CDC's Response to **Zika**

IMPLEMENTING CDC GUIDANCE FOR INFANT NEUROIMAGING AND INFANT AND PLACENTAL ZIKA VIRUS TESTING

Based on maternal Zika virus exposure and laboratory test results

Notes: (1) This tool summarizes general CDC guidance for the following scenarios. The tool only addresses live births. Please consult CDC* or your state or local health department for case-specific questions. Health departments should adapt CDC guidance depending on local capacity and circumstances.

(2) In all cases, infants with anomalies consistent with congenital Zika syndrome should also be evaluated for other etiologies of congenital anomalies.

(3) Infant serum and urine should be tested for Zika virus by Zika NAT, and infant serum for Zika virus IgM antibodies. If CSF is obtained, it can also be tested. Please refer to the published guidance for more information.

(4) Placental testing includes testing of formalin-fixed or formalin-fixed, paraffin-embedded placenta, umbilical cord, and fetal membranes by ZIKV RT-PCR. Microscopic evaluation of fixed tissues is conducted in selected cases. Please note that a positive RT-PCR result from placental testing cannot distinguish between maternal and fetal infection; therefore, a positive RT-PCR result from the placenta can confirm maternal Zika infection but cannot be used to confirm congenital Zika infection in the infant. Negative NAT results on placental tissue do not exclude maternal ZIKV since the duration of ZIKV persistence in the placenta is unknown and the samples evaluated may not reflect the placenta in its entirety. Please refer to the website for further guidance.

Timing of Zika virus exposure† relative to timing of maternal specimen collection		EXPOSURE† WITHIN ANY TIME PERIOD		ALL EXPOSURE† WITHIN 12 WEEKS OF SPECIMEN COLLECTION (I.E., EXPOSURE† IS COMPLETELY WITHIN TESTING WINDOW§)		
Test results and interpretation from maternal specimens (e.g.serum, urine, and whole blood) >>		**Recent ZIKV infection** NAT positive OR non-negative Zika IgM¶ **AND** Zika PRNT** ≥ 10, and dengue PRNT** < 10	**Recent flavivirus infection, specific virus cannot be identified**** non-negative Zika IgM¶ **AND** Zika PRNT** ≥ 10, and dengue PRNT** ≥ 10	**No evidence of ZIKV infection** Zika IgM negative OR non-negative Zika IgM¶ **AND** Zika PRNT** < 10	**Presumptive recent** ZIKV or flavivirus infection** non-negative Zika IgM¶ **AND** PRNT** pending	**Not tested**
Additional maternal testing on serum, urine, and whole blood >>		← **Additional maternal testing not indicated** →			**Additional Maternal Testing:** Follow up PRNT results, if indicated according to lab guidance. If maternal IgM is inconclusive, repeat IgM testing in accordance with EUA.	**Maternal Testing:** Recommended; specimens should be collected as soon as possible.
Infant outcome	**Anomalies consistent with congenital Zika syndrome††**	**Neuroimaging:** Head ultrasound recommended; should be performed before hospital discharge. If technically difficult, consider MRI or CT.	**Neuroimaging:** Head ultrasound recommended; should be performed before hospital discharge. If technically difficult, consider MRI or CT.	**Neuroimaging:** Head ultrasound recommended; should be performed before hospital discharge. If technically difficult, consider MRI or CT.	**Neuroimaging:** Head ultrasound recommended; should be performed before hospital discharge. If technically difficult, consider MRI or CT.	**Neuroimaging:** Head ultrasound recommended; should be performed before hospital discharge. If technically difficult, consider MRI or CT.
		Infant Testing: Recommended; specimens should be collected within 2 days of birth. Consider testing CSF if serum and urine results are negative.	**Infant Testing:** Recommended; specimens should be collected within 2 days of birth. Consider testing CSF if serum and urine results are negative.	**Infant Testing:** Recommended; specimens should be collected within 2 days of birth. Consider testing CSF if serum and urine results are negative.	**Infant Testing:** Recommended; specimens should be collected within 2 days of birth. Do not wait for maternal test results. Consider testing CSF if serum and urine results are negative.	**Infant Testing:** Recommended; specimens should be collected within 2 days of birth. Consider testing CSF if serum and urine results are negative.
		Placental Testing: Not indicated; no added diagnostic value given known maternal ZIKV diagnosis.§§	**Placental Testing:** Should be considered to aid in maternal diagnosis.	**Placental Testing:** Fix and store placenta until infant results are available. Depending on infant test results, placental testing can be considered to aid in maternal diagnosis.¶¶	**Placental Testing:** Fix and store placenta until maternal PRNT results are available. Based on maternal PRNT result interpretation, refer to appropriate column.	**Placental Testing:** Fix and store placenta until maternal results are available. Based on maternal test result interpretation, refer to appropriate column.
	Phenotypically normal	**Neuroimaging:** Head ultrasound recommended; should be performed before hospital discharge.	**Neuroimaging:** Head ultrasound recommended; should be performed before hospital discharge.	**Neuroimaging:** Not indicated.	**Neuroimaging:** Head ultrasound recommended; should be performed before hospital discharge. Can be deferred until next outpatient visit if infant appears well and no concerns for loss to follow up.	**Neuroimaging:** Head ultrasound recommended; should be performed before hospital discharge. Can be deferred until next outpatient visit if infant appears well and no concerns for loss to follow up.
		Infant Testing: Recommended; specimens should be collected within 2 days of birth.	**Infant Testing:** Recommended; specimens should be collected within 2 days of birth.	**Infant Testing:** Not indicated.	**Infant Testing:** Specimens should be collected within 2 days of birth and stored. Decision to test the infant can be deferred until maternal test results are available. Based on maternal PRNT result interpretation, refer to appropriate column.	**Infant Testing:** Specimens should be collected within 2 days of birth and stored. Decision to test the infant can be deferred until maternal test results are available.
		Placental Testing: Not indicated; no added diagnostic value given known maternal ZIKV diagnosis.§§	**Placental Testing:** Should be considered to aid maternal diagnosis.	**Placental Testing:** Not indicated.	**Placental Testing:** Fix and store placenta until maternal PRNT results are available. Based on maternal PRNT result interpretation, refer to appropriate column.	**Placental Testing:** Fix and store placenta until maternal results are available. Based on maternal test result interpretation, refer to appropriate column.

Abbreviations: CT= Computed Tomography; EUA = Emergency Use Authorization; IgM = Immunoglobulin M; MRI= Magnetic Resonance Imaging; NAT = Nucleic Acid Test (includes rRT-PCR); PRNT = Plaque Reduction Neutralization Test; rRT-PCR = Real-time Reverse Transcription-Polymerase Chain Reaction; RT-PCR = Reverse Transcription-Polymerase Chain Reaction; ZIKV = Zika virus.

* Please contact CDC Zika Pregnancy Hotline at 770-488-7100 or zikamch@cdc.gov.

† Possible Zika virus exposure is defined as travel to or residence in an area with risk of Zika or sex without a condom with someone who traveled to or lived in an area with risk of Zika.

§ Start and end date of exposure are both are within the 12-week testing window.

¶ Non-negative serology terminology varies by assay and examples include positive, equivocal, presumptive positive, or possible positive results. For explanation of a specific interpretation and informaton on each assay, refer to https://www.fda.gov/MedicalDevices/Safety/EmergencySituations/ucm161496.htm#zika, under the "Labeling" bullet for the specific assay. Inconclusive maternal IgM specimens should be retested in accordance with EUA. If the inconclusive maternal IgM cannot be reconciled, refer to the relevant exposure category "Not tested" column, and base decision to test placenta on maternal and/or infant test results.

** Currently, PRNT confirmation is not routinely recommended for individuals living in Puerto Rico. In Puerto Rico, for "presumptive recent ZIKV" guidance, refer to the column for "recent ZIKV infection;" and for "presumptive recent flavivirus infection" guidance, refer to the column for "Recent flavivirus, specific virus cannot be identified."

†† Including but not limited to: microcephaly; structural brain anomalies (e.g., decreased brain volume, calcifications); posterior eye anomalies (e.g., chorioretinal scarring, optic nerve hypoplasia); contracture of one or more joints; and functional neurologic abnormalities (e.g., spasticity/hypertonia, dystonia/dyskinesia). For complete list of anomalies please check the CDC Zika virus pregnancy outcomes website.

§§ In exceptional circumstances, placental testing may be considered in consultation with CDC at 770-488-7100 or zikamch@cdc.gov.

¶¶ If infant testing is done it should be performed before placental testing, if possible. If (1) infant NAT (rRT-PCR) is positive for Zika, or (2) infant IgM is Zika positive or equivocal AND infant or maternal PRNT is positive for Zika but negative for dengue, then there is limited utility of placental testing. If other infant test results are obtained, placental testing may provide another opportunity to identify maternal infection that would otherwise go unrecognized.

Implementing CDC Guidance for Infant Neuroimaging and Infant and Placental Zika Virus Testing Based on Maternal Zika Virus Exposure and Laboratory Test Results

Notes: (1) This tool summarizes general CDC guidance for the following scenarios. The tool only addresses live births. Please consult CDC* or your state or local health department for case-specific questions. Health departments should adapt CDC guidance depending on local capacity and circumstances.

(2) In all cases, infants with anomalies consistent with congenital Zika syndrome should also be evaluated for other etiologies of congenital anomalies.

(3) Infant serum and urine should be tested for Zika virus by Zika NAT, and infant serum for Zika virus IgM antibodies. If CSF is obtained, it can also be tested. Please refer to the published guidance for more information.

(4) Placental testing includes testing of formalin-fixed or formalin-fixed, paraffin-embedded placenta, umbilical cord, and fetal membranes by ZIKV RT-PCR. Microscopic evaluation of fixed tissues is conducted in selected cases. Please note that a positive RT-PCR result from placental testing cannot distinguish between maternal and fetal infection; therefore, a positive RT-PCR result from the placenta can confirm maternal Zika infection but cannot be used to confirm congenital Zika infection in the infant. Negative NAT results on placental tissue do not exclude maternal ZIKV since the duration of ZIKV persistence in the placenta is unknown and the samples evaluated may not reflect the placenta in its entirety. Please refer to the website for further guidance.

Timing of Zika virus exposure† relative to timing of maternal specimen collection		**ALL OR PART OF THE EXPOSURE† OCCURRED MORE THAN 12 WEEKS PRIOR TO SPECIMEN COLLECTION (I.E., EXPOSURE† IS COMPLETELY OR PARTIALLY OUTSIDE TESTING WINDOW***)**		
Test results and interpretation from maternal specimens (e.g.serum, urine, and whole blood) >>		**No evidence of recent ZIKV infection** NAT negative **AND** Zika IgM negative†††	**Presumptive recent ZIKV or flavivirus infection** non-negative Zika IgM¶ **AND** PRNT** pending	**Not tested**
Additional maternal testing on serum, urine, and whole blood >>		**Additional Maternal Testing:** Not indicated.	**Additional Maternal Testing:** Follow up PRNT results, if indicated according to lab guidance. If maternal IgM is inconclusive, repeat IgM testing in accordance with EUA.	**Maternal Testing:** Might be considered.***
Infant outcome	**Anomalies consistent with congenital Zika syndrome††**	**Neuroimaging:** Head ultrasound recommended; should be performed before hospital discharge. If technically difficult, consider MRI or CT.	**Neuroimaging:** Head ultasound recommended; should be performed before hospital discharge. If technically difficult, consider MRI or CT.	**Neuroimaging:** Head ultasound recommended; should be performed before hospital discharge. If technically difficult, consider MRI or CT.
		Infant Testing: Recommended; specimens should be collected within 2 days of birth. Consider testing CSF if serum and urine results are negative.	**Infant Testing:** Recommended; specimens should be collected within 2 days of birth. Consider testing CSF if serum and urine results are negative.	**Infant Testing:** Recommended; specimens should be collected within 2 days of birth. Consider testing CSF if serum and urine results are negative.
		Placental Testing: Fix and store placenta until infant results are available. Depending on infant test results, placental testing can be considered to aid maternal diagnosis.¶¶	**Placental Testing:** Can be considered to aid maternal diagnosis. Can consider fixing and storing placenta until maternal PRNT results are available. Based on maternal PRNT result interpretation, refer to appropriate column.	**Placental Testing:** Fix and store placenta until infant results are available. Depending on infant test results, placental testing can be considered to aid maternal diagnosis.¶¶
	Phenotypically normal	**Neuroimaging:** Head ultrasound recommended; should be performed before hospital discharge.	**Neuroimaging:** Head ultrasound recommended, should be performed before hospital discharge. Can be deferred until next outpatient visit if infant appears well and no concerns for loss to follow up.	**Neuroimaging:** Head ultrasound recommended; should be performed before hospital discharge. Can be deferred until next outpatient visit if infant appears well and no concerns for loss to follow up.
		Infant Testing: Should be considered§§§; specimens should be collected within 2 days of birth.	**Infant Testing:** Specimens should be collected within 2 days of birth and stored. Decision to test the infant can be deferred until maternal test results are available. Based on maternal PRNT result interpretation, refer to appropriate column.	**Infant Testing:** Should be considered§§§; specimens should be collected within 2 days of birth.
		Placental Testing: If infant testing is performed, fix and store placenta until infant results are available. Depending on infant test results, placental testing can be considered to aid maternal diagnosis.¶¶ Consult CDC if infant testing is not performed.*	**Placental Testing:** Can be considered to aid maternal diagnosis. Can consider fixing and storing placenta until maternal PRNT results are available. Based on maternal PRNT result interpretation, refer to appropriate column.	**Placental Testing:** If infant testing is performed, fix and store placenta until infant results are available. Depending on infant test results, placental testing can be considered to aid maternal diagnosis.¶¶ Consult CDC if infant testing is not performed.*

Abbreviations: CT= Computed Tomography; EUA = Emergency Use Authorization; IgM = Immunoglobulin M; MRI= Magnetic Resonance Imaging; NAT = Nucleic Acid Test (includes rRT-PCR); PRNT = Plaque Reduction Neutralization Test; rRT-PCR = Real-time Reverse Transcription-Polymerase Chain Reaction; RT-PCR = Reverse Transcription-Polymerase Chain Reaction; ZIKV = Zika virus.

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† Possible Zika virus exposure is defined as travel to or residence in an area with risk of Zika or sex without a condom with someone who traveled to or lived in an area with risk of Zika.

*** If maternal testing is performed >12 weeks after exposure and/or symptom onset, a negative Zika IgM or NAT result does not rule out recent maternal ZIKV infection because IgM antibody and viral ribonucleic acid levels decline over time.

††† If PRNT testing also performed and is negative, please refer to 'No evidence of ZIKV infection' column in the 'All exposure within 12 weeks of specimen collection' section of this table.

¶ Non-negative serology terminology varies by assay and examples include positive, equivocal, presumptive positive, or possible positive results. For explanation of a specific interpretation and informaton on each assay, refer to https://www.fda.gov/MedicalDevices/Safety/EmergencySituations/ucm161496.htm#zika, under the "Labeling" bullet for the specific assay. Inconclusive maternal IgM specimens should be retested in accordance with EUA. If the inconclusive maternal IgM cannot be reconciled, refer to the relevant exposure category "Not tested" column, and base decision to test placenta on maternal and/or infant test results.

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¶¶ If infant testing is done it should be performed before placental testing, if possible. If (1) infant NAT (rRT-PCR) is positive for Zika, or (2) infant IgM is Zika positive or equivocal AND infant or maternal PRNT is positive for Zika but negative for dengue, then there is limited utility of placental testing. If other infant test results are obtained, placental testing may provide another opportunity to identify maternal infection that would otherwise go unrecognized.

§§§ Infant testing should be considered because recent maternal ZIKV infection is not ruled out by negative maternal NAT or IgM, or when maternal testing has not been performed. Specimens should be collected soon after birth, as Zika RNA and IgM antibodies decline over time.

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