

Zika: Resources at Your Fingertips

Original Publication: February 28, 2016
Current as of September 29, 2017

This document provides Zika virus disease resources and an overview of public health and healthcare system considerations and implications that are applicable to professionals in those systems, emergency management stakeholders, and other audiences. **Appendix A** contains resources from the U.S. Department of Health and Human Services (HHS) Office of the Assistant Secretary for Preparedness and Response (ASPR) and relevant contact links. **Appendix B** includes citations with annotations for additional relevant resources and Zika Guidance. Finally, individuals can review ASPR TRACIE (Technical Resources, Assistance Center, and Information Exchange) [Topic Collections](#), which provide a wide array of materials and resources for further research.

This document and its hyperlinks/guidance references are current as of [September 29, 2017](#). Changes to resources and guidance since the last update are indicated in **RED FONT** and all changes or additions since the original publication include the date of inclusion or update. Information on Zika is constantly evolving, therefore if you are a clinician treating a patient, please check the Centers for Disease Control and Prevention (CDC) [Zika site](#) for the most current information and clinical guidance.

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What is Zika Virus?

Zika virus is transmitted through the bite of an infected *Aedes* species mosquito. It is a single-stranded RNA virus of the genus Flavivirus (the same family as dengue). Illness is usually mild – current data show that most people infected will not become symptomatic. Symptoms (fever, rash, joint pain and conjunctivitis) typically resolve in a few days to a week without any medical intervention. The illness is rarely severe though Zika illness has been linked to rare cases of Guillain-Barré syndrome (ascending paralysis).

More concerning is the confirmed linkage between [Zika virus infection in pregnant women and microcephaly and other severe fetal brain defects](#). (Updated May 9, 2016) This linkage and the spectrum of potential Zika-mediated neurologic syndromes is being actively investigated. Women who contract Zika virus during pregnancy are at risk, though the timing and magnitude of the risk are not well defined. [Microcephaly](#) is a birth defect where a baby's head is smaller than expected when compared to babies of the same sex and age. Babies with microcephaly typically have smaller brains that might not have developed properly. Zika virus' effects on neurological function may result in a spectrum of neurological disorders, not simply causing brain damage leading to microcephaly in utero or Guillain-Barre in pediatric and adult patients. Due to the clusters of microcephaly and other neurological syndromes potentially linked to the spread of Zika virus, the World Health Organization (WHO) declared the situation a [Public Health Emergency of International Concern](#) (PHEIC) February 1, 2016. The Emergency Committee convened by WHO on November 18, 2016 determined that Zika virus and associated consequences [no longer met the definition for a PHEIC](#), but the demonstrated link between Zika virus infection and microcephaly required sustained research to address the long-term nature of the disease and its consequences. (Updated January 27, 2017) Zika virus is a [Nationally Notifiable Condition](#), so healthcare providers must notify their local/State health departments according to the laws or regulations for reportable diseases in their jurisdiction. (Updated January 27, 2017)

Access the [Clinicians/Healthcare Providers](#) section of this document for information on Preparedness, Testing, and Patient Care.

Why is Zika Virus Disease a Public Health and Healthcare Systems Concern?

Zika virus is an emerging pathogen and our understanding of it is still evolving. The major reason that Zika virus disease is a public health concern is due to the implications for women in endemic areas or traveling to endemic areas who are pregnant or considering pregnancy and the potential neurological sequela that may present in some patients. (Updated May 9, 2016) Zika virus disease has been identified in [fetal and placental tissues](#) of fetuses with severe

congenital abnormalities although little is known about the specific rates of transmission nor the risks and timing of [congenital malformations](#). (Updated May 9, 2016) Though the brain damage and associated microcephaly have attracted the most attention, it is likely that Zika causes a broader spectrum of neurologic disease which is still being investigated. The WHO published a Bulletin titled [Defining the Syndrome Associated with Congenital Zika Virus Infection](#), which outlines the spectrum of abnormalities that may be associated with Zika virus infection. This spectrum includes microcephaly, craniofacial disproportion, spasticity, seizures, irritability and brainstem dysfunction including feeding difficulties, ocular abnormalities and findings on neuroimaging such as calcifications, cortical disorders and ventriculomegaly. (Updated June 6, 2016) A [review](#) of published studies through September 2016 on Zika-related birth defects identified five features unique to congenital Zika virus infection or rarely seen in other congenital infections: severe microcephaly with partially-collapsed skull, thin cerebral cortices with subcortical calcifications, macular scarring and focal pigmentary retinal mottling, congenital contractures, and marked early hypertonia and symptoms of extrapyramidal involvement. (Updated November 14, 2016) A [recent study](#) of infants with probable congenital Zika virus syndrome found that additional symptoms emerged with age and suggested that Zika-affected babies may continue to fall behind in development compared to those not affected. (Updated October 7, 2016) Early evidence does not suggest a greater health risk than the general population to [pediatric populations who acquire Zika virus disease postnatally](#); however, the study results emphasize the importance of counseling sexually active adolescents on Zika risks and prevention. (Updated October 7, 2016)

As there is no specific treatment or “cure” for Zika virus disease and symptoms of acute infection are usually mild and self-resolving, the most important steps for public health emergency managers relate to prevention, mitigation, and risk communication. Healthcare providers should familiarize themselves with the signs and symptoms of Zika virus, take travel histories of their patients and the sexual partners of pregnant women, and follow CDC guidance on diagnostic testing for Zika virus in pregnant women and monitoring of pregnant women with evidence of Zika virus infection. Women in endemic areas face difficult choices about conceiving with no clear endpoint aside from vaccine availability or the end of the epidemic, and those who have visited or have a partner that have visited an endemic area may have to carefully consider their options, test, and take precautions for months afterwards.

Where is Zika Virus Found?

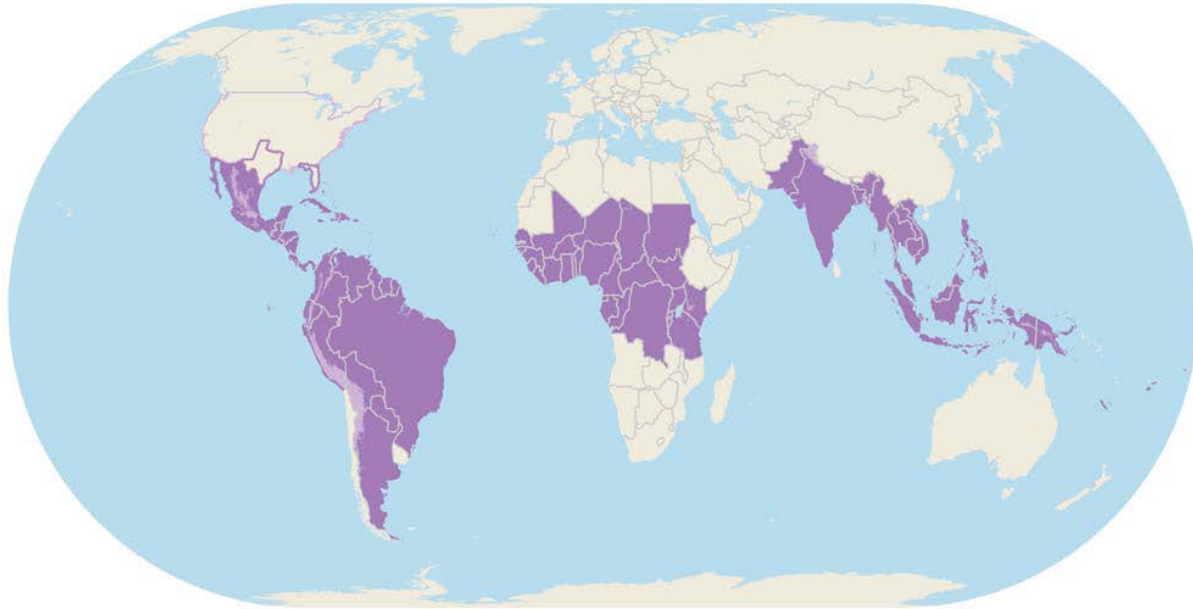
Zika virus was first discovered in the Zika forest in Uganda in 1947. Prior to 2015, Zika virus was found in Africa, Southeast Asia, and the Pacific Islands. The largest outbreak to date occurred in French Polynesia during 2013-2014. A recent retrospective analysis of this outbreak conducted by French Polynesian health authorities after cases of microcephaly were identified in Brazil, found increases of cases of microcephaly.

In May 2015, the Pan American Health Organization (PAHO) issued an alert for the first confirmed patient in Brazil. A significant increase in reported cases of microcephaly has occurred simultaneous to spread of the virus in Brazil. Many countries in Central and South America, the Caribbean, West Africa, Pacific Islands, and the United States report local transmission of the virus. (Updated August 5, 2016) [As of July 29, 2016, the CDC and the State of Florida confirmed local Zika virus transmission by mosquitoes in the continental U.S.](#), in addition to the [cases reported in travelers](#) who visited affected countries. (Updated September 29, 2017) CDC has issued [guidance](#) for people who live in or recently traveled to areas of [South Florida](#) and [Brownsville, Texas](#), where local transmission has occurred via mosquitoes. (Updated September 29, 2017) There remains [active transmission](#) in American Samoa, Puerto Rico and the U.S. Virgin Islands. Though we cannot predict how widespread cases of Zika virus may be in the continental United States, recent chikungunya and dengue outbreaks indicate that we are not likely to experience the same type of rapid spread Zika virus infection currently occurring elsewhere. Local transmission of the virus is anticipated to be small and focal. The CDC is tracking domestic Zika cases and provides [current case counts and geographic spread of cases](#). (Updated September 29, 2017)

What are the Mosquito Vectors for Zika Virus and Where are They Found?

Figure 1 shows countries that have reported local transmission of Zika virus. Figure 2 shows locations within the continental U.S., where *Aedes aegypti* and *Ae. albopictus* mosquitoes, the primary vectors of Zika, dengue, and chikungunya viruses, are found. These *Aedes* mosquitoes have been found in 30 states and the District of Columbia, including the southeastern U.S., up the east coast to New York, and west to Indiana, Ohio, and Kentucky. These are areas at potential risk of local transmission of Zika virus (and also areas of potential transmission of dengue, chikungunya, and other diseases spread by *Aedes* mosquitoes). *Aedes* mosquitoes that spread Zika virus are aggressive daytime biters, but they can also bite at night. *Aedes* mosquitoes breed in small collections of water and seldom venture far from where they were born, making control particularly difficult. Outside of the continental U.S., *Aedes* mosquitoes have been found in the following states and territories: Hawaii, Puerto Rico, American Samoa, Guam, Northern Mariana Islands, and the U.S. Virgin Islands. Zika is spread from an infected mosquito-person-mosquito. The virus can spread to new areas where *Aedes* mosquitoes are known to exist when an infected, viremic traveler from an endemic area is bitten by a mosquito and that person transmits the virus to the mosquito, causing a new transmission chain to begin. Sustainment of that transmission depends on many variables, however, and does not assure that local transmission will continue. Once a mosquito is infected with Zika virus, it will remain infected for life. A mosquito lifespan is up to 30 days. (Updated May 9, 2016)

World Map of Areas with Risk of Zika



International areas and US territories

- Areas with risk of Zika infection (below 6,500 feet)*
- Areas with low likelihood of Zika infection (above 6,500 feet)*
- Areas with no known risk of Zika infection

United States areas

- State Reporting Zika
- No Known Zika

*Mosquitoes that can spread Zika usually live in places below 6,500 feet. The chances of getting Zika from mosquitoes living above that height are very low.

Figure 1. Map Showing Countries with Zika. Centers for Disease Control and Prevention. (Updated September 29, 2017)

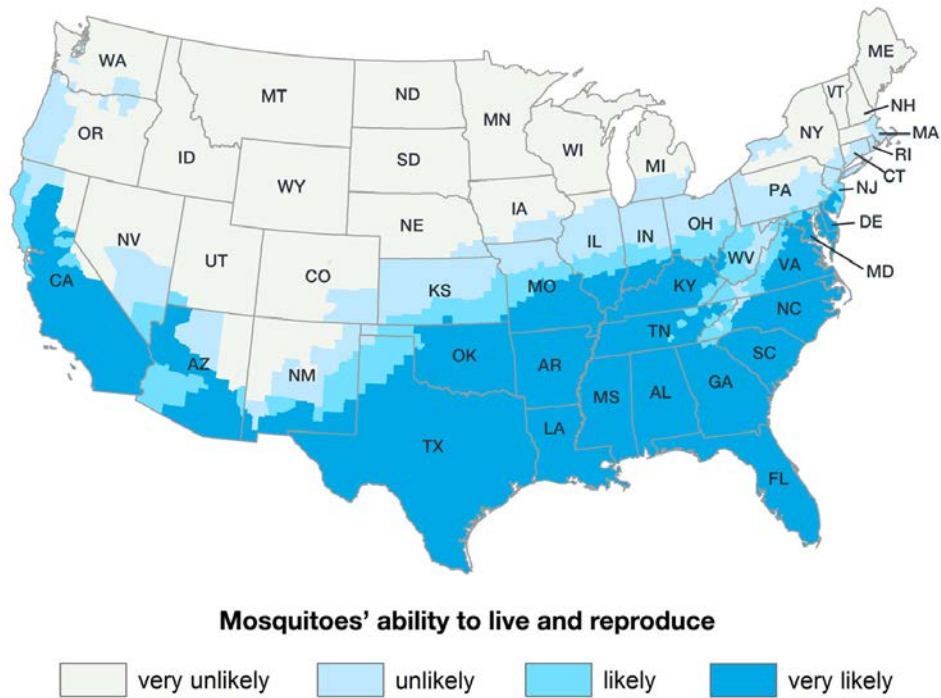


Figure 2. Estimated range of *Aedes aegypti* mosquitoes in the contiguous United States. Graphic courtesy of CDC. (Updated September 29, 2017).

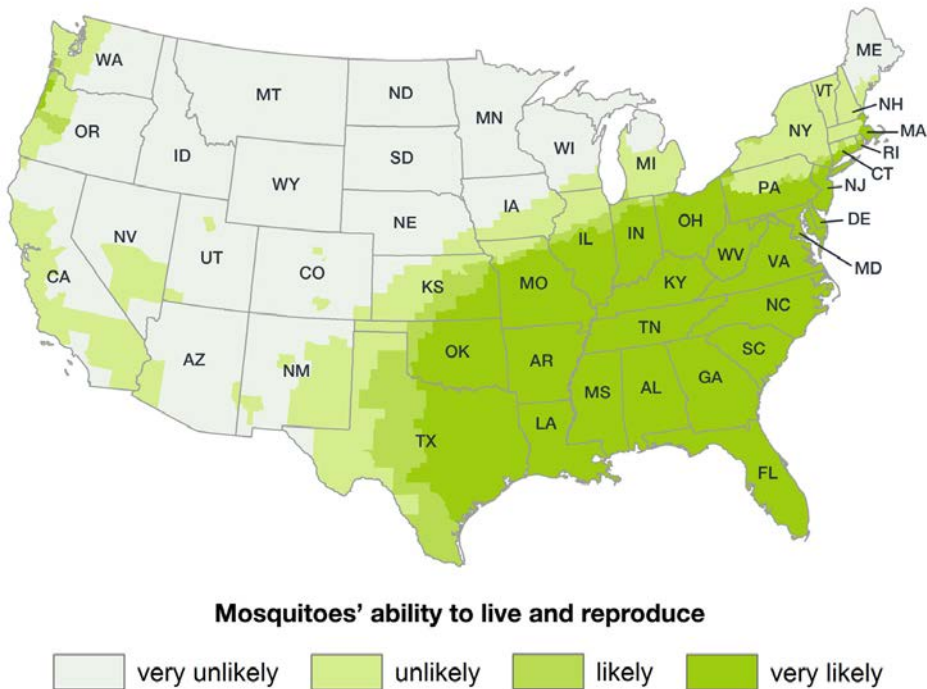


Figure 3. Estimated range of *Aedes albopictus* mosquitoes in the contiguous United States. Graphic Courtesy of CDC. (Current September 29, 2017)

Can Zika Virus be Transmitted Person to Person?

There is evidence that Zika virus can be [sexually transmitted \(male to female\)](#) [Updated April 8, 2016], [male to male](#) [Updated May 9, 2016], and [female to male](#) [Updated September 2, 2016]), and transmitted from a mother to her fetus during pregnancy. A recent case suggests possible [sexual transmission from an asymptomatic male to female](#). (Updated September 2, 2016) Although there is no evidence Zika virus can be transmitted through casual contact or through air, local healthcare providers and the CDC completed an investigation of a possible case of non-sexual [person-to-person transmission in Utah](#). (Updated October 7, 2016)

There are indications that it is possible to transmit Zika through a [blood transfusion](#) (Updated October 7, 2016), so providers should, as always, use standard precautions for personal protection when dealing with blood and blood products. On March 13, the CDC issued a [special notice](#) because analysis of locally-acquired cases in Florida revealed that blood and tissue safety in Broward and Palm Beach Counties may also be at increased risk due to Zika virus transmission in nearby Miami Dade County. While the risk is considered to be very low, tissue donors – particularly semen donors – are currently not tested for Zika, making this finding an important consideration factor for women and their partners trying to conceive, [healthcare providers](#), and [blood and tissue collection establishments](#). (Updated March 20, 2017)

[Current guidelines](#) for prevention of sexual transmission are as follows (Updated October 7, 2016):

- Couples planning to conceive:
 - Men should wait at least 6 months after symptom onset or last possible Zika exposure to attempt to conceive.
 - Women should wait at least 8 weeks after symptom onset or last possible Zika exposure to attempt to conceive.
 - Couples undergoing fertility treatment with their own gametes and embryos should follow the same guidelines.
- Couples who are not pregnant or planning to become pregnant, but who want to maximally reduce their risk of sexual transmission:
 - Men should practice abstinence or use condoms consistently and correctly for at least 6 months after symptom onset or last possible Zika exposure.
 - Women should abstain or use condoms consistently and correctly for at least 8 weeks after symptom onset or last possible Zika exposure.

Possible exposure is living in or traveling to a geographic area with active Zika transmission or sex without a condom with a partner who lives in or has traveled to such an area.

Earlier studies found that Zika virus has been [detected in semen](#) up to eight weeks after the onset of febrile illness and [very high concentrations of live virus have been detected in semen at 2 weeks](#). (Updated October 7, 2016) Additional studies are ongoing, but current findings

suggest that Zika virus [remains in semen longer](#) than other bodily fluids. (Updated September 29, 2017) Zika virus RNA has been found in semen as long as [188 days](#) after symptom onset, though it is not yet clear whether that presence means an individual can transmit the virus. (Updated October 7, 2016)

To avoid Zika transmission from a mother to her fetus, [pregnant women](#) should:

- Avoid travel to [areas](#) where Zika virus has been newly introduced or reintroduced and local mosquito-borne transmission is ongoing, where the virus was present before 2015 and there is no evidence that transmission has stopped, and where the virus is likely to be circulating but has yet to be documented. (Updated March 20, 2017)
- Prevent mosquito bites if they must travel to or reside in such areas.
- Abstain from sex or use a condom with a partner who has possible exposure to Zika.

How do Clinicians [Test for Zika Virus Disease?](#)

Zika virus testing is not recommended for [asymptomatic men, children, or non-pregnant women](#). (Updated September 29, 2017) Molecular diagnosis, via real-time polymerase chain reaction (RT-PCR) testing, is available for Zika virus disease through CDC and public health and commercial laboratories; however, the test is only positive during acute infection, approximately the first 14 days after onset of symptoms. For [symptomatic, non-pregnant individuals](#), negative specimens should undergo additional serological testing to confirm results. (Updated September 29, 2017) For symptomatic, non-pregnant patients whose specimen is collected greater than 14 days following symptom onset, serologic diagnosis through IgM testing is needed. It is often difficult to interpret positive results in people who have been previously infected with another flavivirus (like dengue) due to antibody cross-reaction. Therefore, presumed positive, equivocal, or inconclusive serologic tests must be confirmed via plaque-reduction neutralization testing (PRNT). Contact your local/state health department for local testing policies and procedures.

Some flavivirus infections can result in prolonged IgM responses, with recent data indicating that Zika virus IgM can persist beyond 12 weeks in some infected individuals. This may make it difficult to determine the timing of infection, particularly among those who are asymptomatic. Pregnant women who test positive for IgM antibody may have been infected with Zika virus and developed an IgM response before conception. Due to the prolonged detection of IgM antibodies and declining prevalence of Zika virus disease in the Americas, the CDC updated [guidance for healthcare providers caring for pregnant women with possible Zika virus exposure](#) on July 24. The CDC recommends that healthcare providers concurrently perform nucleic acid testing (NAT) and serological testing on [symptomatic pregnant women with possible Zika virus exposure](#) as soon as possible through 12 weeks after symptom onset. (Updated September 29, 2017) A positive NAT result indicates Zika virus infection. If both tests are negative, there is no evidence of Zika virus infection. If NAT is negative and IgM is not negative, PRNT is needed to

determine infection by Zika or another flavivirus. The CDC does not routinely recommend testing of [asymptomatic pregnant women without ongoing exposure](#). However, healthcare providers in consultation with their patients should consider testing following the algorithm for symptomatic pregnant women based on patient preferences and values, clinical judgment, assessment of risks and outcomes, and jurisdictional recommendations. The CDC recommends that healthcare providers of [asymptomatic pregnant women with ongoing possible exposure](#) perform NAT three times during pregnancy. (Updated July 26, 2017)

The [U.S. Food and Drug Administration](#) has issued 17 Emergency Use Authorizations (EUAs) for commercially-available testing and two for CDC-based testing. Some of these EUAs have been revised to reflect evolving knowledge about the virus and the use of diagnostics. (Updated [September 29, 2017](#)) FDA revoked one of the EUAs at the request of the manufacturer. (Updated June 12, 2017)

The CDC tests are: (Updated June 12, 2017)

- [Trioplex Real-time RT-PCR Assay](#) for the qualitative detection and differentiation of RNA from Zika, dengue, and chikungunya viruses in human sera or cerebrospinal fluid collected alongside a patient-matched serum specimen and for the qualitative detection of Zika virus RNA in urine and amniotic fluid collected alongside a patient-matched serum specimen. At CDC's request, FDA amended the EUA for the Trioplex rRT-PCR on September 21, 2016, January 18, March 1, and April 6.
- [Zika MAC-ELISA](#) for the presumptive detection of Zika virus-specific IgM in human sera or cerebrospinal fluid submitted alongside a patient-matched serum specimen. At CDC's request, FDA amended the EUA for Zika MAC-ELISA in January, November, and December 2016, May 2017, and July 2017 to reflect updated clinical and epidemiological criteria and algorithms, the use of additional antigens, modifications to patient and provider fact sheets, the addition of acceptable automated instruments, the recommendation to run an additional negative human serum control once daily, a limitation when testing infant serum, and updated contact information.

Commercially-available test EUAs include: (Updated [September 29, 2017](#))

- [Quest Diagnostics Infectious Diseases' Zika Virus RNA Qualitative Real-Time RT-PCR test by qualified laboratories](#). This was the first commercially available test to be authorized for emergency use and the FDA reissued the EUA on October 7, 2016 at the request of the manufacturer to allow use of commercially-sourced inactivated virus as a control material and to allow the addition of urine (collected alongside a patient-matched serum specimen) as a specimen type. The EUA was modified April 11 to update the company name.
- [altona Diagnostics RealStar® Zika Virus RT-PCR Kit U.S.](#) for the qualitative detection of RNA from Zika virus in serum or urine (collected alongside a patient-matched serum specimen). At the request of the manufacturer, FDA revised the EUA on October 31,

2016 to add two instruments and their respective extraction chemistry/reagents as authorized extraction methods and on March 6 to update instructions.

- [Hologic, Inc's Aptima Zika Virus assay](#), a test to help detect Zika virus infection in people who have symptoms of Zika virus infection, and live in or have traveled to an area with active Zika virus transmission. At the request of the manufacturer, FDA revised the EUA to add processed urine as an authorized specimen and updated associated fact sheets on October 3, 2016 and to extend the stability of processed urine specimens, clarify storage and stability of serum and plasma specimens, and improve clarity and accuracy of the document on April 12.
- [Viracor Eurofins Zika Virus Real-time RT-PCR](#) test for the qualitative detection of RNA from Zika virus in human serum, plasma or urine (collected alongside a patient-matched serum or plasma specimen). At the request of the manufacturer, FDA revised the EUA on February 28 to update the company name, combine fact sheets, and update language to align with current guidance.
- [Siemens Healthcare Diagnostics Inc.'s VERSANT® Zika RNA 1.0 Assay \(kPCR\) Kit](#) for the qualitative detection of RNA from Zika virus in human serum, EDTA plasma, and urine (collected alongside a patient-matched serum or plasma specimen). At the request of the manufacturer, the separate fact sheets for patients and pregnant women were combined on December 19 into a single fact sheet, which reflects updated CDC laboratory testing guidance.
- [Luminex Corporation's xMAP® MultiFLEX™ Zika RNA Assay](#) for the qualitative detection of Zika virus RNA in human serum, plasma, and urine, which was revised January 7 at the request of the manufacturer to combine fact sheets and align with updated laboratory guidance and May 19 to include minor updates and clarifications requested by FDA.
- [InBios International, Inc.'s ZIKV Detect™ IgM Capture ELISA](#) for the qualitative detection of human IgM antibodies to Zika virus, which was revised March 27 to modify instructions for use labeling and fact sheets.
- Roche Molecular Systems, Inc.'s LightMix® Zika rRT-PCR Test for the qualitative detection of RNA from Zika virus in human serum and EDTA plasma, which was revised November 23, 2016 at the request of the manufacturer to modify the interpretation of results. At the request of the manufacturer, FDA revoked the EUA on March 13.
- [Vela Diagnostics USA, Inc.'s Sentosa® SA ZIKV RT-PCR Test](#) for the qualitative detection of RNA from Zika virus in human serum, EDTA plasma, and urine (collected alongside a patient-matched serum or plasma specimen).
- [ARUP Laboratories' Zika Virus Detection by RT-PCR Test](#) for the qualitative detection of RNA from Zika virus in human serum, EDTA plasma, and urine (collected alongside a patient-matched serum or EDTA plasma specimen).
- [Abbott Molecular Inc.'s RealTime Zika Assay](#) for the qualitative detection of RNA from Zika virus in human serum, EDTA plasma, and urine (collected alongside a patient-matched serum or plasma specimen).

- [ELITechGroup Inc. Molecular Diagnostics' Zika ELITe MGB® Kit](#) for the qualitative detection of RNA from Zika virus in human serum and EDTA plasma.
- [Nanobiosym Diagnostics, Inc.'s Gene-RADAR® Zika Virus Test](#) for the qualitative detection of RNA from Zika virus in human serum.
- [DiaSorin Incorporated's LIAISON® XL Zika Capture IgM Assay](#) for the presumptive qualitative detection of Zika virus IgM antibodies in human sera.
- [Thermo Fisher Scientific's TaqPath Zika Virus Kit](#) for the qualitative detection of RNA from Zika virus in human serum and urine.
- [Columbia University's CII-ArboViroPlex rRT-PCR Assay](#) for the qualitative detection and differentiation of RNA from Zika, dengue, chikungunya, and West Nile viruses in serum and for the qualitative detection of Zika virus RNA in urine (collected alongside a patient-matched serum specimen).
- [Siemens Healthcare Diagnostics Incorporated's ADVIA Centaur Zika Test](#) for the presumptive qualitative detection of Zika virus IgM antibodies in human serum and plasma.

How is Zika Virus Disease Treated?

There is no specific treatment for Zika virus disease. Supportive care and symptom management are the best options. No vaccination currently exists. It is important to note that Zika virus disease is transmitted by the same mosquitoes that spread chikungunya and dengue viruses, therefore all three diseases should be considered in any patient with consistent signs and symptoms. The mainstay of disease management is prevention. Pregnant women should be referred to their provider for further evaluation and treatment. For more information about Zika virus disease and the current outbreak, including guidance for clinicians, visit the [CDC Zika virus website](#).

What Research and Development is Underway Related to Zika Virus Disease?

The US government is supporting numerous research and development efforts related to Zika virus and how it affects various populations. Areas of focus include:

- Developing a vaccine and pharmaceutical countermeasures or antiviral treatments.
- Refining laboratory tests (including point-of-care, real-time) to specifically diagnose Zika, chikungunya, and dengue fever.
- Defining effective risk communication and behavior change methodologies for the US public.
- Defining transmissibility risks and duration, especially non-vector transmission via sexual and other means.
- Further defining the linkage between Zika and Guillain-Barré syndrome, microcephaly, and other conditions.

- Defining the period of viremia and establishing a “safe period” of waiting prior to becoming pregnant after visiting endemic areas.

The development and approval of a safe and effective vaccine is expected to take several years. Current research efforts include:

- The first of five clinical trials to test the safety and ability of the [investigational Zika Purified Inactivated Virus \(ZPIV\)](#) vaccine candidate began in November 2016. In September 2017, Sanofi Pasteur [announced](#) its decision not to continue development or seek licensure of the Zika vaccine candidate. [\(Updated September 29, 2017\)](#)
- The National Institute of Allergy and Infectious Diseases (NIAID) began a clinical trial of its [Zika virus investigational DNA vaccine](#) in August 2016, which was found to be safe and induced an immune response. A [Phase 2/2b clinical trial](#) began in spring 2017. [\(Updated June 12, 2017\)](#)
- Other vaccine candidates in the pre-clinical stage include one using self-amplifying mRNA technology, a live-attenuated investigational Zika vaccine, and one using a genetically engineered version of vesicular stomatitis virus.

Early research on potential treatments for Zika includes using an existing antiviral drug screening program for other flaviviruses to test drug compounds for activity against Zika; screening a library of approved drugs for activity against Zika; creating a rodent model on which to test antiviral compounds; and developing monoclonal antibodies capable of neutralizing Zika.

The following links provide up-to-date information on the status of federally-funded Zika research and development efforts:

- [NIAID Description of Research Efforts](#)
- [Biomedical Advanced Research and Development Authority Partnership Opportunities](#)
- [National Institute of Health \(NIH\) Funding Opportunities](#)
- [NIH Clinical Trials](#)
- [Potential Research Priorities to Inform Public Health and Medical Practice for Domestic Zika Virus: Workshop in Brief](#)

Internationally, the WHO published a [Zika Virus Research Agenda](#) that identifies areas of research that the organization may be uniquely qualified to implement or coordinate. The WHO [summarized](#) its effort to harmonize its research protocols with those of PAHO, Institut Pasteur, and the networks of Fiocruz, Consortium for the Standardization of Influenza Seroepidemiology, and the International Severe Acute Respiratory and Emerging Infection Consortium. This harmonization effort includes the development of [draft standardized research protocols](#) for case-control, prospective longitudinal cohort, and cross-sectional seroprevalence studies of various populations.

What Support is Available to Communities Preparing for and Responding to Zika Virus Disease?

In September 2016, the federal government [approved funding of \\$1.1 billion](#) for Zika preparedness and response. In addition to supporting federal Zika-related efforts and vaccine and diagnostic development, a portion of these funds has been awarded by several federal agencies to state, territorial, and local governments; health centers and healthcare providers; and public health organizations. To date, [CDC](#), the [Centers for Medicare & Medicaid Services](#), and [Health Resources & Services Administration](#) (with support from ASPR) have awarded funds to address health and social support needs in affected geographic locations and to strengthen capabilities in areas such as vector control and laboratory capacity. Additional funds will be distributed to meet targeted needs as they are identified. The HHS [Secretary's Ventures Fund](#) is providing \$100,000 to enable the sharing of Zika laboratory testing orders and results between clinicians and public health laboratories. (Updated June 12, 2017)

What Effect Do Hurricanes and Tropical Storms Have on Zika?

The risk of Zika virus disease is not expected to increase in the immediate aftermath of natural disasters, but preventive efforts are necessary to reduce the long-term risk. Adult mosquitoes are likely to be killed by the high winds brought by [hurricanes](#) and tropical storms. Populations of floodwater mosquitoes – those species that lay eggs in soil that periodically floods – are likely to spike in the days and weeks following flooding conditions, but these tend to be nuisance species that do not carry Zika virus, West Nile virus, and dengue. In the longer term, standing water provides breeding grounds for those species that do transmit infectious diseases. In locations where flooding has occurred and standing water is present, particularly where Zika virus and mosquito-borne infections are endemic, residents should take steps to limit exposure to mosquitoes, particularly if their living quarters were compromised. Local officials should encourage the use of insect repellants; remove sources of standing water; continue surveillance of mosquito populations and vector-borne illnesses; and maintain or establish vector control programs. (Updated September 29, 2017)

Key Points for Consideration and Resources by Profession

All Professions

Current Case Numbers

- [Cases in the United States](#) [CDC]
- [Cases among Pregnant Women in the United States](#) [CDC]

Prevention

- There is currently no vaccine. Senior federal officials outlined [three potential strategies](#) for investigators to consider when conducting clinical trials on Zika vaccine candidates. (Updated October 7, 2016)
- Because Zika infection is a cause of severe congenital disease, pregnant women (and those anticipating becoming pregnant in the next few months) who live in or cannot avoid travel to endemic areas should strictly follow steps to [prevent mosquito bites](#). (Updated May 9, 2016)
- If a pregnant woman has a male sex partner who lives in or has traveled to an area with Zika virus transmission, he or she should use a condom every time they have sexual intercourse or should not have sexual intercourse with that male partner during the pregnancy. (Updated May 9, 2016)

Transmission

- The primary mode of transmission of Zika virus is a bite from an infected mosquito.
- Perinatal and sexual transmission, as well as transmission via blood transfusion, have been reported.
- The incubation period is 2-7 days, but other arboviral diseases, like dengue and chikungunya, can take up to two weeks.

Presentation and Treatment

- Most people infected with Zika virus will not become symptomatic. (Updated May 9, 2016)
- Illness is usually mild, lasting several days to a week.
- Acute onset of fever with maculopapular rash (flat, red area on skin covered by small bumps), arthralgia (joint pain), and/or conjunctivitis (inflammation of the inner surface of the eyelid and outermost layer of the eye) may occur.
- Myalgia (muscle pain) and headache are also reported.
- There is no “cure” or treatment specific to Zika virus disease.
- Symptoms of acute Zika virus infection can be treated with supportive care.
- Hospitalization for acute Zika infection is uncommon.
- Deaths are rare.

Clinicians/Healthcare Providers

Preparedness

- Monitor outbreak information and changes or updates to [CDC medical management guidance](#) and from public health departments or healthcare coalitions. (Updated September 29, 2017)
- Contact the state health department to facilitate testing. Ensure a plan is in place for transporting laboratory samples to designated labs for confirmatory testing. As of July 1, 2016 public health laboratories in all 50 states can provide testing using RT-PCR, IgM ELISA, and PRNT assays. (Updated January 27, 2017)
- Familiarize yourself with testing [algorithms](#) based on presence of symptoms and pregnancy status. (Updated July 26, 2017)
- Review this [Zika Virus Planning Considerations for Healthcare Facilities and Coalitions](#) document to identify anticipated hospital and healthcare system planning issues. (Updated September 2, 2016)
- Resources:
 - [Information for Healthcare Providers](#). [CDC] (Updated September 29, 2017)
 - [Zika Virus: Information for Clinicians PowerPoint](#). [CDC] (Updated July 7, 2016)
 - [Zika Virus: A Primer for Nurses](#). [CDC] (Updated July 26, 2017)
 - [Zika Action Planning Follow-up Teleconferences](#). [CDC] (Updated November 14, 2016)
 - [Zika Sustainment Strategy Presentations](#). [CDC] (Updated June 12, 2017)
 - [Training Resources for Health Professionals](#). [CDC] (Updated September 29, 2017)
 - [Zika in the ED: How Emergency Care Staff Can Take Action Webinar](#). [CDC] (Updated January 27, 2017)
 - [Zika Virus Planning Resource Introduction](#). [ASPR TRACIE] (Updated June 6, 2016)
 - [Key Zika Considerations for Healthcare Settings](#). [CDC] (Updated September 2, 2016)
 - [Fact Sheets and Posters](#). [CDC] (Updated September 29, 2017)

Testing

- Maintain awareness of evolving [laboratory guidance](#) about when to test for Zika virus based on presence of symptoms, pregnancy status, and travel history. (Updated July 26, 2017) The CDC does not currently recommend testing of [asymptomatic men, children, or non-pregnant women](#). (Updated September 29, 2017)
- Review [updated guidance](#) for healthcare providers caring for pregnant women with possible exposure to Zika virus, which: revises recommendations on which pregnant women should be tested, how, and how often; updates guidance on prenatal management of pregnant women with laboratory evidence of possible Zika infection and evaluation of placental and fetal tissue specimen for Zika virus infection; and

describes implications for the evaluation and care of infants with possible congenital Zika virus exposure. (Updated July 26, 2017)

- Rule out the possibility of a false positive by performing further testing following presumed positive, equivocal, or inconclusive Zika IgM tests. In December 2016, the [FDA reminded physicians](#) to wait for confirmatory test results before making patient management decisions due to false positives from the ZIKV Detect test. (Updated January 27, 2017) Zika serologic tests are cross-reactive if the patient has been previously infected with other flaviviruses (e.g., yellow fever and dengue). CDC issued a HAN on May 5 with additional recommendations on the [interpretation of Zika IgM antibody results](#). (Updated June 12, 2017)
- Resources:
 - [Guidance for U.S. Laboratories Testing for Zika Virus Infection](#). [CDC] (Updated July 26, 2017)
 - [When to Test for Zika Virus](#). [CDC] (Updated September 29, 2017)
 - [3 Zika Tests Explained](#). [APHL] (Updated October 7, 2016)
 - [Collection and Submission of Body Fluids for Zika Virus Testing](#). [CDC] (Updated January 27, 2017)
 - [Interim Guidance for Zika Virus Testing of Urine](#). [CDC] (Updated June 6, 2016)
 - [Zika Virus: Collection and Submission of Fetal Tissues for Zika Virus Testing](#). [CDC] (Updated September 29, 2017)
 - [Collection and Submission of Specimens for Zika Virus Testing at the Time of Birth](#). [CDC] (Updated September 29, 2017)
 - [Implementing CDC Guidance for Infant Neuroimaging and Infant and Placental Zika Virus Testing](#). [CDC] (July 26, 2017)
 - [Make Sure to Get Your Zika Test Results](#). [CDC] (Updated October 7, 2016)

Patient Care – General

- Do **not** give NSAIDs—for example acetyl-salicylic acid (aspirin) and ibuprofen—until dengue infection can be ruled out. These drugs thin the blood and can increase the risk of bleeding. Fever and pain can be addressed with acetaminophen. (Updated May 9, 2016)
- Continue to collect travel histories during healthcare assessments for: (1) symptoms suggestive of mosquito-borne illness, and (2) all pregnant patients and their sexual partners. (Updated May 9, 2016)
- Advise patients to strictly [follow steps to prevent mosquito bites during the first week of illness](#) to help prevent others from getting sick from local mosquito transmission. (Updated May 9, 2016)
- Monitor for guidance on immunocompromised patients. Little is known about Zika virus disease behavior in immunocompromised patients. We do not currently have data on risk factors for severe Zika virus disease. We do know that for West Nile virus, a related flavivirus, immunosuppression does appear to be a risk factor for more severe

disease. Similarly, serious adverse events are more likely following administration of live yellow fever vaccine, which is also a related flavivirus. However, we do not know whether Zika virus would pose a similar risk in immunosuppressed patients. The CDC has provided additional information on [HIV infection and Zika virus](#). (Updated January 27, 2016)

- Counsel male and female patients of reproductive age on preventive behaviors.
- Resources:
 - [Symptoms, Testing, & Treatment](#). [CDC]
 - [Prevention of Sexual Transmission of Zika Virus](#). [WHO] (Updated October 7, 2016)
 - [Clinical Guidance for Healthcare Providers for Prevention of Sexual Transmission of Zika Virus](#). [CDC] (Updated July 26, 2017)
 - [Providing Family Planning Care for Non-Pregnant Women and Men of Reproductive Age in the Context of Zika](#). [OPA] (Updated January 27, 2017)
 - [Guidance for Organ Donation and Transplantation Professionals Regarding the Zika Virus](#). [UNOS] (Updated April 8, 2016)
 - [Tool for the Diagnosis and Care of Patients with Suspected Arboviral Diseases](#). [PAHO] (Updated June 12, 2017)
 - [WHO Toolkit for the Care and Support of People Affected by Complications Associated with Zika Virus](#). [WHO] (Updated September 29, 2017)

Patient Care – Pregnant Women and Women of Reproductive Age

- Discuss Zika infection with [women of reproductive age](#), residing in or planning travel to areas with Zika virus transmission risk. (Updated April 8, 2016)
- Assure access to barrier contraception for patients and partners at potential risk. (Updated May 9, 2016)
- Counsel pregnant women in [mosquito avoidance](#).
- Screen pregnant women for exposure to Zika virus. A marked increase in the number of babies born with congenital neurologic damage has been reported in areas experiencing Zika virus disease outbreaks and a causal link from Zika virus infection to neurological syndromes including microcephaly and [Guillain-Barré syndrome](#) has been confirmed (updated May 9, 2016). Pregnant women presenting with Zika virus disease symptoms should be evaluated according to the [Update: Interim Guidance for Health Care Providers Caring for Pregnant Women with Possible Zika Exposure - United States \(Including U.S. Territories\), July 2017](#). (Updated July 26, 2017)
- Call the CDC Zika Pregnancy Hotline for Health Care Providers (770-488-7100), which provides 24/7 consultative services for questions and concerns related to clinical management. (Updated May 9, 2016)
- Resources:

- [Zika Grand Rounds Facilitation Guide: Pregnancy](#). [CDC] (Updated January 27, 2017)
- [Healthcare Provider Toolkit: For Obstetricians](#). [CDC] (Updated March 20, 2017)
- [Practice Advisory on Zika Virus](#). [ACOG & SMFM] (Updated September 29, 2017)
- [Maternal-Fetal Health Planning Resource](#). [ASPR TRACIE] (Updated August 5, 2016)
- [Promoting Stress Management for Pregnant Women during the Zika Virus Disease Outbreak](#). (Updated June 6, 2016) [Spanish Version](#). [ASPR ABC] (Updated July 7, 2016)
- [Psychosocial Support for Pregnant Women and for Families with Microcephaly and other Neurological Complications in the Context of Zika Virus: Interim Guidance for Healthcare Providers](#). [WHO] (Updated September 2, 2016)
- [US Zika Pregnancy Registry](#). [CDC] (Updated September 29, 2017)
- [Zika Active Pregnancy Surveillance System \(ZAPSS\)](#). [CDC] (Updated March 20, 2017)
- [Estimating Contraceptive Needs and Increasing Access to Contraception in Response to the Zika Virus Disease Outbreak](#). [CDC] (Updated April 8, 2016)
- [Preconception Counseling](#). [CDC] (Updated June 12, 2017)
- [Contraception to Prevent Unintended Pregnancy during the Zika Virus Outbreak](#). [CDC] (Updated June 12, 2017)
- [Gaps in Contraception Access and Zika: Interactive Map](#). [ASPR] (Updated September 2, 2016)
- [Increasing Access to Contraception in the Context of Zika Preparedness](#). [CDC] (Updated November 14, 2016)
- [Birth Control Guide](#). [FDA] (Updated January 27, 2017)
- [Preventing Transmission of Zika Virus in Labor and Delivery Settings Through Implementation of Standard Precautions](#). [CDC] (Updated April 8, 2016)
- [Pregnancy and Zika Testing Web Tool](#). [CDC] (Updated June 12, 2017)
- [Infographic: Zika Virus Testing for any Pregnant Woman Not Living in an Area with Zika](#). [CDC] (Updated September 2, 2016)

Patient Care – Infants and Children

- Use this [case definition](#) to evaluate infants for congenital neurologic changes. (Updated November 14, 2016) Because it is difficult to predict at birth what problems babies will have, babies with specific findings or likely in utero exposure need close follow-up through regular check-ups with a doctor or other healthcare provider to track their growth and development. (Updated May 9, 2016)
- Be prepared to strengthen antenatal care and ensure availability of fetal ultrasound capability as well as antenatal counseling and support.
- Resources:

- [Interim Guidelines for Health Care Providers Caring for Infants and Children with Possible Zika Virus Infection.](#) [CDC] (Updated September 2, 2016)
- [Interim Guidance for the Evaluation and Management of Infants with Possible Congenital Zika Virus Infection.](#) [CDC] (Updated September 2, 2016)
- [Webcast Recordings: Clinical Evaluation and Management of Infants with Congenital Zika Infection.](#) [CDC] (Updated September 2, 2016)
- [Zika Grand Rounds Facilitation Guide: Pediatrics.](#) [CDC] (Updated January 27, 2017)
- [Healthcare Provider Toolkit: For Pediatricians.](#) [CDC] (Updated March 20, 2017)
- [Zika Virus Transmission in Infants and Children.](#) [CDC] (Updated June 12, 2017)
- [Zika Virus Evaluation and Testing.](#) [CDC] (Updated September 29, 2017)
- [Implementing CDC Guidance for Infant Neuroimaging and Infant and Placental Zika Virus Testing.](#) [CDC] (July 26, 2017)
- [Zika Virus Infection and Microcephaly.](#) [CDC] (Updated September 29, 2017)
- [Zika Virus: What Pediatricians Need to Know.](#) [AAP] (Updated January 27, 2017)
- [Measuring Infant Head Circumference: An Instructional Video for Healthcare Providers.](#) [CDC] (Updated November 14, 2016)
- [Zika Virus: Collection and Submission of Fetal Tissues for Zika Virus Testing.](#) [CDC] (Updated September 29, 2017)
- [Collection and Submission of Specimens for Zika Virus Testing at the Time of Birth.](#) [CDC] (Updated September 29, 2017)
- [Surveillance and Services for Babies Affected by Zika.](#) [CDC] (Updated April 8, 2016)
- [ASPR Supporting Children with Special Health Care Needs Planning Resource.](#) [ASPR TRACIE] (Updated September 2, 2016)
- [Resources and Guidance for Healthcare Providers Caring for Infants Affected by Zika Virus.](#) [CDC] (Updated September 29, 2017)
- [Resource Guide for States and Communities Caring for Infants and Children Affected by Zika Virus.](#) [HRSA] (Updated January 27, 2017)
- [Screening, Assessment and Management of Neonates and Infants with Complications Associated with Zika Virus Exposure in Utero.](#) [WHO] (Updated September 2, 2016)
- [Support for Families of Newborns Affected by Zika.](#) [CDC] (Updated March 20, 2017)
- [Caring for Children with Congenital Zika Virus: Building Community Support Webinar.](#) [AAP & CDC] (Updated January 27, 2017)
- [Psychosocial Support for Pregnant Women and for Families with Microcephaly and other Neurological Complications in the Context of Zika Virus: Interim Guidance for Healthcare Providers.](#) [WHO] (Updated September 2, 2016)

- [Follow-Up of Care](#). [CDC] (Updated September 29, 2017)
- [Zika Virus: Psychosocial Support Videos](#). [AAP] (Updated July 26, 2017)
- [Guidance for Review of Zika-Related Fatalities](#). [National Center for Fatality Review and Prevention] (Updated June 12, 2017)

Patient Care – GBS/Neurological

- Maintain awareness of the link between Zika virus and Guillain-Barré syndrome. Cases of [Guillain-Barré](#) have been reported, which could result in the need for intensive care and mechanical ventilation – unlikely to reach levels of significant impact on the healthcare system, but localized surges requiring specialized care could be possible. In endemic areas, intensive care may not be available. (Updated May 9, 2016)
- Be prepared for a possible increase in demand for specialized care for patients with Guillain-Barré syndrome – while unlikely to result in a surge in demand for critical care resources, the potential for Guillain-Barré syndrome and other neurologic sequelae should be prepared for in a diligent and determined manner. The potential for a cluster of cases certainly exists, while the availability of clinicians with expertise in the management of Guillain-Barré syndrome may be limited, especially in certain geographic locations. (Updated May 9, 2016)
- Resources:
 - [Guillain-Barré Syndrome and Other Neurological Deficits Planning Resource](#). [ASPR TRACIE] (Updated September 2, 2016)

Emergency Management/ Public Health Preparedness/ Healthcare System Emergency Management Professionals

General Preparedness and Response

- Use the [HHS Response and Recovery Resources Compendium](#) to search the repository of HHS products, services, and capabilities available to state, tribal, territorial, and local agencies before, during, and after public health and medical incidents.
- Monitor outbreak information and changes or updates to CDC [medical management guidance](#).
- Ensure a plan is in place for transporting laboratory samples to designated labs for testing. Ensure healthcare facilities have plans and policies in place that state under what situations testing is indicated. Widespread testing is NOT recommended and testing is often best carried out in the primary care or obstetric clinic setting since the results are not rapidly available.
- Review this [Zika Virus Planning Considerations for Healthcare Facilities and Coalitions](#) document to identify anticipated hospital and healthcare system planning issues. (Updated September 2, 2016) Key roles of healthcare coalitions include:

- Sharing guidance from federal, state, and local authorities, including updates.
- Identifying local/regional experts (specifically, neurology, maternal fetal medicine, neonatology) who can interpret guidance and serve as regional discussant/subject matter experts.
- Coordinating with public health departments on testing indications and process.
- Coordinating public information about Zika virus disease.
- Engage Medical Reserve Corps and other voluntary organizations.
- Resources:
 - [Zika Community Action Response Toolkit \(Z-CART\)](#). [CDC] (Updated August 5, 2016)
 - [Top 10 Zika Response Planning Tips: Brief Information for State, Tribal, Local, and Territorial Health Officials](#). [CDC] (Updated April 8, 2016)
 - [Zika Recommendations for State and Local Health Departments](#). [CDC] (Updated September 29, 2017)
 - [Zika Virus Response Planning: Interim Guidance for District and School Administrators in the Continental United States and Hawaii](#) [CDC] (Updated November 14, 2016)
 - [Resource Guide for States and Communities Caring for Infants and Children Affected by Zika Virus](#). [HRSA] (Updated January 27, 2017)
 - [Zika Virus Planning Considerations for Healthcare Facilities and Coalitions](#). [ASPR TRACIE] (Updated September 2, 2016)
 - [WHO Toolkit for the Care and Support of People Affected by Complications Associated with Zika Virus](#). [WHO] (Updated September 29, 2017)
 - [Partner with the Medical Reserve Corps for a More Effective Zika Response](#). [MRC] (Updated September 2, 2016)
 - [Zika Outreach Guide](#). [MRC] (Updated September 2, 2016)
 - [Zika Tracking Spreadsheet](#). [MRC] (Updated September 2, 2016)
 - [Promotion of Zika Activities Form](#). [MRC] (Updated September 2, 2016)
 - [Zika Action Guide: Health Ministers are a Community Resource](#). [CDC] (Updated September 29, 2016)
 - [Toolkit for Investigating Possible Local Mosquito-Borne Transmission of Zika Virus](#). [CDC] (Updated June 12, 2017)
 - [Zika in the States: What You Need to Know](#). [NGA] (Updated June 12, 2017)
 - [Tribal Zika Response](#). [CDC] (Updated June 12, 2017)

Worker Health and Safety

- Advise workers on preventive actions to avoid exposure to Zika virus.
- Resources:
 - [Interim Guidance for Protecting Workers from Occupational Exposure to Zika](#). [OSHA & NIOSH] (Updated September 29, 2017)
 - [Interim Guidance for Protecting Workers from Occupational Exposure to Zika Virus Fact Sheet](#). [OSHA & NIOSH] (Updated May 9, 2016)

- [Interim Guidance for Managing Occupational Exposures to Zika Virus for Healthcare Personnel](#). [CDC] (June 12, 2017)
- [Preventing Transmission of Zika Virus in Labor and Delivery Settings Through Implementation of Standard Precautions](#). [CDC] (Updated April 8, 2016)
- [Healthcare Exposure to Zika and Infection Control](#). [CDC] (Updated September 29, 2017)
- [Laboratory Safety when Working with Zika Virus](#). [CDC] (Updated June 12, 2017)
- [Protecting the Health and Safety of Workers in Emergency Vector Control of Aedes Mosquitoes](#). [WHO] (Updated May 9, 2016)
- [Mosquito-Borne Diseases](#). [NIOSH] (Updated May 9, 2016)
- [The Zika Virus: What Employers Should Not Do](#). [SHRM] (Updated May 9, 2016)
- [The Zika Virus: Answers to Employers' FAQs](#). [EHS Today] (Updated May 9, 2016)
- [Prevent Mosquito-borne Diseases: Cruise Line Employees](#). [NIOSH] (Updated July 7, 2016)
- [Human Resources Flexibilities and Authorities for Federal Employees Affected by the Zika Virus](#). [OPM] (Updated October 7, 2016)

Risk Communication

- Provide clear instructions to the community about mosquito abatement and avoiding mosquitoes, particularly during biting hours.
- Educate the community on the purchase and proper use of EPA-registered insect repellents containing one of the following active ingredients: DEET, picaridin, IR3535, oil of lemon eucalyptus, permethrin, or para-menthane-diol.
 - When used as directed, EPA-registered [insect repellents are proven safe and effective](#), even for [pregnant and breastfeeding women](#).
 - Insect repellent [containing DEET should not be used on infants younger than 2 months of age and repellents containing oil of lemon eucalyptus should not be used on children under 3 years](#). (Updated September 2, 2016)
 - Follow instructions on [treating clothing with permethrin](#). (Updated October 7, 2016)
- Share information with the community about signs and symptoms of Zika virus disease and when to seek medical evaluation or treatment.
- Publicize travel advisories, targeting travelers, especially women who are pregnant or considering pregnancy.
- Monitor reports of local transmission of Zika virus.
- Correct misinformation and rumors with science-based educational materials and outreach activities.
- Resources:
 - [Controlling Mosquitoes at Home](#). [CDC] (Updated June 12, 2017)
 - [Mosquito Control and Bite Prevention Educational Flipbook](#) [CDC] (Updated October 7, 2016)

- [Mosquito Control: Do Your Part](#). [CDC] (Updated November 14, 2016)
- [Zika Virus and Pregnancy Fact Sheet](#). [March of Dimes] (Updated October 7, 2016)
- [Zika Virus and Pregnancy](#). [Mother to Baby] (Updated June 12, 2017)
- [What to Know if Your Baby May Have Been Affected by Zika but Has No Related Health Conditions at Birth](#). [CDC] (Updated January 27, 2017)
- [Roadmap for Parents of Babies Infected with Zika Before Birth Who Appear Healthy](#). [CDC] (June 12, 2017)
- [What to Know if Your Baby Was Born with Congenital Zika Syndrome](#). [CDC] (Updated January 27, 2017)
- [Roadmap for Parents of Babies with Congenital Zika Syndrome](#). [CDC] (June 12, 2017)
- [What to Know if Your Doctor Suspects Microcephaly During Pregnancy](#). [CDC] (Updated January 27, 2017)
- [Tips for Communicating with Your Baby’s Doctor or Healthcare Provider](#). [CDC] (Updated September 29, 2017)
- [Zika Virus Disease and Your Eyes](#). [Prevent Blindness] (Updated October 7, 2016)
- [Current CDC Travel Advisories](#). [CDC] (Updated September 29, 2017)
- [Guidelines for US Citizens and Residents Living in Areas with Ongoing Zika Virus Transmission](#). [CDC] (Updated March 20, 2017)
- [Country Classification Technical Guidance](#). [CDC] (Updated March 20, 2017)
- [Zika Communication Planning Guide for States](#). [CDC] (Updated September 29, 2017)
- [Fact Sheets and Posters](#). [CDC] (Updated September 29, 2017)
- [Zika Virus Infection: Step-by-Step Guide to Risk Communication and Community Engagement](#). [PAHO] (Updated January 27, 2017)
- [Dispelling Rumours Around Zika and Complications](#). [WHO] (Updated October 7, 2016)
- [Zika Action Day Toolkit](#). [CDC] (Updated September 29, 2017)
- [Zika, Dengue and Chikungunya Prevention Toolkit](#). [International Federation of Red Cross and Red Crescent Societies] (Updated January 27, 2017)

Vector Control

- Collaborate with environmental health entities on community-based vector control/bite prevention education
 - Community/Facility
 - Eliminate standing water and maintain brush.
 - Apply insecticide spray to outdoor areas as feasible.
 - Make netting and other prevention items available as appropriate.
 - Individuals
 - Use insect repellent (as appropriate) and advise to follow label instructions.

- Place netting over sleeping areas (e.g., beds, cribs) when screens are not available.
 - Avoidance of exposure is best and pregnant women/those considering pregnancy should delay travel to endemic areas when possible.
 - Refer to CDC guidance on [Prevention](#) for more specific steps. (Updated April 8, 2016)
- Consider bed netting, insect spray, or other mosquito prevention equipment for facilities and workers if local cases are detected in endemic areas (such as U.S. territories) with open-air homes/hospitals.
- Monitor recommendations related to disinsection. On May 24, 2016, CDC issued a [Technical Statement on the Role of Disinsection in the Context of Zika Outbreaks](#) stating that CDC does not recommend disinsection inside commercial passenger aircraft to be an effective approach to control the movement of Zika virus over long distances, such as from one country to another. CDC recommends that other local public health interventions should be the primary focus to prevent local transmission of Zika virus. (Updated October 7, 2016)
- Resources:
 - [Interim CDC Recommendations for Zika Vector Control in the Continental United States](#). [CDC] (Updated April 8, 2016)
 - [Regulation of Intentionally Altered Genomic DNA in Animals – Draft Guidance](#). [FDA] (June 12, 2017)
 - [Surveillance and Control of *Aedes aegypti* and *Aedes albopictus* in the United States](#). [CDC] (Updated May 9, 2016)
 - [Information on Aerial Spraying](#). [CDC] (Updated June 12, 2017)
 - [Aerial Spraying with Naled](#). [CDC] (Updated January 27, 2017)
 - [What You Need to Know About Bti](#). [CDC] (Updated September 29, 2017)
 - [Insect Repellent Use and Safety](#). [CDC]
 - [Final Environmental Assessment for Genetically Engineered Mosquito](#). [FDA] (Updated September 2, 2016)
 - [CDC Emergency Vector Control Request Form](#). [CDC] (Updated July 7, 2016)
 - [A Visual Guide to Modified Mosquitoes](#). [Scientific American] (Updated January 27, 2017)
 - [Mosquitoes and Hurricanes](#). [CDC] (Updated September 29, 2017)
 - [Mosquitoes and the Diseases They Transmit](#). [Texas A&M AgriLife Extension] (Updated September 29, 2017)

Surveillance

- Establish or enhance surveillance (in people and mosquitoes).
- Conduct regular surveillance of and testing for mosquitoes. The use of GIS mapping of mosquito locations and abatement programs can show effectiveness and impact. (Updated May 9, 2016)
- Screen patients for travel history to an area with ongoing Zika transmission.

- Zika virus disease affected patients
- Birth defect surveillance
- Neurologic and autoimmune syndrome surveillance
- Border screening is not an effective method of controlling vector-borne diseases and is not recommended for Zika management.
- Resources:
 - [Surveillance and Control of *Aedes aegypti* and *Aedes albopictus* in the United States](#). [CDC] (Updated May 9, 2016)
 - [Surveillance and Services for Babies Affected by Zika](#). [CDC] (Updated April 8, 2016)
 - [US Zika Pregnancy Registry](#). [CDC] (Updated September 29, 2017)
 - [Zika Active Pregnancy Surveillance System \(ZAPSS\)](#) [CDC] (Updated June 6, 2016)

Blood/Organ/Tissue Donation

- Maintain awareness of guidance related to blood, organ, and tissue donation.
- Resources:
 - [FDA Informs Collection Establishments of CDC-Identified Potential Increased Zika Virus Risk to Blood and Tissue Safety in Florida’s Miami-Dade, Palm Beach, and Broward Counties](#). [FDA] (Updated March 20, 2017)
 - [Important Information for Human Cell, Tissue and Cellular and Tissue-based Product \(HCT/P\) Establishments Regarding Zika Virus](#). [FDA] (Updated March 20, 2017)
 - [Important Information for Blood Establishments Regarding Zika Virus](#). [FDA] (Updated March 20, 2017)
 - [Revised Recommendations for Reducing the Risk of Zika Virus Transmission by Blood and Blood Components](#). [FDA] (Updated September 2, 2016)
 - [Guidance for Organ Donation and Transplantation Professionals Regarding the Zika Virus](#). [UNOS] (Updated April 8, 2016)

Veterinary/Animal Care Preparedness

- Maintain awareness of research and guidance related to Zika virus in animals.
 - Animals do not appear to be involved in the spread of Zika virus.
 - While Zika virus was first discovered in a monkey with a mild fever in the Zika Forest of Uganda in the 1940s, the current prevalence of Zika virus in monkeys and other nonhuman primates is not known.
 - At this time there have been no reports of other animals becoming sick with Zika or of being able to spread Zika to people or other animals.
- Resources:
 - [Zika Virus and Animals](#). [CDC] (Updated July 26, 2017)

Large-Scale Events, Population Movement, and Travel

- Prepare for major national and international events in Zika-affected areas.
- Screen patients for travel history to an area with ongoing Zika transmission.

- Resources:
 - [Travelers Can Protect Themselves from Zika](#). [CDC] (Updated January 27, 2017)
 - [Guidance for Areas with Local Zika Virus Transmission in the Continental United States and Hawaii](#). [CDC] (Updated September 29, 2017)
 - [Zika Virus Country Classification Scheme](#). [WHO] (Updated March 20, 2017)

Administrative Preparedness

- Review emergency authorities and statutes for any relief necessary.
- Resources:
 - [Executive Orders and Emergency Declarations for the West Nile Virus: Applying Lessons from Past Outbreaks to Zika](#). [CDC] (Included March 9, 2016.)
 - [Human Resources Flexibilities and Authorities for Federal Employees Affected by the Zika Virus](#). [OPM] (Updated October 7, 2016)
 - [Emergency Legal Preparedness and Zika Virus: Primer](#). [The Network for Public Health Law] (Updated January 27, 2017)

Recovery

- Continue surveillance and mosquito abatement, as appropriate.
- Evaluate any long-term health impacts to the community.
- Use the [HHS Response and Recovery Resources Compendium](#) to search the repository of HHS products, services, and capabilities available to state, tribal, territorial, and local agencies before, during, and after public health and medical incidents.

Plans and State- and Locally-Developed Resources

Please note these plans are public health plans concentrating on vector management and risk communications but do not reflect many of the clinical issues nor involvement by coalition partners, both of which are encouraged to be included in plans.

If your jurisdiction or healthcare entity has a Zika Response Plan that you would like included in ASPR TRACIE, please send the plan to askasprtracie@hhs.gov for consideration.

National and International Plans

- [Zika: CDC Interim Response Plan](#) (Updated June 12, 2017)
- [WHO: Zika Strategic Response Plan and Quarterly Update](#) (Updated January 27, 2017)

State and Locally-Developed Plans and Resources (Updated July 7, 2016)

- Alabama
 - [A Guide for Public Health Environmentalists, Municipalities, and County Commissions](#). (Updated October 7, 2016)

- California
 - [Operational Checklist for Local Health Departments, Local Vector Control Agencies, and California Department of Public Health in the Event of Local Dengue, Chikungunya, or Zika Transmission.](#) (Updated January 27, 2017)
- Florida
 - [Sample Clinical Protocol for Suspected Zika Virus Infection.](#) (Updated August 5, 2016)
- Kentucky
 - [Louisville Zika Response Plan](#) (Updated July 7, 2016)
- Louisiana
 - [City of New Orleans Zika Virus Plan](#) (Updated July 7, 2016)
- Maryland
 - [Zika Public Service Announcements](#) (Updated October 7, 2016)
- Pennsylvania
 - [Zika Virus Response Plan](#) (Updated July 7, 2016)
- Texas
 - [Regional Response Teams: Zika Response.](#) (Updated July 7, 2016)
 - [Texas Integrated Vector Management Capacity.](#) (Updated July 7, 2016)
 - [Zika Communications Toolkit.](#) (Updated October 7, 2016)
 - [Zika in Texas Website.](#) (Updated September 29, 2017)
 - [Zika Virus Preparedness and Response Plan.](#) (Updated January 27, 2017)
- Virginia
 - [Zika Virus Disease Response Annex](#) (Updated July 7, 2016)

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Appendix A: ASPR Resources

PHE.Gov serves as the key one-stop website for all federal public health and medical information sources and assets. The site is searchable for multiple resources.
<http://www.phe.gov>

The Technical Resources, Assistance Center, and Information Exchange (TRACIE) is a healthcare emergency information gateway that provides timely access to resources and promising practices, identifies and remedies knowledge gaps, and connects users with responses to a range of requests for technical assistance. <https://asprtracie.hhs.gov/>

The HHS Response and Recovery Resources Compendium is an easy to navigate, comprehensive, web-based repository of HHS resources and capabilities available to federal, state, local, territorial and tribal stakeholders before, during, and after public health and medical incidents.
<http://www.phe.gov/emergency/hhscapabilities/Pages/default.aspx>

Appendix B: Full References with Annotations

Adams, L., Bello-Pagan, M., Lozier, M., et al. (2016) [Update: Ongoing Zika Virus Transmission – Puerto Rico](#). Morbidity and Mortality Weekly Report. (Included August 5, 2016)

This report provides an update on the continued transmission of Zika virus disease in Puerto Rico including a review of the epidemiology of the outbreak and the public health response.

American College of Obstetricians and Gynecologists. (2016). [Practice Advisory: Interim Guidance for Care of Obstetric Patients During a Zika Virus Outbreak](#).

This joint message from the American College of Obstetricians and Gynecologists and the Society for Maternal Fetal Medicine mirrors the Interim Guidance issued by the Centers for Disease Control and Prevention (CDC) for the management of pregnant women presenting with symptoms consistent with Zika virus disease infection. This publication includes an algorithm for assessment, diagnosis, and treatment of a pregnant woman.

American Medical Association. (2016). [Zika Virus Resource Center](#).

This webpage provides a compilation of resources related to Zika virus disease.

Bhatnagar, J., Rabeneck, D., Martines, R., et al. (2016). Zika Virus RNA Replication and Persistence in Brain and Placental Tissue. *Emerging Infectious Diseases*. 23(3). (Included January 27, 2017)

This study examined placental issues from 44 women and brain tissues from 8 deceased infants who had microcephaly. All samples were from patients suspected to be infected with Zika, and testing detected Zika virus in all infant tissues and nearly three-quarters of the placental tissues of women with adverse pregnancy or birth outcomes. Zika virus RNA was found in placentas and fetal brains more than seven months after pregnant women contracted Zika. Additionally, Zika RNA levels were 1,000 times higher in the brain than the placenta tissues.

Bingham, A., Cone, M., Mock, V., et al. (2016). [Comparison of Test Results for Zika Virus RNA in Urine, Serum, and Saliva Specimens from Persons with Travel-Associated Zika Virus Disease – Florida, 2016](#). Morbidity and Mortality Weekly Report. 65(18).

The Florida Department of Health Bureau of Public Health Laboratories conducted testing on samples from 913 persons who met the state criteria for testing. Results for urine and serum samples showed that approximately twice as many urine specimens

tested positive for Zika virus than serum specimens, suggesting that urine might be a more useful specimen for identifying acute Zika virus infection.

Bogoch, I., Brady, O., Kraemer, M., et al. (2016). [Anticipating the International Spread of Zika Virus from Brazil](#). *The Lancet*. 387:335-336.

Through evaluation of travel patterns from current countries with Zika virus disease spread and mosquito habitation patterns, the authors have predicted possible Zika virus disease spread throughout the Americas, including the U.S. The authors also included a predictive map.

Boulet, S., D'Angelo, D., et al. (2016) [Contraceptive Use Among Non-pregnant and Postpartum Women at Risk for Unintended Pregnancy, and Female High School Students, in the Context of Zika Preparedness](#). *Morbidity and Mortality Weekly Report*. (Included August 5, 2016)

This study is a review of surveys and studies that aims to provide State-based estimates of contraception use among nonpregnant and postpartum women at risk for unintended pregnancies and sexually active female high school students. This data can be used to target campaigns for effective use of contraception.

Braga, J., Bressan, C., Dalvi, A., et al. (2017). [Accuracy of Zika Virus Disease Case Definition During Simultaneous Dengue and Chikungunya Epidemics](#). *PLOS One*. 12(6):e0179725. (Included July 26, 2017)

The authors developed and tested the accuracy of a clinical case definition model to distinguish Zika virus infection when dengue and chikungunya viruses are co-circulating. They found that presence of rash with pruritus or conjunctival hyperemia was the best case definition and that the sensitivity and specificity of their case definition were better than existing case definitions.

Brasil, P., Pereira, J., Moreira, E., et al. (2016). [Zika Virus Infection in Pregnant Women in Rio de Janeiro](#). *The New England Journal of Medicine*. (Included January 27, 2017)

This follow-up study looked at 207 enrolled pregnant women expected to give birth by July 31, 2016. Among the 125 women who tested positive for Zika via PCR with confirmed pregnancy outcomes, 46.4 percent had adverse pregnancy outcomes compared to 11.5 percent in the non-Zika positive cohort. The adverse outcomes occurred in 55 percent of women infected during the first trimester, 52 percent in the second trimester, and 29 percent in the third trimester.

Brasil, Patricia, et al. (2016). [Zika Virus Infection in Pregnant Women in Rio de Janeiro – Preliminary Report](#). The New England Journal of Medicine.

Researchers in Rio de Janeiro enrolled 88 pregnant women in a prospective study, where they were tested for Zika virus and then followed throughout their pregnancies. Seventy-two of the 88 women enrolled tested positive for Zika virus infection. The authors concluded that “despite mild clinical symptoms, Zika virus infection during pregnancy appears to be associated with grave outcomes, including fetal death, placental insufficiency, fetal growth restriction, and CNS injury.”

Center for Infectious Disease Research and Policy. (2016.) [Zika Resource Page](#).

This webpage offers a compilation of resources on Zika virus disease including governmental publications, academic publications, research pieces, and popular media mentions. The compilation is updated regularly.

Centers for Disease Control and Prevention. (2016). [Executive Orders and Emergency Declarations for the West Nile Virus: Applying Lessons from Past Outbreaks to Zika](#).

This document provides an overview of Executive Orders and Emergency Declarations issued by states and territories in the past (specific to West Nile Virus), and how those authorities may be used to support prevention, response, and recovery actions for Zika virus.

Centers for Disease Control and Prevention. (2016). [Possible Zika Virus Infection Among Pregnant Women – United States and Territories, May 2016](#). Morbidity and Mortality Weekly Report. 65(20).

This article discusses the establishment of a comprehensive surveillance system to monitor pregnant women with Zika virus in the United States.

Centers for Disease Control and Prevention. (2016). [Top 10 Zika Response Planning Tips: Brief Information for State, Tribal, Local, and Territorial Health Officials](#).

This summary of key Zika virus resources is a ready reference and aid for response planning for state, local, and territorial public health officials.

Centers for Disease Control and Prevention. (2016). [Zika Virus](#).

This website provides the Centers for Disease Control and Prevention resources related to Zika Virus disease including current transmission and spread information, current

clinical recommendations, and prevention and mitigation information. This page is updated regularly.

Centers for Disease Control and Prevention. (2016). [Zika Virus Action Planning](#).

This website includes links to the video and presentations from the day-long workshop “Zika Virus Action Planning” held April 1, 2016.

Cragan, J., Mai, C., Petersen, E., et al. (2017). [Baseline Prevalence of Birth Defects Associated with Congenital Zika Virus Infection – Massachusetts, North Carolina, and Atlanta, Georgia, 2013-2014](#). *Morbidity and Mortality Weekly Report*. 66(8):219-222. (Included March 20, 2017)

The authors retrospectively applied the CDC case definition for birth defects potentially associated with Zika virus infection to data from birth defect surveillance programs in three jurisdictions for the 2013-2014 time period, before Zika was introduced in the Americas. This data was used as a baseline for comparison to data on infants and fetuses of women with laboratory evidence of possible Zika infection reported to the U.S. Zika Pregnancy Registry (USZPR) during the first 9 months of 2016. The comparison found that the prevalence of infants and fetuses with birth defects was 20 times higher and the prevalence of brain abnormality or microcephaly was 33 times higher for those in the USZPR than in the three surveillance programs pre-Zika.

Cuevas, E., Tong, V., Rozo, N., et al. (2016). [Preliminary Report of Microcephaly Potentially Associated with Zika Virus Infection During Pregnancy – Columbia, January-November 2016](#). *Morbidity and Mortality Weekly Report*. 65(49): 1409-1413. (Included January 27, 2017)

This preliminary report examined cases of congenital microcephaly in Colombia identified between January 31 and November 12, 2016. The study found a fourfold increase in microcephaly prevalence compared to the same study period in 2015. The peak number of cases occurred approximately 24 weeks after the peak of the country’s Zika virus disease outbreak, suggesting infection with Zika virus disease is most risky in the first trimester and early second trimester of pregnancy. The authors note several limitations to the study, including that a majority of cases did not have laboratory-confirmed Zika infection, the passive surveillance system used in Colombia is less complete than an active one, birth defects may be underreported among pregnancy losses and may not be detected until several months after birth, and prevalence ratios may be unstable when examining rare outcomes.

Da Silva, A., Ganz, J., Sousa, P., et al. (2016). [Early Growth and Neurologic Outcomes of Infants with Probable Congenital Zika Virus Syndrome](#). *Emerging Infectious Diseases*. 22(11). (Included October 7, 2016)

This article describes findings from a study of 48 infants up to eight months of age with probable congenital Zika virus syndrome. The study found that additional neurological symptoms emerged with age and that head circumference measurements fell further from the mean, suggesting that affected infants may continue to fall further behind non-affected children.

Eppes, C., Rac, M., Dunn, J., et al. (2017). [Testing for Zika Virus Infection in Pregnancy: Key Concepts to Deal with an Emerging Epidemic](#). *American Journal of Obstetrics and Gynecology*. 216(3):209-225. (Included June 12, 2017)

This expert review discusses screening and diagnostic considerations, epidemiological data on the risk of congenital Zika virus disease by trimester of exposure, and using alternative neurosonographic approaches to detect malformations other than microcephaly.

Ethics Working Group on ZIKV Research and Pregnancy. (2017). [Pregnant Women and the Zika Virus Vaccine Research Agenda: Ethics Guidance on Priorities, Inclusion, and Evidence Generation](#). (Included July 26, 2017)

This report details the consensus recommendation of an expert working group on the importance of: prioritizing and incentivizing the development of a Zika virus vaccine that can be used by pregnant women; the need for research on vaccine use in pregnancy for all Zika virus vaccines; and the importance of including pregnant women in research with possible direct benefits.

Goodman, A, Dziuban, E., Powell, K., et al. (2016). [Characteristics of Children Aged <18 Years with Zika Virus Disease Acquired Postnatally – U.S. States, January 2015-July 2016](#). *Morbidity and Mortality Weekly Report*. (Included October 7, 2016)

This MMWR early release examined 158 cases of confirmed or probable Zika virus disease in children under 18 reported to the CDC by 30 states. All cases were acquired postnatally and most had mild symptoms, with 2 hospitalizations and no deaths reported. Nearly half of the cases were aged 15-17, which the authors attributed to healthcare-seeking or testing bias (five cases were pregnant) or a greater likelihood of exposure through travel.

Graham, K., Fox, D., Talati, A., et al. (2017). [Prevalence and Clinical Attributes of Congenital Microcephaly – New York, 2013-2015](#). Morbidity and Mortality Weekly Report. 66(5):125-129. (Included March 20, 2017)

The authors used reports requested from birth hospitals and a statewide administrative discharge database to identify infants born with severe congenital microcephaly between 2013 and 2015, before Zika virus infections were identified in New York. This baseline prevalence estimate can be used to approximate the risk of severe congenital microcephaly attributable to Zika virus infection.

Honein, M., Dawson, A., Petersen, E., et al. (2016). [Birth Defects Among Fetuses and Infants of US Women with Evidence of Possible Zika Virus Infection During Pregnancy](#). Journal of the American Medical Association. 317(1):59-68. (Included January 27, 2017)

Using preliminary data from the U.S. Zika Pregnancy Registry, this study found that six percent of completed pregnancies following Zika virus infection resulted in potentially Zika-related birth defects. This included 11 percent of women infected with Zika during the first trimester having fetuses or infants with birth defects. The four percent of completed pregnancies with findings of microcephaly was substantially higher than the background prevalence of 0.07 percent.

Krauer, F., Riesen, M., Reveiz, L., et al. (2017). [Zika Virus Infection as a Cause of Congenital Brain Abnormalities and Guillain-Barré Syndrome: Systematic Review](#). PLOS Medicine. (Included January 27, 2017)

The authors describe the development of a causality framework for Zika virus and congenital brain abnormalities and Guillain-Barré Syndrome (GBS), a systematic review of literature on the topic through May 30, 2016, and the convening of a multidisciplinary expert panel to assess research findings of causality. The review found sufficient evidence to conclude that Zika virus causes congenital abnormalities and triggers GBS.

Krittanawong, C., Zhang, H., and Sun, T. (2016). [Cardiovascular Complications After Zika Virus Infection](#). International Journal of Cardiology. 221:859. (Included March 20, 2017)

This correspondence notes short- and long-term cardiovascular complications are associated with other flaviviruses, the virus family in which Zika is included. The authors encourage additional research to determine whether similar effects may be associated with Zika, particularly because complications may be underdiagnosed in those with mild or asymptomatic Zika virus infection.

Lee, B., Alfaro-Murillo, J., Parpia, A., et al. (2017). [The Potential Economic Burden of Zika in the Continental United States](#). PLOS Neglected Tropical Diseases. (Included June 12, 2017)

The authors modeled the potential economic burden in direct medical costs, Medicaid costs, productivity losses, and total costs to society at different attack rates in six states considered to be at greatest risk of Zika emergence. Costs ranged from \$183.4 million at an attack rate of 0.01% to \$1.2 billion at an attack rate of 1%.

Li, G., Poulsen, M., Fenyvuesvolgyi, C, et al. (2016). [Characterization of Cytopathic Factors Through Genome-wide Analysis of the Zika Viral Proteins in Fission Yeast](#). Proceedings of the National Academy of Sciences of the United States of America. 114(3): E376-E385. (Included January 27, 2017)

This study identifies seven Zika virus proteins that had cytopathic effects in a fission yeast cell system. These effects included inhibition of growth/proliferation, cell hypertrophy, cell cycle dysregulation, and cell death.

Lima, A., Lovin, D., Hickner, P., et al. (2015). [Evidence for an Overwintering Population of Aedes Aegypti in Capitol Hill Neighborhood, Washington, DC](#). The American Journal of Tropical Medicine and Hygiene. 94(1):231-5.

This article describes a research study demonstrating that *Aedes aegypti* mosquitoes were present in samples taken in Capitol Hill, Washington, DC throughout 2011-2014. These mosquitoes were not previously thought to travel further north than the average 10 degree Celsius isotherm.

Lucey, D. (2016). [Will Zika Virus and Microcephaly Epidemics Emerge After Ebola in West Africa? The Need for Prospective Studies Now](#). Health Security.

The author discusses the emerging cases of Zika virus in Cape Verde, West Africa and the need to begin surveillance and mosquito control to prevent more transmission. The author also discusses the timeline of the epidemic, beginning in October 2015 and predicting an increase in cases of microcephaly in May/June 2016, from mothers infected with Zika virus who have not been properly screened and evaluated.

Lucey, D. and Gostin, L. (2016). [The Emerging Zika Pandemic: Enhancing Preparedness](#). Journal of the American Medical Association. 315(9):865-866.

The authors discuss the current outbreak of Zika virus disease and why it is a concern for the U.S. public health and healthcare systems. They also describe steps that should be taken now to prevent and mitigate spread and steps that should be taken to prepare. The article also includes an outline for a Zika virus disease research agenda.

Marston, H., Lurie, N., Borio, L., and Fauci, A. (2016). [Considerations for Developing a Zika Virus Vaccine](#). The New England Journal of Medicine. 375:1209-1212. (Included October 7, 2016)

This article presents the perspective of federal officials on three potential strategies for investigators to consider when conducting clinical trials on Zika vaccine candidates. The strategies are following the traditional 3 phase vaccine development approach, conducting human challenge studies after phase 2 studies, and relying on the FDA's Animal Rule. The officials advise selecting a pathway based on disease incidence and its effect on the generation of reliable safety and efficacy data as well as active engagement with affected communities in trial design and execution.

Mlakar, J., Korva, M., Tul, N., et al. (2016). [Zika Virus Associated with Microcephaly](#). New England Journal of Medicine. 374(10): 951-958.

This article discusses a case report of an expectant mother infected with Zika during the end of her first trimester while in Brazil. Serial ultrasounds at 14 and 20 weeks showed normal fetal growth and anatomy. An ultrasound performed at 29 weeks confirmed intrauterine growth retardation and fetal anomalies. Medical termination of the pregnancy occurred at 32 weeks of gestation. Fetal autopsy findings detail the severe brain injury and placental damage associated with the infection. Genome sequence identity was also performed.

Moore, C., Staples, J., Dobyms, W., et al. (2016). [Characterizing the Pattern of Anomalies in Congenital Zika Syndrome for Pediatric Clinicians](#). JAMA Pediatrics. (Included November 14, 2016)

This review of public reports of birth defects associated with intrauterine Zika virus infection through September 2016 identified five features that are unique to congenital Zika virus infection or rarely seen in other congenital infections. The features are severe microcephaly with partially-collapsed skull, thin cerebral cortices with subcortical calcifications, macular scarring and focal pigmentary retinal mottling, congenital contractures, and marked early hypertonia and symptoms of extrapyramidal involvement.

National Library of Medicine. (2016). [Zika Virus Health Information Resources](#).

This resource is a comprehensive collection of Zika virus disease-related resources from the U.S. and abroad. It is compiled and updated regularly from the National Library of Medicine.

Pan American Health Organization. (2016). [Epidemiological Update: Neurological Syndrome, Congenital Anomalies, and Zika Virus Infection.](#)

This document is the latest in a series of epidemiological updates provided by the Pan American Health Organization. It highlights the specific issues related to the correlation between Zika virus disease outbreaks and the increase in neurological syndromes, including Guillain-Barre syndrome and congenital anomalies, specifically microcephaly. The document details recommendations for management, increased surveillance and other public health recommendations.

Pan American Health Organization. (2016). [Zika Virus Infection.](#)

This website provides an outline of the disease and its progression specifically in the Americas. It provides information for the general public and health professionals on disease spread, identification, treatment and prevention.

Rasmussen, S., Jamieson, D., Honein, M., and Petersen, L. (2016). [Zika Virus and Birth Defects – Reviewing the Evidence for Causality.](#) The New England Journal of Medicine. 374:1981-1987.

The authors evaluated available data to determine causality of Zika infection and birth defects, most notably microcephaly. This evidence included Zika virus infection during specific times in pregnancy, a specific rare phenotype involving microcephaly, and data that support biologic plausibility. The researchers concluded that the evidence supports a causal relationship between Zika virus infection and birth defects.

Reagan-Steiner, S., Simeone, R., Simon, E., et al. (2017). [Evaluation of Placental and Fetal Tissue Specimens for Zika Virus Infection – 50 States and District of Columbia, January-December, 2016.](#) Morbidity and Mortality Weekly Report. 66(24):636-643. (Included July 26, 2017)

The authors describe that placental tissue RT-PCR testing confirmed maternal Zika virus infection for 10% of live births to mothers with possible exposure who tested positive for an unspecified flavivirus infection or tested negative for Zika infection when serum collection occurred more than 12 weeks after exposure. The study demonstrates the value of placental testing when maternal testing is not definitive or testing is not performed during the recommended time.

Reefhuis, J. Gilboa, S., Johansson, M., et al. (2016). [Projecting Month of Birth for At-Risk Infants after Zika Virus Disease Outbreaks.](#) Emerging Infectious Diseases. 22(5).

This article looked at Zika virus occurrence and surges of microcephaly births to determine if projections could be made. Researchers developed a [modifiable spreadsheet tool](#) that public health officials can use to plan for delivery of infants from mothers infected with Zika virus.

Reynolds, M., Jones, A., Petersen, E., et al. (2017). [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](#). Morbidity and Mortality Weekly Report. 66(13):366-373. (Included June 12, 2017)

The authors analyzed completed pregnancies with laboratory evidence of possible Zika virus infection reported to the US Zika Pregnancy Registry from January 15-December 27, 2016. Zika virus-associated birth defects were reported in 5% of fetuses/infants from completed pregnancies with laboratory evidence of possible recent Zika virus infection and 15% with confirmed Zika virus infection in the first trimester. Only 28% of infants born after CDC updated guidance recommending routine postnatal neuroimaging and testing for infants born to women with laboratory evidence of Zika virus infection during pregnancy received postnatal neuroimaging.

Rosa, R., Abbo, L., Kapur, G., et al. (2016). [Development and Implementation of a Zika Virus Disease Response Protocol at a Large Academic Medical Center](#). Disaster Medicine and Public Health Preparedness. (Included August 5, 2016)

The authors describe the process used to develop a Zika response protocol at a large academic medical center.

Ruckert, C., Weger-Lucarelli, J., Garcia-Luna, S., et al. (2017). [Impact of Simultaneous Exposure to Arboviruses on Infection and Transmission by Aedes Aegypti Mosquitoes](#). Nature Communications. (Included June 12, 2017)

The authors exposed *Aedes aegypti* mosquitoes to Zika, dengue, and chikungunya viruses individually and as double and triple co-infections. They found that the mosquitoes could be infected with and transmit all combinations of the viruses simultaneously and that infection, dissemination, and transmission rates were only mildly affected by coinfection.

Shapiro-Mendoza, C., Rice, M., Galang, R., et al. (2017). [Pregnancy Outcomes After Maternal Zika Virus Infection During Pregnancy – U.S. Territories, January 1, 2016-April 25, 2017](#). Morbidity and Mortality Weekly Report. 66(23):615-621. (Included July 26, 2017)

This study of 2,549 completed pregnancies reported by U.S. territories confirmed findings from other recent studies that Zika virus infection during any trimester of

pregnancy may result in Zika-related birth defects. The authors emphasize the importance of follow-up of women with laboratory evidence of Zika infection and adherence to newborn testing recommendations to facilitate timely and appropriate clinical interventions and follow-up for Zika-affected infants.

Tang, H., Hammack, C., Ogden, S., et al. (2016). [Zika Virus Infects Human Cortical Neural Progenitors and Attenuates Their Growth](#). *Cell Stem Cell*. 18(5):1–4.

Researchers working with Zika virus and human neural cells demonstrated that Zika virus does infect the neural cells and affects their ability to replicate and survive.

The Network for Public Health Law. (2016). [Primer: Emergency Legal Preparedness Concerning Zika Virus](#).

This primer, presented in a PowerPoint format, outlines public health concerns from Zika Virus disease and discusses potential legal issues in the U.S. and abroad.

Vasquez, Amber, et al. (2016.) [Survey of Blood Collection Centers and Implementation of Guidance for Prevention of Transfusion-Transmitted Zika Virus Infection – Puerto Rico, 2016](#). *Morbidity and Mortality Weekly Report*. 65(14):375–378.

The authors have gathered information on blood collection operations in Puerto Rico to assess the impact the Zika-related restriction on blood collection is having and what would be needed to replace the affected products.

Vestin, Natalie. (2016). [Zika Outbreak Expands in West Africa, Americas](#). Center for Infectious Disease Research and Policy.

This article highlights the Zika virus outbreak in Cape Verde, and includes information on the outbreak in Panama and Honduras.

World Health Organization. (2016). [Zika App. Android. iOS](#).

Healthcare providers and others can download this app to access the latest World Health Organization information Zika virus disease.

World Health Organization. (2016). [Zika Virus and Complications: Questions and Answers](#).

This webpage provides responses to commonly asked questions about Zika virus and mosquito protection and surveillance, sexual transmission, travel, neurological syndromes, pregnancy, and government response.

World Health Organization. (2016). [WHO Announces a Public Health Emergency of International Concern.](#)

This page includes the official statement from the World Health Organization Director-General declaring Zika virus disease a Public Health Emergency of International Concern. The declaration was made on February 1, 2016 after a meeting of the International Health Regulations (2005) Emergency Committee.

World Health Organization. (2016). [Zika Virus.](#)

This World Health Organization website provides an outline of Zika and an overview of its progression around the world. Links to information on signs and symptoms, transmission, diagnosis, treatment, and prevention along with Situation Reports are included on the page.