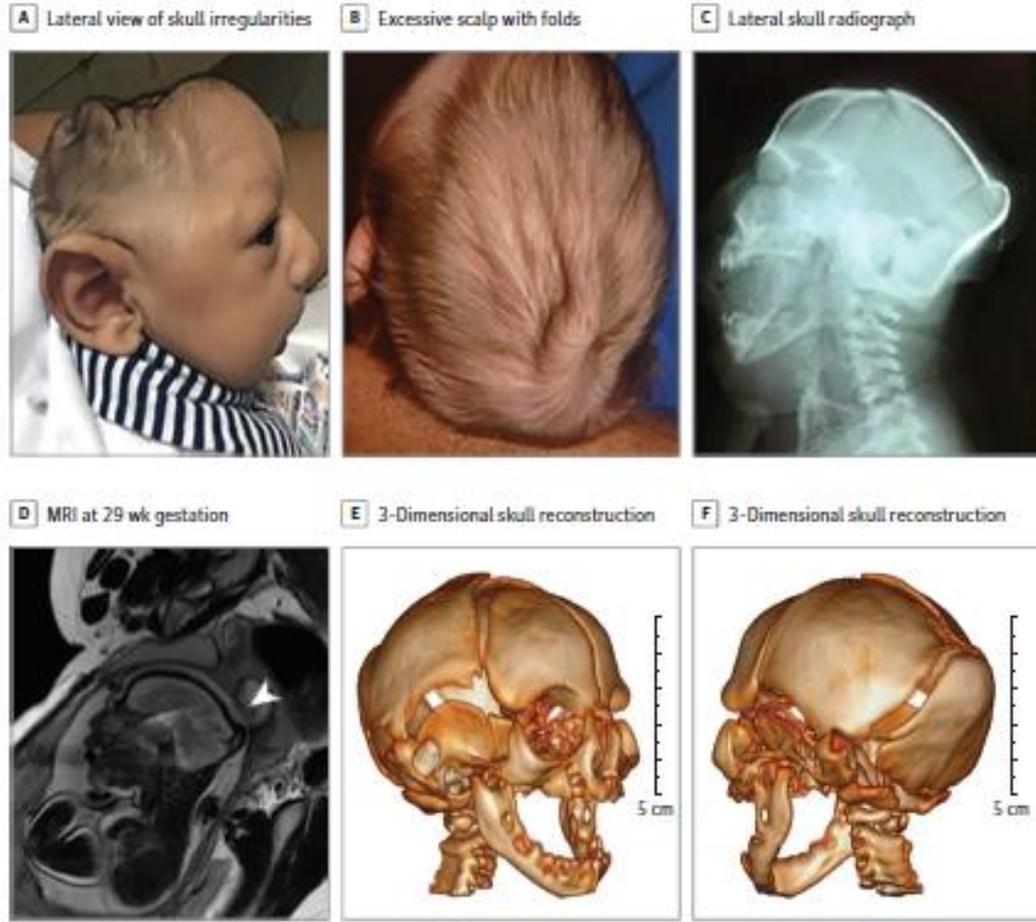
Prenatal Zika Virus Infection – Congenital Zika Syndrome



Congenital Zika Syndrome – Components of Unique Pattern

- Severe microcephaly with partial skull collapse
- Intracranial calcifications in the subcortical region
- Macular scarring and focal pigmentary retinal mottling
- Congenital contractures
- Neurologic abnormalities both pyramidal and extrapyramidal

Figure 1. Cranial Morphology Supporting Fetal Brain Disruption Sequence Phenotype in Congenital Zika Syndrome



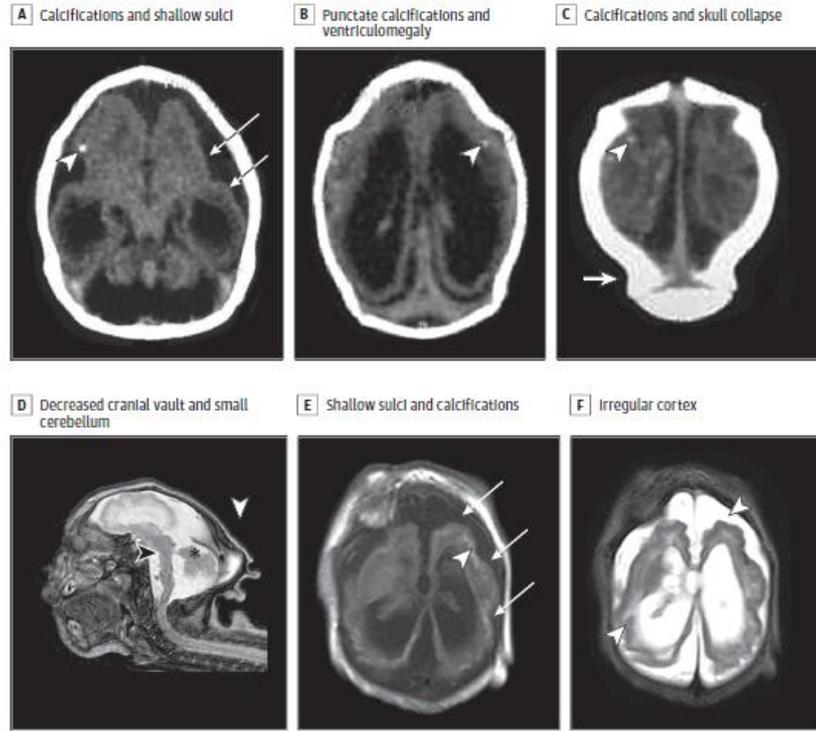
Cranial Morphology

- Features
 - Severe microcephaly (most more than 3 SD below the mean)
 - Partial collapse of the skull with overlapping sutures
 - Occipital bone prominence
 - Small or absent anterior fontanel
 - Scalp rugae

Moore CA, Staples JE, Dobyns WB, et al. Characterizing the pattern of anomalies on congenital Zika syndrome for pediatric clinicians. *JAMA Pediatr.* 2017;171:288-295.

Congenital Zika Syndrome – Brain Anomalies

Figure 2. Brain Findings in Infants With Presumed Congenital Zika Syndrome



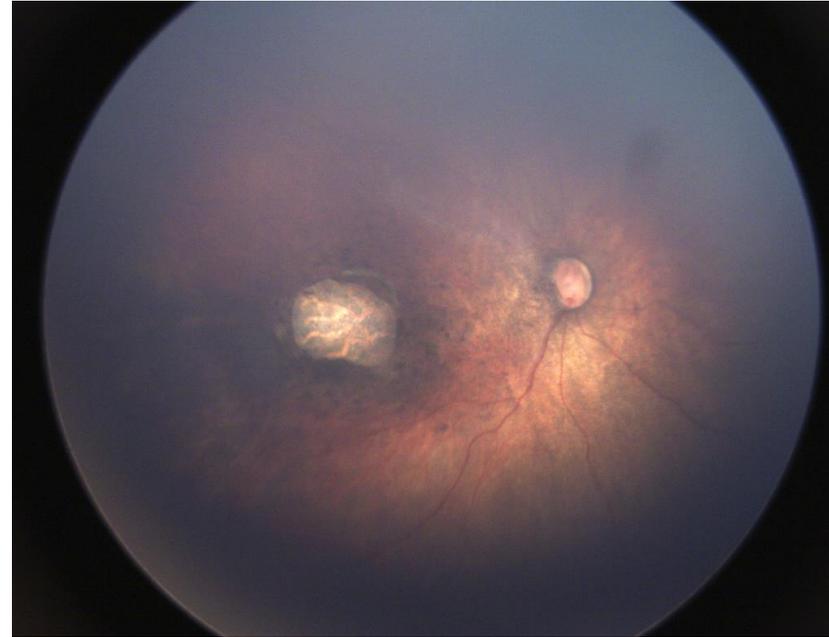
■ Features

- Intracranial calcifications
- Cerebral volume loss, ventriculomegaly
- Abnormal gyral development
- Low forehead and small cranial vault

Moore CA, Staples JE, Dobyns WB, et al. Characterizing the pattern of anomalies on congenital Zika syndrome for pediatric clinicians. *JAMA Pediatr.* 2017;171:288-295.

Congenital Zika Syndrome – Ocular Findings

- Structural and anterior eye anomalies
 - » Microphthalmia, coloboma
 - » Cataracts, intraocular calcifications
- Posterior eye anomalies
 - » Optic nerve hypoplasia, atrophy
 - » Chorioretinal atrophy and scarring
 - » Macular pallor
 - » Gross pigmentary anomalies – generally in the macular area
- No active chorioretinitis reported to date



Moore CA, Staples JE, Dobyns WB, et al. Characterizing the pattern of anomalies on congenital Zika syndrome for pediatric clinicians. *JAMA Pediatr.* 2017;171:288-295.

Congenital Zika Syndrome – Congenital Contractures



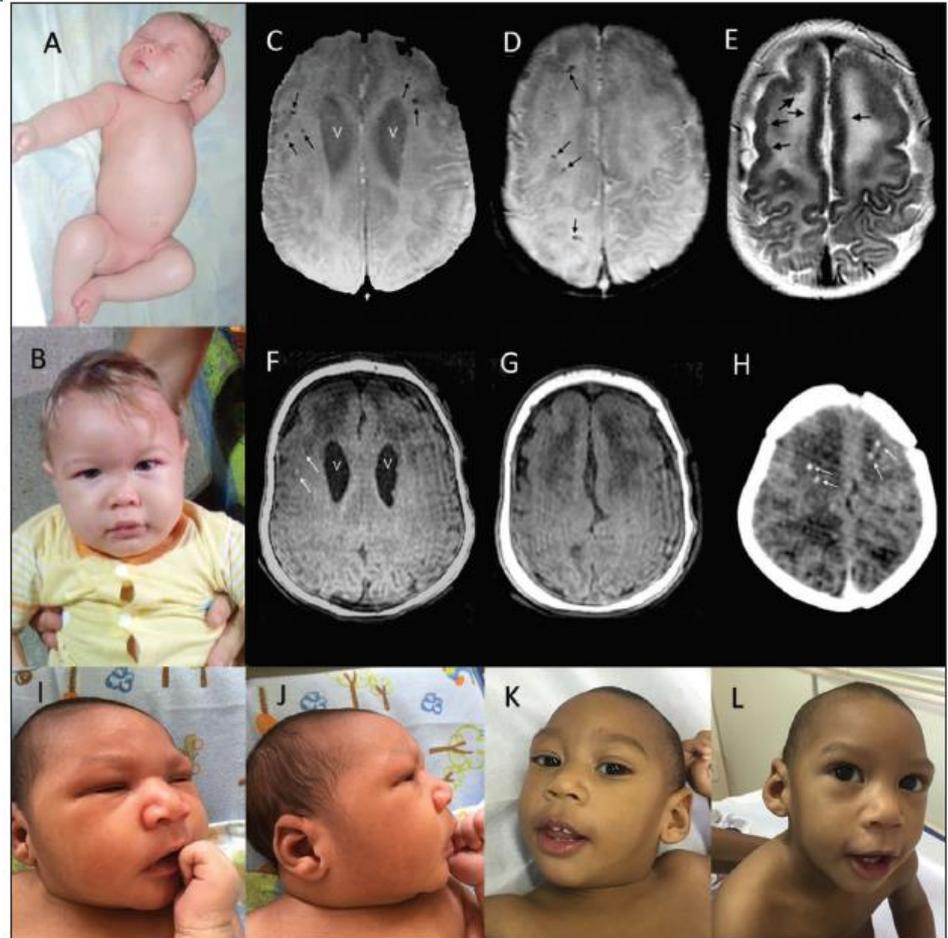
Moore CA, Staples JE, Dobyns WB, et al. Characterizing the pattern of anomalies on congenital Zika syndrome for pediatric clinicians. *JAMA Pediatr.* 2017;171:288-295.

Congenital Zika Syndrome – Other Neurologic Sequelae

- Information on long-term medical and developmental outcomes or mortality sparse
- Neurologic sequelae reported include the following:
 - » Motor and cognitive disabilities
 - » Epilepsy
 - » Swallowing difficulties
 - » Vision loss and hearing impairment
 - » Hypertonia and spasticity with tremors
 - » Irritability with excessive crying

Congenital Zika Syndrome – Postnatal Microcephaly

- Recent report of 13 infants who did not have microcephaly at birth (>-2 SD)
- Had severe findings including
 - All with significant brain abnormalities, 23% with retinal anomalies
 - All with hypertonia
 - 60% with epilepsy
- Head growth slowed and microcephaly diagnosed at \approx 6 months of age



Congenital Zika Syndrome – Expanding the Phenotype

- Infants with
 - » Brain or eye anomalies but no microcephaly
 - » Sensory/cranial nerve dysfunction only at birth or later
 - » Other neurologic anomalies with origin in the embryonic period
 - » Non-neurologic congenital anomalies
 - » Developmental disabilities
 - » Growth restriction

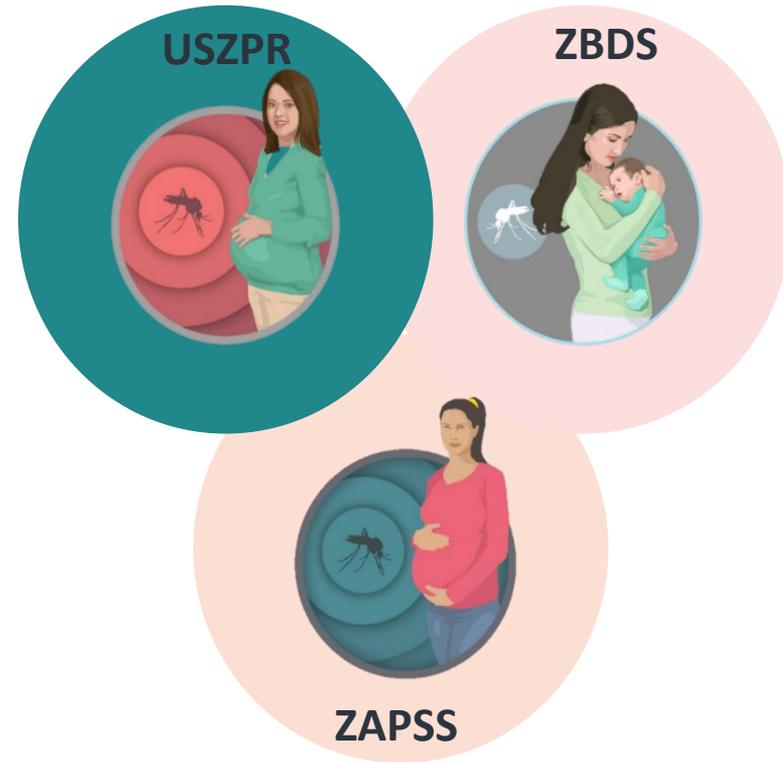
Congenital Zika Syndrome – Knowledge Limits

- Most available information based on infants with microcephaly and severe phenotype
- Information on long-term medical and developmental outcomes is incomplete
- Majority of reports to date have focused on only one aspect of the phenotype such as neurologic sequelae, eye anomalies, hearing, etc. so information is lacking to describe clustering of anomalies
- Information on mortality rates and causes of death is incomplete

Information is needed by families, healthcare providers, communities, governmental organizations and others to plan for needed services.

What Do We Hope to Learn in the Next Year?

- Identify full range of health effects among infants with congenital Zika exposure
- Determine optimal Zika virus testing to identify infants with congenital Zika virus infection
- Understand how neuroimaging will help identify infants with adverse effects of congenital Zika infection
- Assess risk of other adverse outcomes associated with Zika infection during pregnancy
- Use data to inform clinical management of pregnant women with Zika



What You Can Do to Help

- 1 Educate families on Zika prevention
- 2 Ask about Zika
- 3 Provide all needed tests and follow-up care
- 4 Support infants and families

Educate Families about Zika Virus Prevention

Pregnant women should not travel to areas with risk of Zika

If a pregnant woman *must* travel, she should

- » Talk with her healthcare provider before she goes
- » Strictly follow steps to prevent mosquito bites during the trip
- » Take steps to prevent sexual transmission
- » Talk with her healthcare provider after she returns, even if she doesn't feel sick



Healthcare Providers Caring for Pregnant Women and Infants Should Ask about Zika Exposure during Pregnancy

Have you traveled to an area with risk of Zika during pregnancy or just before you became pregnant?

Have you had sex without a condom with a partner who lives in or traveled to an area with risk of Zika?

Do you live in or do you frequently travel (daily or weekly) to an area with risk of Zika?



Who Should Be Tested for Zika?

All pregnant women (regardless of symptoms) who

- » Live in or recently traveled to an area with risk of Zika that has a CDC Zika travel notice, or
- » Had unprotected sex with a partner who lives in or traveled to an area with risk of Zika that has a CDC Zika travel notice

Pregnant women who live in or recently traveled to an area with risk of Zika but without a CDC Zika travel notice

- » If they develop symptoms of Zika, or
- » If their fetus has abnormalities on an ultrasound that may be related to Zika infection



Testing Infants for Zika

CDC recommends laboratory testing for

- » All infants born to mothers with laboratory evidence of Zika virus infection during pregnancy
- » Infants who have abnormal clinical or neuroimaging findings suggestive of congenital Zika syndrome and a mother with a possible exposure to Zika virus, regardless of maternal Zika virus testing results



Laboratory Testing of Infants with Possible Congenital Zika Virus Infection

Additional Considerations

Testing for Zika virus infection should be considered for infants

- Born to mothers with an epidemiologic link for whom
 - » There is concern about infant follow-up care
 - » Maternal testing was not performed before delivery and exposure was >12 weeks before delivery, or
 - » Maternal testing was negative but was performed on a specimen obtained >12 weeks after maternal exposure



Pediatric Evaluation and Follow-Up: The First 12 Months

CDC's Response to ZIKA

TABLE 1

Interpretation of results of laboratory tests*

•rRT-PCR	Positive	Positive
•rRT-PCR	Negative	Negative

Abbreviations: rRT-PCR = real-time reverse transcription polymerase chain reaction.

* Infant serum, urine or cerebrospinal fluid.

† Laboratory results should be interpreted in the context of findings consistent with congenital Zika syndrome, as appropriate.

CHECKLIST 1

Initial clinical evaluation & management of infants with laboratory evidence of Zika virus infection and abnormalities consistent with congenital Zika syndrome†

Consultation with:

- Neurologist for determination of appropriate physical and additional evaluation.
- Infectious disease specialist for diagnostic evaluation of congenital infections (e.g. syphilis, toxoplasma, cytomegalovirus infection, lymphocytic choriomeningitis, and herpes simplex virus infection).
- Ophthalmologist for comprehensive eye exam for possible cortical visual impairment prior to hospital or within 1 month of birth.
- Endocrinologist for evaluation for hypothalamic dysfunction.
- Clinical geneticist to evaluate for other causes of microcephaly or other anomalies if present.

Consider consultation with:

- Orthopedist, physiatrist and physical therapist for management of hypertonia, clubfoot or arthralgia conditions.
- Pulmonologist or otolaryngologist for concerns.
- Lactation specialist, nutritionist, gastroenterology or occupational therapist for the management of feeding difficulties.
- Perform ABR to assess hearing.
- Perform complete blood count and metabolic panel liver function tests.
- Provide family and supportive services.

CDC's Response to ZIKA

Outpatient Management Checklist*

2 weeks	<input type="checkbox"/> Thyroid screen (TSH & T4)
ROW 1	Infant with abnormalities consistent with congenital Zika syndrome† and laboratory evidence of Zika virus infection* <ul style="list-style-type: none"> <input type="checkbox"/> Routine <input type="checkbox"/> Refert <input type="checkbox"/> Refert (See Page 3)
ROW 2	Infant with abnormalities consistent with congenital Zika syndrome† and negative for Zika virus infection <ul style="list-style-type: none"> <input type="checkbox"/> Continue <input type="checkbox"/> Further
ROW 3	Infant with no abnormalities consistent with congenital Zika syndrome† and laboratory evidence of Zika virus infection* <ul style="list-style-type: none"> <input type="checkbox"/> Ophthalmology exam <input type="checkbox"/> ABR
ROW 4	Infant with no abnormalities consistent with congenital Zika syndrome† and negative for Zika virus infection <ul style="list-style-type: none"> <input type="checkbox"/> Months and age <input type="checkbox"/> Months and age

Abbreviations: rRT-PCR = real-time reverse transcription-polymerase chain reaction; ABR = auditory brainstem response; CT = computed tomography; M = maternal; LFTs = liver function tests.

* Laboratory evidence of Zika virus infection includes: (1) Zika virus confirmed by neutralizing antibody titers are needed in addition to laboratory evidence of Zika virus infection; (2) Zika virus confirmed by neutralizing antibody titers are needed in addition to laboratory evidence of Zika virus infection; (3) Zika virus confirmed by neutralizing antibody titers are needed in addition to laboratory evidence of Zika virus infection.

† Outpatient management checklist for infants born to a woman with laboratory evidence of Zika virus infection can include: (1) Findings consistent with congenital Zika syndrome can include: (a) Microcephaly; (b) Cortical visual impairment; (c) Hypothalamic dysfunction; (d) Arthralgia; (e) Hypertonia; (f) Clubfoot; (g) Arthralgia; (h) Feeding difficulties; (i) Lactation difficulties; (j) Gastrointestinal dysfunction; (k) Occupational dysfunction; (l) Hearing loss; (m) Hearing loss; (n) Hearing loss; (o) Hearing loss; (p) Hearing loss; (q) Hearing loss; (r) Hearing loss; (s) Hearing loss; (t) Hearing loss; (u) Hearing loss; (v) Hearing loss; (w) Hearing loss; (x) Hearing loss; (y) Hearing loss; (z) Hearing loss.

‡ Infant testing is recommended within the first two days after birth.

CS2019191A August 10, 2016

INITIAL EVALUATION AND OUTPATIENT MANAGEMENT DURING THE FIRST 12 MONTHS OF LIFE FOR INFANTS WITH POSSIBLE CONGENITAL ZIKA VIRUS INFECTION

Morbidity and Mortality Weekly Report

Update: Interim Guidance for the Evaluation and Management of Infants with Possible Congenital Zika Virus Infection — United States, August 2016

Kate Russell, MD^{1,2}; Sara E. Oliver, MD^{1,3}; Lillian Lewis, MD^{1,4}; Wanda D. Barfield, MD⁵; Janet Cragan, MD⁶; Dana Meaney-Delman, MD⁷; J. Erin Staples, MD, PhD⁸; Marc Fischer, MD⁸; Georgina Peacock, MD⁹; Titilope Oduyeyo, MD⁵; Emily E. Petersen, MD⁵; Sherif Zaki, MD, PhD¹⁰; Cynthia A. Moore, MD, PhD⁶; Sonja A. Rasmussen, MD¹¹; Contributors

On August 19, 2016, this report was posted as an MMWR ongoing psychosocial support and assistance with coordina-

Link to updated infant guidance (April 2017): <https://www.cdc.gov/zika/hc-providers/infants-children/evaluation-and-management.html?permalink=https://www.cdc.gov/zika/hc-providers/infants-children/evaluation-and-management.html>

Contribute to the US Zika Pregnancy Registry

Notify health department of pregnant women and/or infants with Zika virus infection

- » More information available on the [U.S. Zika Pregnancy Registry website](#)
- » To contact CDC Registry staff, call the CDC Emergency Operations Center watch desk at 770-488-7100 and ask for the Zika Pregnancy Hotline or email ZIKApregnancy@cdc.gov.
- » For non-urgent requests, call 800-CDC-INFO (800-232-4636)



Thank you!

More information on caring for pregnant women, infants, or children with Zika virus infection is available at [CDC's Zika website](http://www.cdc.gov/zika).

The screenshot shows the CDC Zika website interface. At the top left is the CDC logo with the text "Centers for Disease Control and Prevention" and "CDC 24/7: Saving Lives. Protecting People™". To the right is a search bar with the word "SEARCH" and a magnifying glass icon. Below the search bar is a "CDC A-Z INDEX" dropdown menu. A dark blue header bar contains the text "Zika Virus". Below the header are social media icons for Facebook, Twitter, and a plus sign. To the right of the icons is a "Language:" dropdown menu set to "English". The main content area features a large banner on the left with a world map, a mosquito, and the text "ZIKA VIRUS UPDATE" and "Zika Cases in Florida". Below the banner are five small circular navigation dots. On the right side of the main content area, there are two sections: "At-A-Glance" and "Zika Virus Disease Cases Reported to ArboNET*". The "At-A-Glance" section includes a sub-heading "Pregnant Women with Any Lab Evidence of Zika Virus Infection*" and a list of statistics: "US States and DC: 808" and "US Territories: 1,490". Below the list is the source information: "*Source: Pregnancy Registries as of September 22, 2016" and a link "More on Outcomes". The "Zika Virus Disease Cases Reported to ArboNET*" section includes a list of statistics: "US States and DC: 3,625" and "US Territories: 22,069". Below the list is the source information: "*Source: ArboNET as of September 28, 2016".

www.cdc.gov/zika