Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Weekly / Vol. 66 / No. 41
October 20, 2017

Update: Interim Guidance for the Diagnosis, Evaluation, and Management of Infants with Possible Congenital Zika Virus Infection — United States, October 2017

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CDC has updated its interim guidance for U.S. health care providers caring for infants with possible congenital Zika virus infection (*1*) in response to recently published updated guidance for health care providers caring for pregnant women with possible Zika virus exposure (*2*), unknown sensitivity and specificity of currently available diagnostic tests for congenital Zika virus infection, and recognition of additional clinical findings associated with congenital Zika virus infection. All infants born to mothers with possible Zika virus exposure* during pregnancy should receive a standard evaluation at birth and at each subsequent well-child visit including a comprehensive physical examination, age-appropriate vision screening and developmental monitoring and screening using validated tools (*3*–*5*), and newborn hearing screen at birth, preferably using auditory brainstem response (ABR) methodology (*6*). Specific guidance for laboratory testing and clinical evaluation are provided for three clinical scenarios in the setting of possible maternal Zika virus exposure: 1) infants with clinical findings consistent with congenital Zika syndrome regardless of maternal testing results, 2) infants without clinical findings consistent with congenital Zika syndrome who were born to mothers with laboratory evidence of possible Zika virus infection,† and 3) infants without clinical findings consistent with congenital Zika syndrome who were born to mothers without laboratory evidence of possible Zika virus infection. Infants in the first two scenarios should receive further testing and evaluation for Zika virus, whereas for the third group, further testing and clinical evaluation for Zika virus are not recommended. Health care providers should remain alert for abnormal findings (e.g., postnatal-onset microcephaly and eye abnormalities without microcephaly) in infants with possible congenital Zika virus exposure without apparent abnormalities at birth.

* Possible Zika virus exposure includes travel to, or residence in an area with mosquitoborne Zika virus transmission or sex without the use of condoms with a partner who has traveled to or resides in an area with mosquitoborne Zika virus transmission.

† Laboratory evidence of possible Zika virus infection during pregnancy is defined as 1) Zika virus infection detected by a Zika virus RNA nucleic acid test (NAT) on any maternal, placental, or fetal specimen (referred to as NAT-confirmed), or 2) diagnosis of Zika virus infection, timing of infection cannot be determined or unspecified flavivirus infection, timing of infection cannot be determined by serologic tests on a maternal specimen (i.e., positive/equivocal Zika virus immunoglobulin M [IgM] and Zika virus plaque reduction neutralization test [PRNT] titer ≥10, regardless of dengue virus PRNT value; or negative Zika virus IgM, and positive or equivocal dengue virus IgM, and Zika virus PRNT titer ≥10, regardless of dengue virus PRNT titer). The use of PRNT for confirmation of Zika virus infection, including in pregnant women, is not routinely recommended in Puerto Rico (https://www.cdc.gov/zika/laboratories/lab-guidance.html).

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Continuing Education examination available at https://www.cdc.gov/mmwr/cme/conted_info.html#weekly.

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Congenital Zika Virus Infection

Zika virus infection during pregnancy can cause serious fetal brain anomalies and microcephaly (*7*). Among infants with substantial loss of brain volume, severe microcephaly and partial collapse of the bones of the upper skull or cranium produce a distinctive physical appearance. Characteristic findings in the brain and spinal cord include thin cerebral cortices with enlarged ventricles and increased extra-axial fluid collections, intracranial calcifications particularly between the cortex and subcortex, abnormal gyral patterns, absent or hypoplastic corpus callosum, hypoplasia of the cerebellum or cerebellar vermis, and hypoplasia of the ventral cord (*8*–*10*). Reported anomalies of the anterior and posterior eye include microphthalmia, coloboma, intraocular calcifications, optic nerve hypoplasia and atrophy, and macular scarring with focal pigmentary retinal mottling (*11*–*13*). Some infants with suspected congenital Zika virus infection without structural eye lesions have cortical visual impairment, attributable to abnormalities in the visual system of the brain (*13*). Other reported neurologic sequelae include congenital limb contractures, dysphagia, sensorineural hearing loss, epilepsy, and abnormalities of tone or movement, including marked hypertonia and signs of extrapyramidal involvement (*14*,*15*). Currently, there is no evidence suggesting that delayed-onset hearing loss occurs following congenital Zika virus infection. Since publication of the previous interim guidance in August 2016 (*1*), additional clinical findings have been reported in the setting of laboratory evidence of Zika virus infection in the mother or infant, including eye findings in infants without microcephaly or other brain anomalies (*16*), postnatal-onset microcephaly in infants born with normal head circumferences (*17*), postnatal-onset hydrocephalus in infants born with microcephaly (*18*), abnormalities on sleep electroencephalogram (EEG) in some infants with microcephaly who did not have recognized seizures (*19*), and diaphragmatic paralysis in infants born with microcephaly and arthrogryposis (*20*–*22*).

Zika Virus Laboratory Testing

Laboratory testing for Zika virus has a number of limitations. Zika virus RNA is only transiently present in body fluids; thus, negative nucleic acid testing (NAT) does not rule out infection. Serologic testing is affected by timing of sample collection: a negative immunoglobulin M (IgM) serologic test result does not rule out infection because the serum specimen might have been collected before the development of IgM antibodies, or after these antibodies have waned. Conversely, IgM antibodies might be detectable for months after the initial infection; for pregnant women, this can make it difficult to determine if infection occurred before or during a current pregnancy. In addition, cross-reactivity of the Zika virus IgM antibody tests with other flaviviruses can result in a false-positive test result, especially in persons previously infected with or vaccinated against a related flavivirus, further complicating interpretation (*23*,*24*). Limitations of Zika virus IgM antibody assays that were

The *MMWR* series of publications is published by the Center for Surveillance, Epidemiology, and Laboratory Services, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30329-4027.

Suggested citation: [Author names; first three, then et al., if more than six.] [Report title]. MMWR Morb Mortal Wkly Rep 2017;66:[inclusive page numbers].

approved under an Emergency Use Authorization have been recognized; both false-positive and false-negative test results have occurred. CDC is updating the Emergency Use Authorization to improve assay performance and develop more standardized methods to improve precision (*25*). Recent epidemiologic data indicate a declining prevalence of Zika virus infection in the Americas; lower prevalence results in a lower pretest probability of infection and a higher probability of false-positive test results.

Updated Guidance for Testing of Pregnant Women with Possible Zika Virus Exposure

Given the decreasing prevalence of Zika virus infection cases in the Americas and emerging data regarding Zika virus laboratory testing, on July 24, 2017, CDC published updated guidance for testing of pregnant women with possible Zika virus exposure (*2*). Zika virus NAT testing should be offered as part of routine obstetric care to asymptomatic pregnant women with ongoing possible Zika virus exposure (residing in or frequently traveling to an area with risk for Zika virus transmission); serologic testing is no longer routinely recommended because of the limitations of IgM tests, specifically the potential persistence of IgM antibodies from an infection before conception and the potential for false-positive results. Zika virus testing is not routinely recommended for asymptomatic pregnant women who have possible recent, but not ongoing, Zika virus exposure; however, guidance might vary among jurisdictions (*2*). The updated guidance for maternal testing (*2*) is intended to reduce the possibility of false-positive results in the setting of the lower pretest probability; however, there is a possibility that the lack of routine testing might delay identification of some infants without clinical findings apparent at birth, but who may have complications from congenital Zika virus infection. Communication regarding possible maternal exposures between pediatric health care providers and obstetric care providers is critical, and strategies to enhance coordination of care and communication of health information are being developed. For families of infants with possible congenital Zika virus infection, health care providers should ensure that psychosocial support is in place and that families have access to care. The long-term prognosis for infants with congenital Zika virus infection is not yet known; health care providers should strive to address families' concerns, facilitate early identification of abnormal findings, and refer infants for neurodevelopmental follow-up and therapy when indicated.

Forum on the Diagnosis, Evaluation, and Management of Zika Virus Infection Among Infants

On August 30–31, 2017, CDC, in collaboration with the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists, convened the Forum on the Diagnosis, Evaluation, and Management of Zika Virus Infection among Infants, with the goal of obtaining individual expert opinion to inform development of updated guidance for diagnosing, evaluating, and managing infants with possible congenital Zika virus infection and to identify strategies to enhance communication and coordination of care of mothers and infants affected by Zika virus. Experts from various medical specialties, professional organizations, public health agencies, and federal agencies participated in the Forum (Box 1). Discussion focused on the diagnosis, evaluation, and management of three groups of infants born to mothers with possible Zika virus exposure during pregnancy: 1) infants with clinical findings consistent with congenital Zika syndrome, regardless of maternal testing results, 2) infants without clinical findings consistent with congenital Zika syndrome who were born to mothers with laboratory evidence of possible Zika virus infection, and 3) infants without clinical findings consistent with congenital Zika syndrome who were born to mothers without laboratory evidence of possible Zika virus infection (Figure).

This updated interim guidance is based on current, limited data about Zika virus infection, the interpretation of individual expert opinion collected during the Forum, and knowledge about other congenital infections, and reflects the information available as of September 2017. As more information becomes available, this guidance will be updated.

Diagnosis of Congenital Zika Virus Infection

The optimal assays, specimens, and timing of testing for congenital Zika virus infection are unknown. A few reports have described infants with clinical findings consistent with possible congenital Zika syndrome but with negative laboratory results (*20*,*26*). Recommended laboratory testing for congenital Zika virus infection includes evaluation for Zika virus RNA in infant serum and urine and Zika virus IgM antibodies in serum. In addition, if cerebrospinal fluid (CSF) is obtained for other purposes, NAT and IgM antibody testing should be performed on CSF because CSF was the only sample that tested positive in some infants with congenital Zika virus syndrome (*26*). Testing of cord blood is not recommended because it can yield false-positive and false-negative test results (*27*,*28*).

Because levels of Zika virus RNA and IgM antibodies decline over time, laboratory testing of infants should be performed as early as possible, preferably within the first few days after birth, although testing specimens within the first few weeks to months after birth might still be useful (*17*,*29*,*30*). Diagnosis of congenital Zika virus infection is confirmed by a positive Zika virus NAT result (Table). If Zika virus IgM antibodies are detected in the infant with a negative NAT, the infant is considered to have probable congenital Zika virus infection. If neither Zika virus RNA nor Zika IgM antibodies is

BOX 1. Areas of expertise and organizations represented at the Forum on the Diagnosis, Evaluation, and Management of Zika Virus Infection Among Infants — Atlanta, Georgia, August 30–31, 2017

Specialties represented
- Audiology
- Clinical genetics
- Developmental and behavioral pediatrics
- Infectious disease
- Maternal-fetal medicine
- Neonatology
- Neurology
- Obstetrics and gynecology
- Ophthalmology
- Pediatrics
- Pediatric rehabilitation and medicine
- Radiology

Professional organizations
- American Academy of Pediatrics (including representation from the Puerto Rico chapter)
- American College of Obstetricians and Gynecologists
- Association of Maternal and Child Health Programs
- Association of Public Health Laboratories
- Association of State and Territorial Health Officials
- Council of State and Territorial Epidemiologists
- Family Voices
- March of Dimes
- National Association of County and City Health Officials
- National Association of Pediatric Nurse Practitioners

Public health organizations
- California Department of Public Health
- County of San Diego Health and Human Services Agency
- Department of Health of Puerto Rico
- Florida Department of Health
- New York City Department of Health and Mental Hygiene
- Texas Department of State Health Services

Federal agencies
- Administration for Children and Families
- Centers for Disease Control and Prevention
- Centers for Medicare & Medicaid Services
- Maternal and Child Health Bureau, Health Resources and Services Administration
- National Institute of Child Health and Human Development, National Institutes of Health
- Office of the Assistant Secretary for Preparedness and Response

detected on the appropriate specimens (e.g., serum or urine) obtained within the first few days after birth, congenital Zika virus infection is unlikely. Distinguishing between congenital and postnatal infection is difficult in infants who live in areas where there is ongoing transmission of Zika virus and who are not tested soon after birth. If the timing of infection cannot be determined, infants should be evaluated as if they had congenital Zika virus infection.

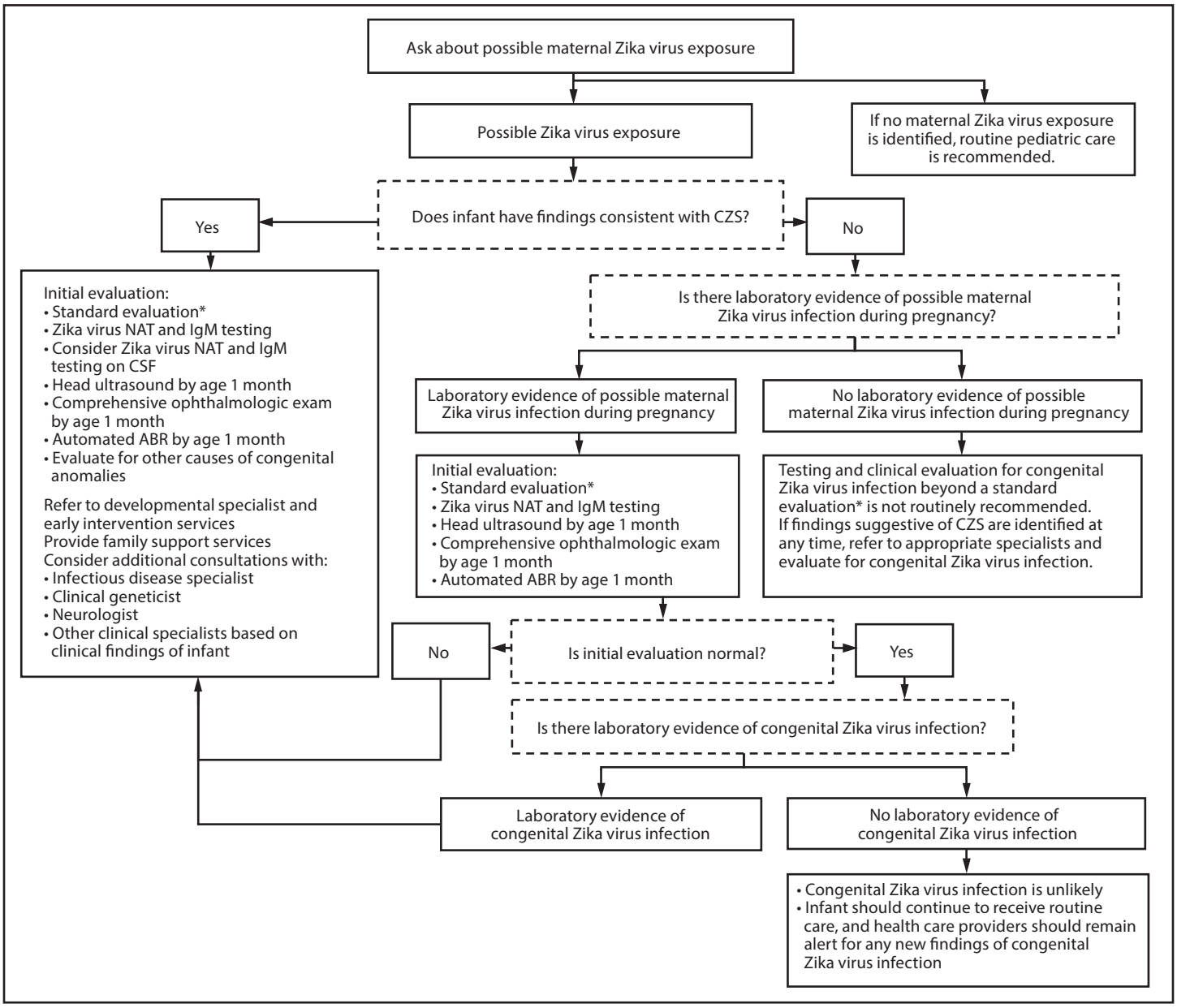
The plaque reduction neutralization test (PRNT), which measures virus-specific neutralizing antibodies, can be used to help identify false-positive results (*24*). In the United States and U.S. territories, if the infant's initial sample is IgM nonnegative (nonnegative serology terminology varies by assay and might include "positive," "equivocal," "presumptive positive," or "possible positive") and NAT negative, but PRNT was not performed on the mother's sample, PRNT for Zika and dengue viruses should be performed on the infant's initial sample if the test is appropriate given the setting. A negative Zika virus PRNT suggests that the infant's Zika virus IgM test was a false positive (*23*).

PRNT cannot distinguish between maternal and infant antibodies in specimens collected from infants at or near birth; however, based on what is known about other congenital infections, maternal antibodies are expected to become undetectable by age 18 months and might become undetectable earlier (*31*). For infants whose initial sample is IgM nonnegative and Zika virus neutralizing antibodies are detected on either the infant's specimen at birth or the mother's specimen, PRNT at age ≥18 months might help confirm or rule out congenital Zika virus infection. However, PRNT cannot be used to determine timing of infection. If PRNT is positive in an infant at age ≥18 months, congenital Zika virus infection is presumed; however, for infants living in or traveling to areas with risk of Zika virus transmission, postnatal infection cannot be excluded. If PRNT is negative at age ≥18 months, congenital Zika virus infection is unlikely. For infants with clinical findings consistent with congenital Zika syndrome who have maternal laboratory evidence of possible Zika virus infection during pregnancy, PRNT at age ≥18 months could be considered if the infant testing results are negative (i.e., negative Zika virus NAT and IgM on infant serum and urine) or if the infant was not tested at birth.

Updated Recommendations for Diagnosis, Clinical Evaluation, and Management of Infants with Clinical Findings Consistent with Congenital Zika Syndrome Born to Mothers with Possible Zika Virus Exposure in Pregnancy

Laboratory testing. Zika virus testing is recommended for infants with clinical findings consistent with congenital Zika syndrome and possible maternal Zika virus exposure during

FIGURE. Recommendations for the evaluation of infants with possible congenital Zika virus infection based on infant clinical findings,*,† maternal testing results,§,¶ and infant testing results,†† — United States, October 2017**



Abbreviations: ABR= auditory brainstem response; CSF = cerebrospinal fluid; CZS = congenital Zika syndrome; IgM = immunoglobulin M; NAT = nucleic acid test; PRNT = plaque reduction neutralization test.

* All infants should receive a standard evaluation at birth and at each subsequent well-child visit by their health care providers including 1) comprehensive physical examination, including growth parameters and 2) age-appropriate vision screening and developmental monitoring and screening using validated tools. Infants should receive a standard newborn hearing screen at birth, preferably using auditory brainstem response.

† Automated ABR by age 1 month if newborn hearing screen passed but performed with otoacoustic emission methodology.

§ Laboratory evidence of possible Zika virus infection during pregnancy is defined as 1) Zika virus infection detected by a Zika virus RNA NAT on any maternal, placental, or fetal specimen (referred to as NAT-confirmed), or 2) diagnosis of Zika virus infection, timing of infection cannot be determined or unspecified flavivirus infection, timing of infection cannot be determined by serologic tests on a maternal specimen (i.e., positive/equivocal Zika virus IgM and Zika virus PRNT titer ≥10, regardless of dengue virus PRNT value; or negative Zika virus IgM, and positive or equivocal dengue virus IgM, and Zika virus PRNT titer ≥10, regardless of dengue virus PRNT titer). The use of PRNT for confirmation of Zika virus infection, including in pregnant women, is not routinely recommended in Puerto Rico (https://www.cdc.gov/zika/laboratories/lab-guidance.html).

¶ This group includes women who were never tested during pregnancy as well as those whose test result was negative because of issues related to timing or sensitivity and specificity of the test. Because the latter issues are not easily discerned, all mothers with possible exposure to Zika virus during pregnancy who do not have laboratory evidence of possible Zika virus infection, including those who tested negative with currently available technology, should be considered in this group.

** Laboratory testing of infants for Zika virus should be performed as early as possible, preferably within the first few days after birth, and includes concurrent Zika virus NAT in infant serum and urine, and Zika virus IgM testing in serum. If CSF is obtained for other purposes, Zika virus NAT and Zika virus IgM testing should be performed on CSF.

†† Laboratory evidence of congenital Zika virus infection includes a positive Zika virus NAT or a nonnegative Zika virus IgM with confirmatory neutralizing antibody testing, if PRNT confirmation is performed.

TABLE. Interpretation of results of laboratory testing of infant's blood, urine, and/or cerebrospinal fluid for evidence of congenital Zika virus infection

Infant test result*		
NAT	**IgM**	**Interpretation**
Positive	Any result	Confirmed congenital Zika virus infection†
Negative	Nonnegative	Probable congenital Zika virus infection§,¶
Negative	Negative	Congenital Zika virus infection unlikely§,**

Abbreviations: IgM = immunoglobulin M; NAT = nucleic acid test.

* Infant serum, urine, or cerebrospinal fluid.

† Distinguishing between congenital and postnatal infection is difficult in infants who live in areas where there is ongoing transmission of Zika virus and who are not tested soon after birth. If the timing of infection cannot be determined, infants should be evaluated as if they had congenital Zika virus infection.

§ Laboratory results should be interpreted in the context of timing of infection during pregnancy, maternal serology results, clinical findings consistent with congenital Zika syndrome, and any confirmatory testing with plaque reduction neutralization testing.

¶ If Zika virus plaque reduction neutralization test is negative, this suggests that the infant's Zika virus IgM test is a false positive.

** Congenital Zika virus infection is unlikely if specimens are collected within the first few days after birth and the clinical evaluation is normal; however, health care providers should remain alert for any new findings of congenital Zika virus infection.

pregnancy, regardless of maternal testing results (Figure). Testing CSF for Zika virus RNA and Zika virus IgM antibodies should be considered, especially if serum and urine testing are negative and another etiology has not been identified.

Clinical Evaluation and Management. In addition to a standard evaluation (Box 2), infants with clinical findings consistent with congenital Zika syndrome should have a head ultrasound and a comprehensive ophthalmologic exam§ performed by age 1 month by an ophthalmologist experienced in assessment of and intervention in infants. Infants should be referred for automated ABR by age 1 month if the newborn hearing screen was passed using only otoacoustic emissions methodology (*6*). Because infants with clinical findings consistent with congenital Zika syndrome are at risk for developmental delay and disabilities, referrals to a developmental specialist and early intervention service programs are recommended, and family support services should be provided. In addition, the following consultations should be considered: 1) infectious disease for evaluation of other congenital infections and assistance with Zika virus diagnosis, testing, and counseling; 2) clinical genetics for confirmation of the clinical phenotype and evaluation for other causes of microcephaly or congenital anomalies; and 3) neurology by age 1 month for

§ Assessment of visual acuity (if able, responses to teller or grating tests), pupillary response, external examination, anterior segment examination, intraocular pressure measurement if indicated, and dilated fundus examination. After 3–4 months of age, also assess ocular motility, cycloplegia refraction and accommodation by dynamic retinoscopy. If physical abnormalities are present, recommend photo documentation if resources are available. (https://www.aao.org/preferred-practice-pattern/pediatric-eye-evaluations-ppp--september-2012#sectionII.comprehensiveophthamalicexamination).

BOX 2. Standard evaluation recommended at birth and during each well visit for all infants with possible congenital Zika virus exposure during pregnancy — United States, October 2017

- Comprehensive physical exam, including growth parameters
- Developmental monitoring and screening using validated screening tools recommended by the American Academy of Pediatrics (https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Screening/Pages/Screening-Tools.aspx)
- Vision screening as recommended by the American Academy of Pediatrics Policy Statement "Visual System Assessment in Infants, Children, and Young Adults by Pediatricians" (http://pediatrics.aappublications.org/content/137/1/e20153596)
- Newborn hearing screen at birth, preferably with automated auditory brainstem response

comprehensive neurologic examination and consideration for other evaluations, such as advanced neuroimaging and EEG. Consultations with other clinical specialists should be based on the infant's clinical findings (Box 3). Health care providers and families might consider fewer consultations for the evaluation of severely affected infants who are receiving palliative care.

The initial clinical evaluation, including subspecialty consultations, can be performed before hospital discharge or as an outpatient, taking into account hospital capabilities and needs of the family. Transfer to a facility with access to pediatric subspecialty care typically is not necessary unless there is an urgent clinical need. Health care providers should maintain vigilance for the appearance of other clinical findings associated with congenital Zika syndrome. Diaphragmatic paralysis should be considered in an infant who develops respiratory distress or failure or who fails to wean from a ventilator. Infant feedings should be monitored closely, and if there are signs of swallowing dysfunction, such as difficulty breathing with feeding, coughing or choking during feeding, or extended feeding times, an assessment for dysphagia should be performed (*32*,*33*). Signs of increasing intracranial pressure (e.g., increasing head circumference, irritability, or vomiting) should prompt neuroimaging to assess for postnatal hydrocephalus.

The follow-up care of infants with findings consistent with congenital Zika syndrome requires a multidisciplinary team and an established medical home to facilitate the coordination of care and ensure that abnormal findings are addressed (*34*). At each subsequent well-child visit, all infants should have a standard evaluation (Box 2) along with routine preventive pediatric care and immunizations (*35*), with decisions about further evaluation guided by clinical findings and made in consultation with the family. Follow-up visits with an ophthalmologist after the initial

BOX 3. Consultations for infants with clinical findings consistent with congenital Zika syndrome — United States, October 2017

Consider consultation with the following specialists:

- Infectious disease specialist for evaluation for other congenital infections (e.g., toxoplasmosis, syphilis, rubella, cytomegalovirus, or herpes simplex virus) and assistance with Zika virus diagnosis, testing, and counseling
- Neurologist by age 1 month for comprehensive neurologic examination and consideration for other evaluations such as advanced neuroimaging and EEG
- Ophthalmologist for comprehensive eye exam by age 1 month
- Clinical geneticist for confirmation of the clinical phenotype and evaluation for other causes of microcephaly or congenital anomalies
- Early intervention and developmental specialists
- Family and supportive services

Additional possible consultations, based on clinical findings of the infant:

- Endocrinologist for evaluation of hypothalamic or pituitary dysfunction and consideration for thyroid testing
- Lactation specialist, nutritionist, gastroenterologist, or speech or occupational therapist for evaluation for dysphagia and management of feeding issues
- Orthopedist, physiatrist, or physical therapist for the management of hypertonia, clubfoot or arthrogrypotic-like conditions
- Pulmonologist or otolaryngologist for concerns about aspiration

eye examination should be based on ophthalmology recommendations. As a change from the previous guidance (*1*), a diagnostic ABR is no longer recommended at age 4–6 months for infants who passed the initial hearing screen with automated ABR because of the absence of data suggesting delayed-onset hearing loss in infants with congenital Zika virus infection. Additional follow-up will depend on clinical findings in the infant.

Updated Recommendations for Diagnosis, Clinical Evaluation, and Management of Infants without Clinical Findings Consistent with Congenital Zika Syndrome Born to Mothers with Laboratory Evidence of Possible Zika Virus Infection During Pregnancy

Laboratory testing. Zika virus testing is recommended for infants without clinical findings consistent with congenital Zika syndrome born to mothers with laboratory evidence of possible Zika virus infection during pregnancy (Figure).

Clinical evaluation and management. In addition to a standard evaluation (Box 2), infants who do not have clinical findings consistent with congenital Zika syndrome born to mothers with laboratory evidence of possible Zika virus infection during pregnancy should have a head ultrasound and a comprehensive ophthalmologic exam performed by age 1 month to detect subclinical brain and eye findings. Further follow-up visits with an ophthalmologist after the initial examination should be based on ophthalmology recommendations. Infants should also be referred for automated ABR by age 1 month if newborn hearing screen was passed using only otoacoustic emissions methodology.

Health care providers should perform a standard evaluation along with routine preventive pediatric care and immunizations (*35*) at each subsequent well-child visit, and they should be vigilant for signs that might be associated with congenital Zika virus infection. If findings consistent with congenital Zika syndrome (e.g., impaired visual acuity/function, hearing problems, developmental delay, or delay in head growth) are identified at any time, referrals to the appropriate specialists should be made and further evaluation should follow recommendations for infants with clinical findings consistent with congenital Zika syndrome (Figure).

Infants with laboratory evidence of congenital Zika virus infection. Laboratory evidence of congenital Zika virus infection includes a positive Zika virus NAT or a nonnegative Zika virus IgM with confirmatory neutralizing antibody testing, if PRNT confirmation is performed. Further clinical evaluation for infants with laboratory evidence of congenital Zika virus infection should follow recommendations for infants with clinical findings even in the absence of clinically apparent abnormalities (Figure). As a change from the previous guidance (*1*), a diagnostic ABR at 4–6 months or behavioral audiology at age 9 months is no longer recommended if the initial hearing screen is passed by automated ABR, because of absence of data suggesting delayed-onset hearing loss in congenital Zika virus infection.

Infants without laboratory evidence of congenital Zika virus infection. If adequate laboratory testing is performed (e.g., concurrent testing on infant serum and urine within the first few days after birth), there is no laboratory evidence of congenital Zika virus infection (i.e., negative NAT and IgM on infant samples), and the clinical evaluation is normal, then congenital Zika virus infection is unlikely. Infants should continue to receive routine pediatric care, and health care providers should remain alert for any new findings of congenital Zika virus infection.

Updated Recommendations for Diagnosis, Clinical Evaluation, and Management of Infants without Clinical Findings Consistent with Congenital Zika Syndrome Born to Mothers with Possible Zika Virus Exposure in Pregnancy but without Laboratory Evidence of Possible Zika Virus Infection During Pregnancy

This heterogeneous group includes mothers who were never tested during pregnancy as well as those whose test result could have been negative because of issues related to timing or sensitivity and specificity of the test. Because the latter issues are not easily discerned, all mothers with possible exposure to Zika virus during pregnancy who do not have laboratory evidence of possible Zika virus infection, including those who tested negative with currently available technology, should be considered in this group.

Laboratory testing. Laboratory testing for congenital Zika virus infection is not routinely recommended for infants born to mothers in this category based on the unknown risk for infection; the lower likelihood of congenital Zika virus infection as a result of the declining prevalence of Zika virus infection; and limitations of infant laboratory testing. If abnormal findings are identified, these infants should receive further evaluation, including evaluation and testing for congenital Zika virus infection.

Clinical evaluation and management. Infants without clinical findings consistent with congenital Zika syndrome born to mothers without laboratory evidence of possible Zika virus infection during pregnancy should have a standard evaluation (Box 2) performed at birth and at each subsequent well-child visit along with routine preventive pediatric care and immunizations (*35*). Health care providers should be alert to the possibility of congenital infection, especially in infants born to mothers with ongoing possible Zika virus exposure during pregnancy.

Further clinical evaluation for congenital Zika virus infection beyond a standard evaluation and routine pediatric care is not routinely indicated. Health care providers can consider additional evaluation in consultation with families, taking into account the infant's complete physical examination with emphasis on neurologic findings; risks of screening (e.g., identification of incidental findings); and maternal factors, including the presence and timing of symptoms, and type, location, and length of possible Zika virus exposure. Older infants in whom maternal Zika virus exposure was not assessed at birth and who are evaluated later might also have more clinical data available (e.g., neurologic status, development, visual/hearing impairments, or head circumference trajectory) to guide the evaluation. If findings consistent with congenital Zika syndrome are identified at any time, referrals to the appropriate specialists should be made, and subsequent evaluation should follow recommendations for infants with clinical findings consistent with congenital Zika syndrome (Figure).

Special Considerations for the Prenatal Diagnosis of Congenital Zika Virus Infection

While much has been learned about congenital Zika syndrome, limitations of laboratory testing exist and the full spectrum of congenital Zika virus infection is not yet known. Similar to other congenital infections, prenatal diagnostic evaluation can inform the clinical evaluation of infants with possible Zika virus exposure. Current CDC guidance regarding prenatal diagnosis is reviewed below (*2*); as more data become available, understanding of the diagnostic role of prenatal ultrasound and amniocentesis in the clinical evaluation of congenital Zika syndrome will improve and guidance will be updated.

Ultrasound. Routine screening for fetal abnormalities is a component of prenatal care in the United States. Comprehensive ultrasound examination to evaluate fetal anatomy is recommended for all women at 18–22 weeks' gestation (*36*). However, for the detection of abnormalities associated with congenital Zika virus infection, the sensitivity, specificity, and positive and negative predictive values of ultrasound are unknown. Prenatal ultrasound findings associated with congenital Zika virus infection include intracranial calcifications at the gray-white matter junction, ventriculomegaly, abnormalities of the corpus callosum, microcephaly, and limb anomalies (*10*,*37*). The reliability of ultrasound detection for each of these abnormalities as isolated findings is unknown (*37*,*38*). Limited data suggest that a constellation of ultrasound abnormalities (e.g., microcephaly, ventriculomegaly, or abnormalities of the corpus callosum) identified prenatally in the context of maternal Zika virus exposure correlates with reported structural abnormalities in infants at birth (*20*,*21*,*39*–*43*).

Questions remain about optimal timing of ultrasound among pregnant women with possible maternal Zika virus exposure. Abnormalities have been detected anywhere from 2 to 29 weeks after symptom onset (*39*,*41*,*43*,*44*); therefore, insufficient data are available to define the optimal timing between exposure and initial sonographic screening. Brain abnormalities associated with congenital Zika syndrome have been identified by ultrasound in the second and third trimesters in published case reports (*20*,*39*,*41*,*43*,*44*). Currently, the negative predictive value of serial normal prenatal ultrasounds is unknown. Serial ultrasound monitoring can detect changes in fetal anatomy, particularly neuroanatomy, and growth patterns (*39*,*41*,*44*). CDC previously recommended serial ultrasounds every 3–4 weeks for women exposed during pregnancy with

laboratory evidence of Zika virus infection, based upon existing fetal growth monitoring for other maternal conditions (e.g., hypertension or diabetes) (*2*). However, there are no data specific to congenital Zika virus infection to guide these timing recommendations; clinicians may consider extending the time interval between ultrasounds in accordance with patient preferences and clinical judgment. Women with possible exposure but without laboratory evidence of Zika virus infection during pregnancy should receive ultrasound screening as recommended for routine prenatal care. Future data will be used to inform the optimal timing and frequency of ultrasound in pregnant women with possible Zika virus infection.

Amniocentesis. The role of amniocentesis for the detection of congenital Zika virus infection is unknown. Data regarding the positive and negative predictive values and optimal timing for amniocentesis are not available. Reports of the correlation between positive Zika test results in amniotic fluid and clinical phenotype or confirmatory infant laboratory testing are inconsistent (*20*,*42*,*45*,*46*). Zika virus RNA has been detected in amniotic fluid specimens; however, serial amniocenteses have demonstrated that Zika virus RNA might only be present transiently (*45*). Therefore, a negative test result on amniotic fluid cannot rule out congenital Zika virus infection. However, if amniocentesis is indicated as part of the evaluation for abnormal prenatal findings, NAT testing for Zika virus should be considered to assist with the diagnosis of fetal infection.

Summary of prenatal diagnosis of congenital Zika virus infection. Given the limitations in the available screening modalities and the absence of effective interventions to prevent and treat congenital Zika virus infection, a shared decision-making model is essential to ensure that pregnant women and their families understand the risks and benefits of screening in the context of the patient's preferences and values. For example, serial ultrasound examinations might be inconvenient, unpleasant, and expensive, and might prompt unnecessary interventions; amniocentesis carries additional known risks such as fetal loss. These potential harms of prenatal screening for congenital Zika syndrome might outweigh the clinical benefits for some patients; therefore, these decisions should be individualized (*47*).

Acknowledgments

American Academy of Pediatrics (AAP); American College of Obstetricians and Gynecologists (ACOG); Laura Aird, MS, Sean Diederich, Jennifer Frantz, MPH, Kate Klein, MA, MPH, AAP; Sarah Carroll, MPH, Amanda Guiliano, Debra Hawks, MPH, Lindsey Regallis, ACOG; Shannon Fleck-Derderian, MPH, Christina Hillard, MA, Sumaiya Khan, MPH, Karnesha Slaughter, MPH, Tanya Williams, MPH, CDC; Laurel Berryman, MA; Jennifer Camp, MBA; Darren Collins; Paul Decknick, MA; Brenda Duverce, MPP, Deloitte Consulting LLP; Madelyn A. Baez-Santiago, PhD, Philip Oppong-Twene, MBChB, Eagle Medical Services, LLC; Augustina Delaney, G2S Corporation.

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Conflict of Interest

No conflicts of interest were reported.

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HIV Testing, Linkage to HIV Medical Care, and Interviews for Partner Services Among Women — 61 Health Department Jurisdictions, United States, Puerto Rico, and the U.S. Virgin Islands, 2015

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Diagnoses of human immunodeficiency virus (HIV) infection among women declined 17% during 2011–2015, and a total of 7,498 women received a diagnosis of HIV infection in 2015 (*1*). Although black or African American (black) women accounted for only 12% of the U.S. female population, 60% of women with newly diagnosed HIV infection were black (*1*,*2*). By the end of 2014, an estimated 255,900 women were living with HIV infection (*3*), including approximately 12% who did not know they were infected; in addition, approximately 45% of women who had received a diagnosis had not achieved viral suppression (*3*). HIV testing is an important public health strategy for identifying women with HIV infection and linking them to HIV medical care. Analysis of CDC-funded program data submitted by 61 health departments in 2015 indicated that among 4,749 women tested who received a diagnosis of HIV infection, 2,951 (62%) had received a diagnosis in the past (previous diagnosis), and 1,798 (38%) were receiving a diagnosis for the first time (new diagnosis). Of those who had received a previous diagnosis, 87% were not in HIV medical care at the time of the current test. Testing and identifying women who are living with HIV infection but who are not in care (regardless of when they received their first diagnosis) and rapidly linking them to care so they can receive antiretroviral therapy and become virally suppressed are essential for reducing HIV infection among all women.

In 2015, CDC funded 61 state and local health departments and 123 community-based organizations (CBOs)* to provide HIV testing and related services in the United States, Puerto Rico, and the U.S. Virgin Islands. Health departments submitted deidentified program data about services provided by both health departments and CBOs through a secure, online, CDC-supported system. Data analyzed for this report include 2015 CDC-funded HIV tests,† new and previous HIV diagnoses, linkage to medical care within 90 days§ of the current test, and interviews for partner services.¶ Analyses were restricted to persons who reported their sex at birth and current gender identity as female, and were aged ≥13 years. Data were stratified by the following demographic characteristics: age group, race/ethnicity, census region, health department jurisdiction's prevalence of HIV infection, and test setting.** Multivariate robust Poisson regression (*4*) was used to assess the association between demographic characteristics and newly diagnosed HIV infections, linkage to HIV medical care, and interviews for partner services.

Among 3,020,068 CDC-funded HIV tests provided in 2015, a total of 1,454,499 (48%) were provided to women. The highest percentages of tests were provided to women who were aged 20–29 years (41%), black (49%), living in the South (62%), living in medium and high prevalence jurisdictions (97%), and who received testing in health care facilities (83%) (Table 1).

Overall, 4,749 women had positive tests for HIV infection in 2015; among these, 2,951 (62%) had previously received a diagnosis of HIV infection, and 1,798 (38%) received a new diagnosis. Compared with women aged 20–29 years, those aged 13–19 years were less likely to receive a new diagnosis (adjusted

* CDC-funded partners include health departments in the 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and eight directly funded city/county health departments (Baltimore, Maryland; Chicago, Illinois; Fulton County, Georgia; Houston, Texas; Los Angeles County, California; New York City, New York; Philadelphia, Pennsylvania; and San Francisco, California) and 123 directly funded community-based organizations. Community-based organizations report their National HIV Prevention Program Monitoring and Evaluation HIV testing data to their jurisdiction's health department, who then submit them to CDC.

† An human immunodeficiency (HIV) test is defined as the performance of one or more HIV tests to determine a person's HIV infection status. A person might be tested once (e.g., one rapid test or one conventional test) or multiple times (e.g., one rapid test followed by one conventional test to confirm a preliminary HIV-positive test result).

§ Linkage to HIV medical care within 90 days of diagnosis means confirmation that the person attended their first HIV medical care appointment within 90 days of their HIV test date.

¶ Partner services is a process through which HIV infected persons are interviewed to elicit information about their partners, who can then be confidentially notified of their possible exposure or potential risk and offered services that can protect the health of partners and prevent HIV transmission to others.

** Jurisdictions are grouped by HIV prevalence as determined by the number of persons living with diagnosed HIV infection in 2013, as follows: high: ≥20,000 persons living with HIV infection, medium: 4,000–19,999 persons living with HIV infection, medium–low/low: <3,999 persons living with HIV infection. High prevalence jurisdictions include California, Los Angeles, San Francisco, Florida, Georgia, Fulton County (Atlanta), Illinois, Chicago, Maryland, Baltimore, New Jersey, New York, New York City, North Carolina, Pennsylvania, Philadelphia, Texas, Houston, and Virginia. Medium prevalence jurisdictions include Alabama, Arizona, Arkansas, Colorado, Connecticut, District of Columbia, Indiana, Kentucky, Louisiana, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nevada, Ohio, Oklahoma, Oregon, Puerto Rico, South Carolina, Tennessee, Washington, and Wisconsin. Medium–low/low prevalence jurisdictions include Alaska, Delaware, Hawaii, Idaho, Iowa, Kansas, Maine, Montana, Nebraska, New Hampshire, New Mexico, Rhode Island, South Dakota, U.S. Virgin Islands, Utah, Vermont, West Virginia, and Wyoming.

prevalence ratio [aPR] = 0.41), whereas prevalence was higher among women aged 30–39 years (aPR = 1.69), 40–49 years (2.58), and ≥50 years (2.53). Black women accounted for 58% of the new diagnoses of HIV infection and were more likely to receive a new diagnosis than were white women (aPR = 1.31). Compared with tests performed in the South, tests performed in in the Northeast, Midwest, West, and Puerto Rico and the U.S. Virgin Islands were more likely to yield new diagnoses (aPR = 1.65, 1.24, 1.59, and 2.26, respectively). Compared with tests performed in high prevalence jurisdictions, tests performed in medium and medium-low/low prevalence jurisdictions were less likely to yield new diagnoses (aPR = 0.86 and 0.38, respectively). Tests performed in health care facilities were less likely to yield new diagnoses than tests performed in non–health care facilities (aPR = 0.51) (Table 1).

Among the 1,798 women with newly diagnosed HIV infection, 1,104 (61%) were linked to HIV medical care within 90 days of diagnosis, and 1,096 (61%) were interviewed for partner services. The percentages of women with newly diagnosed HIV infection who were linked to care were higher in the Northeast (72%; aPR = 1.21) and Puerto Rico and the U.S. Virgin Islands (79%; aPR = 1.57) than in the South (59%) (Table 2).

Among the 2,951 women with a previously diagnosed infection, 2,554 (87%) were not in HIV medical care at the time of testing (Table 3); among these women, 1,474 (58%) were linked to care within 90 days. The prevalence of being linked to HIV medical care within 90 days was lower for black women (57%) than for white women (65%; aPR = 0.91). The prevalence of being linked to care was 53% in the South, and was higher in the Northeast (78%; aPR = 1.46) and the West (86%; aPR = 1.57). Compared with women tested in non–health care facilities (68%), linkage was lower among women tested in health care facilities (55%; aPR = 0.80) (Table 3).

TABLE 1. HIV tests and newly diagnosed HIV infections among women by selected characteristics — United States, Puerto Rico, and the U.S. Virgin Islands, 2015

Characteristic	HIV tests,* no. (% of total [column %])	Newly diagnosed HIV infections†			
		No.	(% of total [column %])	(% of category [row %])	aPR (95% CI)
Age group (yrs)					
13–19	131,547 (9.08)	43	(2.40)	(0.03)	0.41 (0.30–0.57)¶
20–29	599,777 (41.38)	493	(27.47)	(0.08)	Referent
30–39	347,016 (23.94)	472	(26.30)	(0.14)	1.69 (1.49–1.93)¶
40–49	185,523 (12.80)	392	(21.84)	(0.21)	2.58 (2.25–2.95)¶
≥50	185,612 (12.81)	395	(22.01)	(0.21)	2.53 (2.22–2.90)¶
Race/Ethnicity					
White	339,714 (24.82)	393	(22.39)	(0.12)	Referent
Black	666,322 (48.68)	1,018	(58.01)	(0.15)	1.31 (1.17–1.48)¶
Hispanic	318,456 (23.26)	291	(16.58)	(0.09)	0.65 (0.55–0.75)¶
Asian	25,941 (1.90)	17	(0.97)	(0.07)	0.46 (0.28–0.75)§
American Indian	7,086 (0.52)	15	(0.85)	(0.21)	1.41 (0.82–2.43)
Native Hawaiian	2,439 (0.18)	7	(0.40)	(0.29)	1.96 (0.93–4.13)
Multiple races	8,872 (0.65)	14	(0.80)	(0.16)	1.28 (0.75–2.19)
U.S. Census region					
Northeast	210,472 (14.47)	349	(19.41)	(0.17)	1.65 (1.46–1.88)¶
Midwest	194,856 (13.40)	243	(13.52)	(0.12)	1.24 (1.08–1.43)§
South	895,271 (61.55)	956	(53.17)	(0.11)	Referent
West	129,530 (8.91)	217	(12.07)	(0.17)	1.69 (1.45–1.98)¶
Puerto Rico and U.S. Virgin Islands	24,370 (1.68)	33	(1.84)	(0.14)	2.26 (1.56–3.27)¶
HIV prevalence					
High	833,892 (57.33)	1,149	(63.90)	(0.14)	Referent
Medium	580,710 (39.93)	627	(34.87)	(0.11)	0.86 (0.78–0.95)§
Medium-low/Low	39,897 (2.74)	22	(1.22)	(0.06)	0.38 (0.24–0.58)¶
Test setting					
Health care facility	1,206,078 (83.11)	1,262	(70.46)	(0.10)	0.51 (0.46–0.57)¶
Non–health care facility	245,109 (16.89)	529	(29.54)	(0.22)	Referent
Total	**1,454,499 (100.00)**	**1,798**	**(100.00)**	**(0.12)**	—

Abbreviations: aPR = adjusted prevalence ratio; CI = confidence interval; HIV = human immunodeficiency virus.

* Valid HIV tests were defined as tests for which a test result (i.e., positive or negative) was known. Analyses excluded discordant and indeterminate results. When data are stratified by age group, race/ethnicity, and test setting; missing or invalid values are not shown in the table.

† Included persons who tested HIV-positive during the current test and were not previously reported in the health department jurisdiction's HIV surveillance system or who self-reported not having a previous HIV-positive test result if surveillance system verification was not available.

§ p<0.01.

¶ p<0.001.

TABLE 2. Linkage to HIV medical care and interview for partner services among women with newly diagnosed HIV infection, by selected characteristics — United States, Puerto Rico, and the U.S. Virgin Islands, 2015

Characteristic	No. newly diagnosed HIV infections*	Linked to HIV medical care within 90 days of diagnosis†			Interviewed for partners services§		
		No. (%)	aPR (95% CI)	No. missing linkage information (%)	No. (%)	aPR (95% CI)	No. missing linkage information (%)
Age group (yrs)							
13–19	43	27 (62.79)	1.00 (0.80–1.27)	12 (27.91)	24 (55.81)	0.92 (0.70–1.21)	8 (18.60)
20–29	493	306 (62.07)	Referent	133 (26.98)	296 (60.04)	Referent	83 (16.84)
30–39	472	290 (61.44)	0.97 (0.88–1.07)	115 (24.36)	289 (61.23)	1.02 (0.92–1.13)	98 (20.76)
40–49	392	242 (61.73)	0.96 (0.86–1.06)	111 (28.32)	256 (65.31)	1.08 (0.97–1.20)	72 (18.37)
≥50	395	237 (60.00)	0.89 (0.80–0.99)¶	116 (29.37)	229 (57.97)	0.94 (0.84–1.05)	89 (22.53)
Race/Ethnicity							
White	393	225 (57.25)	Referent	114 (29.01)	236 (60.05)	Referent	67 (17.05)
Black	1,018	642 (63.06)	1.05 (0.95–1.16)	256 (25.15)	623 (61.20)	1.01 (0.92–1.12)	201 (19.74)
Hispanic	291	189 (64.95)	1.00 (0.87–1.13)	77 (26.46)	193 (66.32)	1.01 (0.89–1.15)	51 (17.53)
Asian	17	10 (58.82)	0.97 (0.64–1.47)	6 (35.29)	9 (52.94)	0.85 (0.54–1.34)	6 (35.29)
American Indian	15	10 (66.67)	1.09 (0.77–1.55)	3 (20.00)	9 (60.00)	1.07 (0.73–1.56)	2 (13.33)
Native Hawaiian	7	4 (57.14)	0.88 (0.46–1.69)	2 (28.57)	3 (42.86)	0.62 (0.26–1.49)	1 (14.29)
Multiple races	14	9 (64.29)	1.16 (0.81–1.67)	5 (35.71)	6 (42.86)	0.73 (0.41–1.33)	4 (28.57)
U.S. Census region							
Northeast	349	252 (72.21)	1.21 (1.11–1.32)††	56 (16.05)	217 (62.18)	1.03 (0.93–1.13)	90 (25.79)
Midwest	243	127 (52.26)	0.99 (0.86–1.14)	74 (30.45)	139 (57.20)	1.04 (0.90–1.19)	37 (15.23)
South	956	562 (58.79)	Referent	286 (29.92)	568 (59.41)	Referent	199 (20.82)
West	217	137 (63.13)	1.09 (0.96–1.23)	66 (30.41)	147 (67.74)	1.12 (1.00–1.25)	17 (7.83)
Puerto Rico and U.S. Virgin Islands	33	26 (78.79)	1.57 (1.26–1.95)††	6 (18.18)	25 (75.76)	1.39 (1.09–1.78)**	7 (21.21)
HIV prevalence							
High	1,149	748 (65.10)	Referent	287 (24.98)	732 (63.71)	Referent	208 (18.10)
Medium	627	336 (53.59)	0.81 (0.74–0.89)††	200 (31.90)	345 (55.02)	0.84 (0.76–0.93)††	141 (22.49)
Medium–low/Low	22	20 (90.91)	1.42 (1.19–1.69)††	1 (4.55)	19 (86.36)	1.31 (1.06–1.61)¶	1 (4.55)
Test setting							
Health care facility	1,262	791 (62.68)	1.05 (0.96–1.14)	348 (27.58)	776 (61.49)	1.03 (0.95–1.13)	256 (20.29)
Non–health care facility	529	311 (58.79)	Referent	137 (25.90)	316 (59.74)	Referent	94 (17.77)
Total	**1,798**	**1,104 (61.40)**	—	**488 (27.14)**	**1,096 (60.96)**	—	**350 (19.47)**

Abbreviations: aPR = adjusted prevalence ratio; CI = confidence interval; HIV = human immunodeficiency virus.

* Included persons who tested HIV-positive during the current test and were not found to be previously reported in the health department jurisdiction's HIV surveillance system or self-reported not having a previous HIV-positive test result if surveillance system verification is not available. When data are stratified by age group, race/ethnicity, and test setting; missing or invalid values are not shown in the table.

† Linkage to HIV medical care within 90 days of diagnosis means confirmation that the person attended their first HIV medical care appointment within 90 days of their HIV test date.

§ Partner services is a process through which HIV infected persons are interviewed to elicit information about their partners, who can then be confidentially notified of their possible exposure or potential risk and offered services that can protect the health of partners and prevent HIV transmission to others.

¶ p<0.05.

** p<0.01.

†† p<0.001.

Discussion

HIV testing and partner services are essential strategies for diagnosing and rapidly linking women living with HIV infection and their infected partners to medical care so they can achieve viral suppression. Findings from this report underscore the importance of HIV testing not only to identify new infections, but also to identify women who have previously received a diagnosis but are not receiving medical care, because either they were never linked to care or they stopped receiving care. A high percentage of women tested had already received an HIV diagnosis (62%) before the current test; however, 87% of those women were not receiving HIV medical care. Willingness of women with previously diagnosed HIV infection to take another HIV test might signal a desire or willingness to receive the additional support they need to be linked to care, representing an opportunity for an important public health intervention; however, in this analysis, only 58% of women with previously diagnosed HIV infection were linked to care within 90 days of the current test.

Black women accounted for 72% of women with a previous HIV diagnosis, although they were significantly less likely than were white women to be linked to HIV medical care within 90 days of the current test. Disparities in socioecological factors such as poverty, health literacy, and health care coverage might contribute to lower linkage for black women (*5*). Mistrust of medical providers and conspiracy beliefs about the origin of

TABLE 3. Linkage to HIV medical care among women with previously diagnosed HIV infection, by selected characteristics — United States, Puerto Rico, and the U.S. Virgin Islands, 2015

Characteristic	Previously diagnosed HIV infections* No.	Not in HIV medical care at time of HIV test No. (%)	Women with previously diagnosed HIV infection (not in HIV medical care at time of test) linked to HIV medical care† No. (%)	aPR (95% CI)	Missing linkage info. No. (%)
Age group (yrs)					
13–19	38	35 (92.11)	26 (74.29)	1.20 (0.97–1.48)	2 (5.71)
20–29	564	520 (92.20)	307 (59.04)	Referent	154 (29.62)
30–39	796	700 (87.94)	422 (60.29)	0.99 (0.90–1.09)	184 (26.29)
40–49	740	631 (85.27)	357 (56.58)	0.94 (0.85–1.04)	200 (31.70)
≥50	811	666 (82.12)	362 (54.35)	0.92 (0.84–1.02)	212 (31.83)
Race/Ethnicity					
White	400	365 (91.25)	236 (64.66)	Referent	84 (23.01)
Black	2,047	1,730 (84.51)	978 (56.53)	0.91 (0.84–0.99)§	536 (30.98)
Hispanic	350	308 (88.00)	201 (65.26)	0.98 (0.87–1.10)	80 (25.97)
Asian	18	18 (100.00)	13 (72.22)	1.09 (0.83–1.44)	5 (27.78)
American Indian	10	10 (100.00)	5 (50.00)	0.74 (0.41–1.34)	2 (20.00)
Native Hawaiian	5	5 (100.00)	4 (80.00)	1.06 (0.71–1.57)	N/A
Multiple races	10	9 (90.00)	6 (66.67)	1.07 (0.64–1.80)	3 (33.33)
U.S. Census region					
Northeast	277	254 (91.70)	197 (77.56)	1.46 (1.34–1.59)¶	35 (13.78)
Midwest	226	191 (84.51)	110 (57.59)	1.07 (0.93–1.21)	49 (25.65)
South	2,281	1,959 (85.88)	1,044 (53.29)	Referent	650 (33.18)
West	135	125 (92.59)	107 (85.60)	1.57 (1.43–1.73)¶	13 (10.40)
Puerto Rico and U.S. Virgin Islands	32	25 (78.13)	16 (64.00)	1.12 (0.83–1.53)	7 (28.00)
HIV prevalence					
High	1,804	1,620 (89.80)	946 (58.40)	Referent	477 (29.44)
Medium	1,130	920 (81.42)	518 (56.30)	1.09 (1.01–1.18)§	274 (29.78)
Medium-low/Low	17	14 (82.35)	10 (71.43)	1.11 (0.79–1.56)	3 (21.43)
Test setting					
Health care facility	2,350	1,996 (84.94)	1,095 (54.86)	0.80 (0.75–0.86)¶	653 (32.72)
Non–health care facility	598	555 (92.81)	378 (68.11)	Referent	99 (17.84)
Total	**2,951**	**2,554 (86.55)**	**1,474 (57.71)**	—	**754 (29.52)**

Abbreviations: aPR = adjusted prevalence ratio; CI = confidence interval; HIV = human immunodeficiency virus.

* Previously diagnosed HIV infections included those in women who tested HIV-positive during the current test and were found to have been previously reported in the health department's HIV surveillance system or, if the surveillance system verification is not available, self-reported having a previous HIV-positive test result. When data are stratified by age group, race/ethnicity, and test setting; missing or invalid values are not shown in the table.

† Linkage to HIV medical care within 90 days of diagnosis means confirmation that the person attended their first HIV medical care appointment within 90 days of their HIV test date.

§ $p<0.05$.

¶ $p<0.001$.

HIV and the role of the government in the acquired immunodeficiency syndrome epidemic might also explain why black women are less likely to be engaged in HIV medical care (*6*). Black women might be more likely to remain in HIV medical care if they trust and engage in high quality communication with their provider (*7*).

Overall, 61% of women with newly diagnosed HIV infection were interviewed for partner services. CDC recommends that all persons with newly diagnosed HIV infection be interviewed for partner services so that partners can be confidentially notified of their potential risk (*8*). There are potential prevention benefits of interviewing women with previously diagnosed infection for partner services as well so that their partners may also be confidentially notified of their potential risk, receive an HIV test, and be linked to care if they receive a diagnosis of HIV. It is important to prioritize provision of partner services to women whose characteristics suggest possible recent risk for transmission (e.g., new bacterial sexually transmitted infections, pregnancy, report of sex without condoms, or sharing drug injection equipment) or those who did not receive partner services when they initially received their diagnosis (*8*). Partner services is a process through which HIV infected persons are interviewed to elicit information about their partners, who can then be confidentially notified of their possible exposure or potential risk and offered services that can protect the health of partners and prevent HIV transmission to others.

The findings in this report are subject to at least three limitations. First, findings describe CDC-funded HIV tests only and are not generalizable to all tests provided to women in the United States. Second, linkage data include records with missing or invalid data in the denominator and therefore probably underestimate the percentage of persons linked to

care. Finally, when surveillance data are unavailable to verify previous HIV status, the number of new positive results might be overestimated if clients inaccurately report a previous negative HIV status.

To reduce and eventually eliminate HIV infection among women in the United States, HIV testing programs need to improve early linkage to HIV medical care among HIV-positive women who are not in care, regardless of their known HIV status at the time of testing. It is also important for the HIV prevention public health community to increase their focus on identifying women with previously diagnosed HIV infection who are not in care, especially black women, and promptly link them to care, as well as monitor and evaluate these efforts.

Acknowledgment

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Conflict of Interest

No conflicts of interest were reported.

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Summary

What is already known about this topic?

In 2015, a total of 7,498 women received a diagnosis of human immunodeficiency virus (HIV) infection in the United States, 60% of whom were black, although black women accounted for only 12% of the female population. HIV testing, identification of HIV infections, and early linkage to HIV medical care are critical for ensuring that HIV-positive women receive the care they need to achieve viral suppression and improved health outcomes, and to reduce transmission to others. Providing partner services can further support these prevention goals.

What is added by this report?

Analysis of 2015 data on CDC-funded HIV tests and HIV prevention services from 61 health departments and 123 community-based organizations indicated that among women identified as having HIV infection, 62% had received a diagnosis of HIV infection before the current test, and 87% of those women were not in HIV medical care at the time of the test. Rates for linkage to medical care within 90 days of the current test date were 61% and 58% for women with newly diagnosed and previously diagnosed HIV infection, respectively. Among women with previously diagnosed HIV infection, 57% of black women and 65% of white women were linked to HIV medical care.

What are the implications for public health practice?

Enhanced efforts to test and identify women with HIV infection and promptly link them to HIV medical care, as well as to identify women with previously diagnosed HIV infection who are not in care, especially black women, and link them to care will improve health outcomes, increase rates of viral suppression, and reduce transmission of HIV to others.

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Tdap Vaccination Coverage During Pregnancy — Selected Sites, United States, 2006–2015

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Tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccine is recommended during the third trimester of each pregnancy to provide protection to newborns, who are at risk for pertussis-related morbidity and mortality (*1*). As part of its case-control surveillance study of medications and birth defects, the Birth Defects Study of the Slone Epidemiology Center at Boston University (the Birth Defects Study) has recorded data on vaccinations received during pregnancy since 2006. Among 5,606 mothers of infants without structural birth defects in this population (control group), <1% had received Tdap vaccine before 2009. By 2012, the percentage of mothers of infants in the control group (control infants) who had received Tdap increased to approximately 9%, and then in 2013 and continuing through 2015, increased markedly, to 28% and 54%, respectively. As the prevalence of maternal Tdap vaccination increased, so did the proportion of pregnant women who received Tdap in the third trimester, as recommended (94%–100% from 2010 to 2015). The vast majority of Tdap vaccinations (96%) were received in a traditional health care setting (e.g., the office of the woman's obstetrician or primary care physician or her prenatal clinic). Increasing vaccination coverage during pregnancy could help reduce the impact of pertussis on infant morbidity and mortality.

Pertussis is a highly contagious disease, but mortality is highest among newborns: almost all pertussis-associated deaths occur within the first 2 months of life (*2*), when these infants are too young to receive primary pertussis vaccinations. To provide infants with indirect protection from pertussis, in 2006, the Advisory Committee on Immunization Practices (ACIP) recommended postpartum Tdap administration to mothers, but noted that the vaccine could be administered during pregnancy.* In June 2011, ACIP changed the preferred timing of Tdap administration to mothers, recommending that previously unvaccinated pregnant women should receive Tdap after 20 weeks' gestation (*3*). In October 2012, this recommendation was expanded to include all pregnant women during every pregnancy, with the optimal time for vaccination in the third trimester (*1*). A recent analysis reported 42% coverage with Tdap among pregnant women in 2013 (*4*). To assess the impact of the ACIP recommendations, trends in Tdap coverage in pregnancy were examined, along with the settings in which women received their vaccinations, from 2006 through 2015, using data from the Birth Defects Study.

During 1976–2015, the Birth Defects Study conducted surveillance using a case-control methodology described previously (*5*). Infants with major structural birth defects (case infants) were identified at study centers that, for the present analysis, included participating hospitals in the areas surrounding Boston, Massachusetts, Philadelphia, Pennsylvania, and San Diego, California, as well as statewide birth defects registries in New York and Massachusetts. Control infants were randomly selected each month from study hospitals' discharge lists or statewide vital statistics records. Within 6 months of delivery, mothers of case and control infants were invited to participate in a computer-assisted telephone interview conducted by trained study nurses. Data were collected on demographic characteristics, lifestyle factors, reproductive history, illnesses, and medications used from 2 months before the last menstrual period through the end of pregnancy. Medication data included prescription and over-the-counter drugs, and for pregnancies that began in 2005 or later, any vaccines received during pregnancy. Women were asked to provide an exact date of vaccination, or if the vaccination date was not available, a range of possible dates, along with the setting or facility where the vaccine was administered (e.g., doctor's office/prenatal clinic, workplace, school, pharmacy/supermarket, or government site). All women who reported receiving a vaccine were asked to provide a release allowing study personnel to contact the vaccine provider to validate the vaccine report. If vaccine records were not available, the maternal report was accepted (*6*). All vaccine doses received from the provider were recorded, and during the process of validating vaccination reports, study personnel sometimes discovered unreported Tdap vaccinations. For instance, a maternal report of influenza vaccination might lead to the recording of an unreported Tdap vaccination during pregnancy from the same provider.

This analysis of Tdap vaccination coverage was limited to pregnancies in women who gave birth to control infants during 2006–2015. Among women who reported receiving Tdap vaccine during pregnancy, the exact date of vaccination obtained from the vaccination record was used if the record was available; otherwise, the vaccination date the woman provided or the midpoint of the reported date range was used. Unvaccinated women were defined as those without provider-documented

* https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5540a10.htm.

exposure who did not report receiving the Tdap vaccine, or whose reported Tdap vaccination took place before pregnancy or after delivery.

Among the 5,606 pregnant women who participated in the study during the 10 years included in the analysis, 849 (15%) received doses of Tdap during pregnancy. Among these doses, 83% were validated by provider records; the remaining 17% were ascertained only by maternal self-report. Fifty-nine (7%) Tdap doses were not reported by the mother and were identified during validation of other reported vaccinations (primarily influenza vaccine).

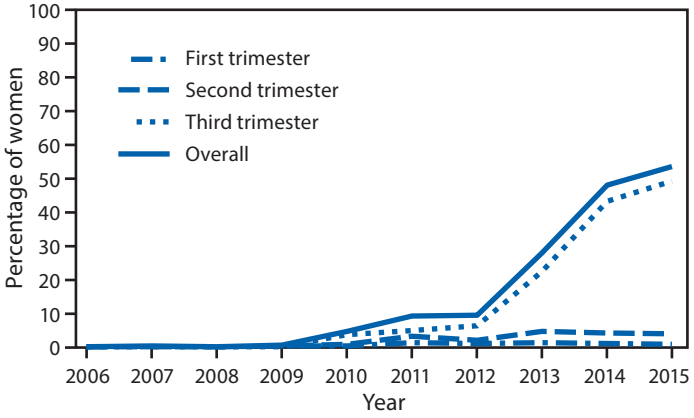
Tdap vaccination during pregnancy increased over the years of the study (Figure). Tdap vaccination during pregnancy occurred in <1% of women who delivered before 2010, but began to increase from 2010 (5%) to 2012 (9%); during 2010–2011, 83% of Tdap vaccinations documented in the study were received among mothers of control infants reported to the San Diego study center. Overall Tdap vaccination coverage approximately tripled in 2013 to 28%, with highest rates reported for mothers of control infants in Boston (34%) and Philadelphia (32%); reported vaccination rates continued to increase in 2014 (48%) and 2015 (54%) (2015 rates were 64% in Philadelphia, 56% in Boston, 52% in San Diego, and 44% in New York). Among all mothers giving birth, Tdap vaccination during the first trimester remained at approximately 1%, and vaccination in the second trimester ranged from 1% to 5%. Tdap vaccination in the third trimester increased from 4% in 2010 to 49% in 2015.

Overall, 96% of Tdap vaccine doses received by pregnant women were administered in a traditional health care setting (e.g., the office of their obstetrician or primary care physician or their prenatal clinic). Among 4% of vaccine doses reported to have been administered in non-traditional health care settings, half were received at work or school settings, and one quarter each at pharmacy/supermarket or government settings. During the 10 years included in this analysis, the proportion of vaccine doses received by pregnant women in these settings remained stable; during 2010–2015, Tdap vaccinations administered in traditional health care settings accounted for 94%–100% of Tdap vaccine doses administered to pregnant women.

Discussion

From 2006 to 2015, Tdap vaccination coverage among pregnant women in the Birth Defects Study who gave birth to control infants increased from <1% of births in 2009 to 9% in 2012, before increasing to 28% in 2013 and to >50% of births in 2015. These increases reflect the implementation of evolving ACIP recommendations, which currently recommend that all pregnant women be vaccinated during each pregnancy, ideally in the third trimester. Of note, before 2012, the San Diego study center accounted for the large majority of pregnant

FIGURE. Percentage of women receiving tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccination during pregnancy, by trimester — selected sites,* United States, 2006–2015



* Birth Defects Study, Slone Epidemiology Center, Boston University. Study sites included participating hospitals in the areas surrounding Boston, Massachusetts, Philadelphia, Pennsylvania, and San Diego, California, as well as birth defects registries in New York and Massachusetts. Women included in the analysis were mothers of control infants (infants born without a structural birth defect).

women in the Birth Defects Study who received Tdap; this was likely a result of California's 2010 recommendation that all women of childbearing age be vaccinated with Tdap "preferably before pregnancy, but otherwise during or after pregnancy" in response to a statewide pertussis epidemic.[†] The higher Tdap coverage beginning in 2010 has also been reported in two studies using the Vaccine Safety Datalink (*4*,*7*), and was likewise attributed to the 2010 recommendation in California (*7*). Tdap coverage in non-California sites remained low until 2012 (*7*). In both the Vaccine Safety Datalink and Birth Defects Study, marked increases were observed for all sites beginning in 2013; the Birth Defects Study data in this report indicate that this increase continued in 2014 and 2015. By 2015, all four Birth Defects Study centers (Boston, Philadelphia, San Diego, and New York) reported Tdap administration prevalences ranging from 44% to 64% among mothers of control infants.

The findings in this report are subject to at least three limitations. First, Tdap vaccination histories were ascertained by self-report and could be subject to misclassification; however, maternal reports of influenza vaccination in the Birth Defects Study were previously found to be accurate within a given trimester for 83% of women in this group (*8*), and 83% of Tdap vaccine doses reported in the current study were confirmed by vaccine providers' records. Second, because the data was limited to reporting centers in only four U.S. locations, the study population might not be representative of the entire U.S. population. Finally, the small number of mothers vaccinated each year might have affected year-to-year variability.

[†] https://www.lahc.edu/includes/Pertussis%20Vaccine%20Info.pdf.

Tdap vaccination during pregnancy increased substantially among mothers of control infants in the Birth Defects Study over the 10 years included in this report. Although approximately half of mothers who gave birth to control infants in the most recent year of the study received Tdap during pregnancy, this proportion remains far below the ACIP recommendation that all pregnant women be vaccinated during each pregnancy. Newborns at highest risk for pertussis-associated complications are too young to be vaccinated, but Tdap vaccination during pregnancy can reduce the potential for morbidity (*9*) and mortality in this vulnerable population. A recent U.S. study found that Tdap vaccination during the third trimester of pregnancy was 85% more effective than postpartum vaccination at preventing pertussis in infants aged <2 months (*10*). To help increase coverage of Tdap vaccination among pregnant women, resources are available for prenatal care providers and pregnant women at https://www.cdc.gov/pertussis/pregnant.

Summary

What is already known about this topic?

Infants are at risk for pertussis-related morbidity and mortality especially in the early months of life when they are too young to be vaccinated. Beginning in 2012, tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccine has been recommended for pregnant women during the third trimester of each pregnancy to provide protection to the newborn. A recent report indicated Tdap vaccination coverage during pregnancy was approximately 42% in women giving birth during 2013.

What is added by this report?

Among mothers of control infants participating in the Birth Defects Study of the Slone Epidemiology Center, which included pregnant women in New York and Massachusetts and the areas surrounding Philadelphia, Pennsylvania, and San Diego, California, Tdap vaccination coverage increased from <1% before 2010 to 28% in 2013, and reached 53% in 2015. Overall, 96% of Tdap vaccinations received by pregnant women in this study were administered in physicians' offices or clinics.

What are the implications for public health practice?

Although Tdap vaccination coverage has increased in recent years and approximately half of pregnant women in this study who had a live birth in 2015 received Tdap, coverage for pregnant women remains far below the recommendation that every woman be vaccinated during each pregnancy. Increasing vaccination coverage during pregnancy could help reduce the impact of pertussis on infant morbidity and mortality.

Acknowledgments

Christina Chambers, PhD, Sonia Hernández-Díaz, Carol Louik, ScD, and Michael Schatz, MD, members of the Vaccines and Medications in Pregnancy Surveillance System (VAMPSS) team that includes the authors; Joseph Bocchini, Elizabeth Conradson Cleary, Peter Gergen, Robert Glynn, Margaret Honein, James Mills, Dixie Snider, VAMPSS Vaccine and Asthma Advisory Committee; Mark Abcede, Casey Braddy, Laurie Cincotta, Christina Coleman, Clare Coughlin, Michelle Eglovitch, Laine Catlin Fletcher, Ileana Gatica, Dawn Jacobs, Rita Krolak, Susan Littlefield, Carolina Meyers, Darryl Partridge, Moira Quinn, Fiona Rice, Nancy Rodriquez-Sheridan, Joan Shander, Kathleen Sheehan, Shannon Stratton, Mary Thibeault, Julia Venanzi, staff members, Massachusetts Department of Public Health Center for Birth Defects Research and Prevention and the Massachusetts Registry of Vital Records; Charlotte Druschel, Deborah Fox, staff members, the New York State Health Department; William Cooper, Vanderbilt University Medical Center; medical and nursing staff members, Boston Children's Hospital, Kent Hospital, Southern New Hampshire Medical Center, Women & Infants' Hospital, Abington Memorial Hospital, Albert Einstein Medical Center, Alfred I. duPont Hospital for Children, Bryn Mawr Hospital, Children's Hospital of Philadelphia, Christiana Care Health Services, Lankenau Hospital, Lancaster General Hospital, Temple University Health Sciences Center, Reading Hospital & Medical Center, Thomas Jefferson University Hospital, Rady Children's Hospital San Diego, Kaiser Zion Medical Center, Palomar Medical Center, Pomerado Hospital, Scripps Mercy Hospital, Scripps Memorial Hospital-Chula Vista, Scripps Memorial Hospital-Encinitas, Scripps Memorial Hospital-La Jolla, Sharp Chula Vista Hospital, Sharp Grossmont Hospital, Sharp Mary Birch Hospital, Tri-City Medical Center, University of California-San Diego Medical Center; Jo Schweinle, Tanima Sinha, Biomedical Advanced Research and Development Authority, U.S. Department of Health and Human Services; Sheila Heitzig, Lauri Sweetman, American Academy of Asthma, Allergy, & Immunology; mothers who participated in the study.

Conflict of Interest

During the previous 36 months, the Birth Defects Study of the Slone Epidemiology Center at Boston University received funding from Seqirus, GSK, and Novartis. Carla Van Bennekom disclosed an honorarium from the American Academy of Allergy, Asthma, and Immunology. Allen Mitchell serves on an Independent Advisory Committee for Biogen's Tecfidera Pregnancy Registry, and he disclosed personal fees from Biogen, outside submitted work. No other conflicts of interest were reported.

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Knowledge, Attitudes, and Practices Related to Ebola Virus Disease at the End of a National Epidemic — Guinea, August 2015

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Health communication and social mobilization efforts to improve the public's knowledge, attitudes, and practices (KAP) regarding Ebola virus disease (Ebola) were important in controlling the 2014–2016 Ebola epidemic in Guinea (*1*), which resulted in 3,814 reported Ebola cases and 2,544 deaths.* Most Ebola cases in Guinea resulted from the washing and touching of persons and corpses infected with Ebola without adequate infection control precautions at home, at funerals, and in health facilities (*2*,*3*). As the 18-month epidemic waned in August 2015, Ebola KAP were assessed in a survey among residents of Guinea recruited through multistage cluster sampling procedures in the nation's eight administrative regions (Boké, Conakry, Faranah, Kankan, Kindia, Labé, Mamou, and Nzérékoré). Nearly all participants (92%) were aware of Ebola prevention measures, but 27% believed that Ebola could be transmitted by ambient air, and 49% believed they could protect themselves from Ebola by avoiding mosquito bites. Of the participants, 95% reported taking actions to avoid getting Ebola, especially more frequent handwashing (93%). Nearly all participants (91%) indicated they would send relatives with suspected Ebola to Ebola treatment centers, and 89% said they would engage special Ebola burial teams to remove corpses with suspected Ebola from homes. Of the participants, 66% said they would prefer to observe an Ebola-affected corpse from a safe distance at burials rather than practice traditional funeral rites involving corpse contact. The findings were used to guide the ongoing epidemic response and recovery efforts, including health communication, social mobilization, and planning, to prevent and respond to future outbreaks or sporadic cases of Ebola.

Ebola-related KAP assessments were conducted in Sierra Leone (*4*), Liberia (*5*), Nigeria (*6*), and in one region in Guinea (*7*) during Ebola epidemics in 2014–2015. To learn more about Ebola-related KAP in Guinea as the nation's epidemic waned following more than a year of Ebola education and prevention activities, several organizations conducted an Ebola KAP assessment across all administrative regions in August 2015. At that time, cumulative case counts varied substantially across the four natural regions of Guinea (Forest Guinea, Maritime Guinea, Middle Guinea, and Upper Guinea) (Figure); previously intense transmission had been controlled in the Forest Guinea region, but transmission persisted in the Maritime Guinea region (*8*). Various control measures were implemented, including case investigation and contact tracing, health communication about prevention practices, and specialized treatment units and burial teams to manage persons and corpses affected by Ebola.

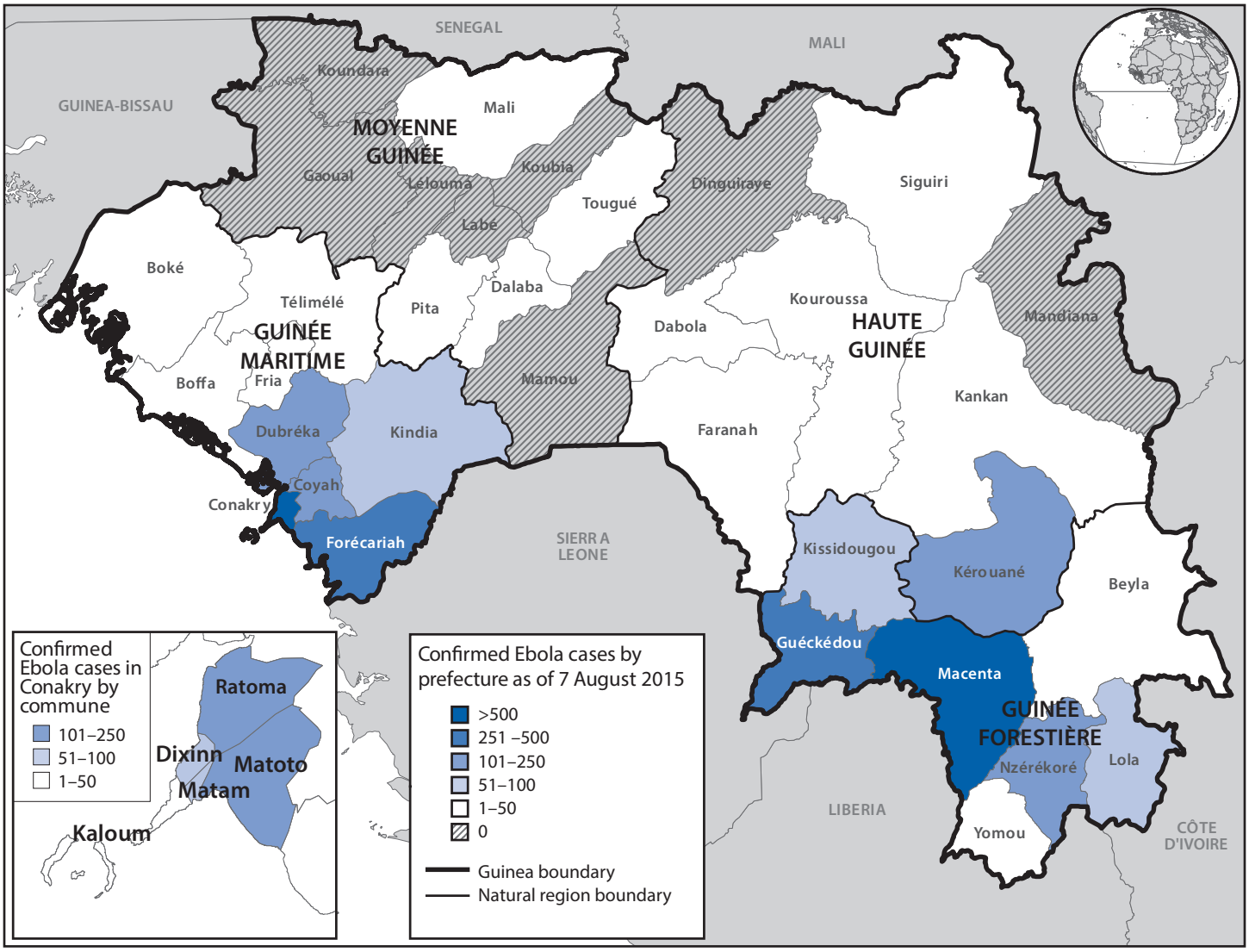
The assessment employed a cross-sectional design using a multistage cluster sampling procedure. The 2014 Guinea Census List of Enumeration Areas served as the sampling frame for the random selection of 150 clusters across all eight administrative regions, which were grouped by the four natural regions of Guinea. Within each administrative region, prefectures were randomly sampled from among two strata defined by high (≥95) or low (<95) cumulative counts of confirmed cases that had been reported to the national Ebola surveillance system by May 2015. The sample was further stratified to include both urban and rural subprefectures. Districts within each subprefecture were randomly selected, and 20 households were selected from each cluster using a form of systematic random sampling known as the random walk method.† In each selected household, two interviews were conducted; the first was with the head of household, and the second was with a randomly selected woman aged ≥25 years or a person of either sex aged 15–24 years. Interviews were conducted by locally trained data collectors using a free open-source set of tools to manage mobile data collection (https://opendatakit.org), installed on mobile devices. Data were analyzed using statistical software. For each record, weighted estimates adjusted for the probability of participant selection were calculated by applying a factor based on population size of the participant's administrative region; 95% confidence intervals were generated for overall and regional data.

Data collection teams approached 6,699 persons, 6,273 (94%) of whom (from 3,137 households) consented to initiate the assessment. Among these, 5,733 (91%) persons who reported that they had heard of Ebola before the survey were asked questions for up to 60 minutes about Ebola through

* https://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/case-counts.html.

† A form of systematic random sampling that helps minimize survey administration cost and time by avoiding prior listing of all households in the enumeration area by beginning the process at a certain geographic point and following a specified path to select households to interview. https://unstats.un.org/unsd/demographic/meetings/egm/Sampling_1203/docs/no_2.pdf.

FIGURE. Cumulative confirmed cases of Ebola virus disease, by natural region* and administrative prefecture† — Guinea, August 7, 2015



Source: Ebola situation reports by the World Health Organization.
* Maritime Guinée = Maritime Guinea; Moyenne-Guinée = Middle Guinea; Haute-Guinée = Upper Guinea; Guinée Forestiere = Forest Guinea.
† Of the sampled prefectures and urban communes, 12 reported 0–50 cumulative cases (Boffa, Boké, Dalaba, Dinguiraye, Fria, Kaloum, Kouroussa, Labé, Mamou, Tougué, Siguiri, and Yomou), and the rest reported 51 or more cumulative cases (Dixinn, Forécariah, Kindia, Kissidougou, Macenta, Matam, Matoto, Nzérékoré, and Ratoma). Four cases reported in Conakry prefecture could not be mapped to a commune.

individual interviews that included closed- and open-ended questions in local languages, and rarely, in French. These respondents were considered to have completed the survey and were included in the analysis (Table 1). Overall, sociodemographic characteristics did not vary substantially by region, except that participants from Forest Guinea were more likely than other participants to report some formal education and Christian religious affiliations.

Participants from the most heavily Ebola-affected regions (Forest Guinea and Martime Guinea) were more likely to have encountered Ebola response teams (61% and 72%, respectively), than were respondents from Middle Guinea (37%) and Upper Guinea (47%) (Table 2). Overall, 15% of participants perceived a high risk for acquiring Ebola; in Maritime Guinea, 25% of participants perceived a high risk. Most participants knew that Ebola is transmitted by contact with body fluids of infected persons (92%) or corpses (87%). However, the misconception that Ebola is transmitted by mosquito bites was reported by 49%, and this belief was reported by 66% of participants in Upper Guinea. Nearly all participants reported taking actions to avoid Ebola (95%), including more frequent handwashing (93%), avoiding contact with persons with suspected Ebola (44%), or avoiding crowds (22%).

TABLE 1. Selected characteristics of respondents to a survey on Ebola virus disease knowledge, attitudes, and practices — Guinea, August 2015

Characteristic	Initiated survey (N = 6,273)* No. (%)	Completed survey (N = 5,733)† No. (%)	% completed survey, natural region			
			Maritime Guinea (n = 2,538)	Middle Guinea (n = 926)	Upper Guinea (n = 1,442)	Forest Guinea (n = 827)
Administrative region						
Conakry	920 (15)	915 (16)	36	—	—	—
Boké	664 (11)	581 (10)	23	—	—	—
Kindia	1,062 (17)	1,042 (18)	41	—	—	—
Mamou	400 (6)	366 (6)	—	40	—	—
Labé	579 (9)	560 (10)	—	60	—	—
Faranah	526 (8)	392 (7)	—	—	27	—
Kankan	1,142 (18)	1,050 (18)	—	—	73	—
Nzérékoré	980 (16)	827 (15)	—	—	—	100
Sex						
Male	3,164 (50)	2,937 (51)	52	44	53	54
Female	3,109 (50)	2,796 (49)	48	56	47	46
Age group (yrs)						
15–24	1,117 (18)	1,032 (18)	19	18	15	21
≥25	5,156 (82)	4,701 (82)	81	82	85	79
Education						
None	3,117 (53)	2,712 (50)	43	60	64	35
Some primary education	1,224 (21)	1,155 (21)	21	18	15	35
Some secondary education or higher	1,600 (26)	1,560 (29)	36	22	21	30
Religion						
Muslim	5,357 (86)	4,949 (87)	97	98	92	32
Christian	788 (13)	689 (12)	3	2	8	60
Other/None	93 (1)	68 (1)	0	0	0	8
Occupation						
Government/Office worker	364 (6)	358 (6)	8	5	5	4
Trader/Merchant	1,216 (20)	1,132 (20)	22	21	19	16
Farmer/Breeder	1,860 (30)	1,667 (29)	22	30	41	29
Police/Military/Guards	37 (1)	34 (1)	1	0	0	1
Student	629 (10)	600 (11)	12	12	6	12
Spiritual/Traditional healer	45 (1)	38 (1)	1	0	1	1
Skilled laborer	282 (5)	264 (5)	7	1	3	5
Other	1,230 (18)	1,120 (19)	18	23	17	25
Unemployed	554 (9)	478 (8)	9	8	8	7
Heard of Ebola before interview	5,733 (93)	5,733 (100)	100	100	100	100

* Denominator varied for those who initiated the survey with regard to education (N = 5,941), religion (N = 6,238), and occupation (N = 6,217).
† Denominator varied for those who completed the survey with regard to education (N = 5,427), religion (N = 5,706), and occupation (N = 5,691).

The majority of participants across all regions (91%) indicated they would send relatives with suspected Ebola to Ebola treatment centers. Most (72%) participants knew that one could survive and recover from Ebola, but such knowledge varied by region, and was lowest in Upper Guinea (58%) and highest in Maritime Guinea (81%). A minority of participants (17%) reported that survivors could infect others through casual contact such as hugging and shaking hands, that they would not buy fresh vegetables from shopkeepers who survived Ebola (28%), and that they would not welcome survivors into their communities (19%). Overall, 44% of participants expressed at least one of those three attitudes toward survivors, and these attitudes were more common in the less-affected regions (Middle Guinea [58%] and Upper Guinea [55%]) than in heavily affected regions (Maritime Guinea [35%] and Forest Guinea [30%]). In contrast, 91% of all participants expressed the opinion that Ebola survivors could contribute to Ebola control, such as through educating community members about Ebola prevention (62%) or caring for Ebola patients (37%) (Table 2).

When asked about intended burial preparations for family members suspected to have died from Ebola at home, only 3% of participants reported that they would wash or touch the body, and most stated that they would accept special Ebola burial teams (89%). Overall, 66% said they would prefer to observe corpses of family members who had died from Ebola from a safe distance at burials, but this attitude varied widely by region (Forest Guinea [90%]; Upper Guinea [83%]; Maritime Guinea [65%]; and Middle Guinea [38%]). Attitudes about other alternatives to touching Ebola-affected corpses also varied by region. When asked about intended burial preparations for family members who died of any cause at home, the majority of participants (72%) indicated they would accept alternatives that did not involve corpse contact, but this attitude was least

TABLE 2. Knowledge, attitudes, and practices related to Ebola virus disease — Guinea, August 2015

Indicator	Response format	Overall*		Natural regions							
				Maritime Guinea†		Middle Guinea§		Upper Guinea¶		Forest Guinea**	
		No.	%	No.	% (95% CI)	No.	% (95% CI)	No.	% (95% CI)	No.	% (95% CI)
Encountered Ebola response teams in the past	Yes/No/DK	**5,681**	**57**	2,509	72 (69.8–73.3)	923	37 (33.6–39.9)	1,438	47 (44.1–49.3)	811	61 (57.5–64.3)
Perceptions of personal risk for becoming infected with Ebola											
No risk	Yes/No/DK	**5,601**	**44**	2,476	40 (38.4–42.3)	884	42 (39.2–45.8)	1,433	50 (47.6–52.8)	808	51 (47.4–54.4)
Low risk			**27**	2,476	23 (21.7–25.0)	884	30 (24.1–30.0)	1,433	28 (25.6–30.3)	808	35 (32.0–38.7)
High risk			**15**	2,476	25 (23.4–26.9)	884	9 (7.2–11.1)	1,433	8 (7.0–9.9)	808	5 (3.9–7.2)
Don't know/Not sure			**14**	2,476	11 (10.1–12.6)	884	22 (19.1–24.6)	1,433	14 (11.8–15.5)	808	9 (6.8–10.7)
Knowledge and perceptions about Ebola prevention and treatment											
Preventable by avoiding contact with body fluids of infected persons	Yes/No/DK	**5,715**	**92**	2,526	91 (89.8–92.0)	925	94 (92.0–95.2)	1,440	94 (92.9–95.3)	824	89 (86.6–91.0)
Preventable by avoiding contact with corpse of persons who died from Ebola		**5,708**	**87**	2,524	86 (84.2–87.0)	922	93 (90.1–94.4)	1,440	87 (85.1–88.5)	822	83 (80.2–85.4)
Immediate treatment in health facility increases chance of survival		**5,704**	**86**	2,526	89 (87.6–90.0)	923	88 (85.5–89.7)	1,438	84 (82.0–85.8)	817	78 (75.4–81.0)
Immediate treatment in health facility reduces chance of Ebola spread		**5,698**	**88**	2,518	90 (88.4–90.8)	925	92 (89.7–93.3)	1,439	86 (84.4–88.0)	816	79 (76.1–81.7)
Male survivors should use condoms for at least 3 months to prevent sexual transmission††		**5,237**	**46**	2,396	44 (42.4–46.4)	746	39 (35.4–42.4)	1,341	49 (45.8–51.2)	754	57 (53.1–60.1)
Misconceptions about Ebola transmission, prevention, and treatment											
Transmissible by ambient air	Yes/No/DK	**5,695**	**27**	2,514	24 (22.6–26.0)	924	31 (27.6–33.6)	1,438	34 (31.5–36.3)	819	17 (14.1–19.1)
Can protect self from Ebola by avoiding mosquito bites		**5,705**	**49**	2,523	44 (42.3–46.1)	925	42 (39.0–45.4)	1,439	66 (63.8–68.6)	818	38 (35.1–41.7)
Preventable by bathing with salt and hot water		**5,695**	**22**	2,522	18 (16.6–19.6)	924	25 (22.1–27.7)	1,437	29 (26.6–31.2)	812	12 (9.5–13.9)
Can be successfully treated by spiritual or traditional healers		**5,693**	**5**	2,517	3 (2.7–4.1)	924	6 (4.6–7.8)	1,439	5 (3.9–6.1)	813	7 (5.1–8.5)
Prevention practices used after learning about Ebola											
Took some action to avoid Ebola infection	Yes/No/DK	**5,537**	**95**	2,452	97 (96.0–97.4)	900	93 (91.7–94.9)	1,407	92 (90.0–93.0)	778	95 (93.9–96.9)
Washed hands with soap and water more often	Open-ended, unprompted	**5,240**	**93**	2,370	94 (92.9–94.9)	840	91 (88.8–92.8)	1,288	94 (92.5–95.1)	742	95 (93.4–96.6)
Avoided all physical contact with those suspected of having Ebola		**5,240**	**44**	2,370	48 (46.1–50.1)	840	41 (37.4–44.0)	1,288	40 (36.8–42.2)	742	46 (42.2–49.4)
Avoided crowded places		**5,240**	**22**	2,370	24 (22.0–25.4)	840	16 (13.8–18.8)	1,288	27 (25.0–29.8)	742	13 (10.9–15.7)
Intentions if family member suspected of having Ebola											
Would send family member to an Ebola treatment center	Yes/No/DK	**5,733**	**91**	2,538	93 (92.1–94.1)	926	94 (92.2–95.4)	1,442	88 (86.2–89.6)	827	87 (84.6–89.2)
Would hide the family member from neighbors and health authorities		**5,520**	**4**	2,426	3 (2.5–3.9)	909	3 (2.1–4.5)	1,404	5 (3.6–5.8)	781	2 (1.3–3.5)
Attitudes toward Ebola survivors§§											
Survivors certified to be cured of Ebola could infect others through casual contact (e.g., hugging or shaking hands)	Yes/No/DK	**4,637**	**17**	2,093	13 (11.1–13.9)	768	25 (22.2–28.4)	1,135	21 (18.2–22.8)	641	12 (9.2–14.2)
Would not buy fresh vegetables from survivor certified by government to be cured of Ebola		**5,417**	**28**	2,367	21 (18.9–22.1)	903	40 (36.3–42.7)	1,372	36 (33.5–38.5)	775	16 (13.5–18.7)
Would not welcome survivor declared to be cured of Ebola back into community		**5,468**	**19**	2,402	14 (12.9–15.7)	911	26 (22.8–28.4)	1,365	28 (25.1–29.9)	790	6 (4.5–7.9)
Expressed one or more of the above attitudes toward Ebola survivors¶¶	Composite	**5,029**	**44**	2,203	35 (32.5–36.5)	871	58 (54.3–60.9)	1,283	55 (52.6–58.0)	672	30 (26.4–33.4)
Possible to survive and recover from Ebola	Yes/No/DK	**5,703**	**72**	2,523	81 (79.8–82.8)	925	74 (70.7–76.3)	1,437	58 (55.0–60.2)	818	69 (65.3–71.7)
Survivors could contribute to Ebola containment efforts		**4,957**	**91**	2,167	93 (92.2–94.4)	820	92 (90.5–94.1)	1,225	84 (81.9–86.1)	736	96 (94.8–97.6)
Survivors could educate community members about Ebola prevention	Open-ended, unprompted	**4,516**	**62**	2,022	58 (55.8–60.2)	757	60 (56.1–63.1)	1,029	63 (59.8–65.8)	708	71 (67.5–74.1)
Survivors could help care for persons suspected of having Ebola		**4,516**	**37**	2,022	46 (44.0–48.4)	757	35 (31.1–37.9)	1,029	39 (36.2–42.2)	708	18 (15.4–21.0)

See table footnotes on next page.

TABLE 2. (*Continued*) Knowledge, attitudes, and practices related to Ebola virus disease — Guinea, August 2015

Indicator	Response format	Overall*		Natural regions							
				Maritime Guinea†		Middle Guinea§		Upper Guinea¶		Forest Guinea**	
		No.	%	No.	% (95% CI)	No.	% (95% CI)	No.	% (95% CI)	No.	% (95% CI)
Intentions if family member died at home											
Would wash or touch body if family member died	Yes/No/DK	**5,460**	**8**	2,416	5 (4.0–5.8)	870	11 (8.7–12.9)	1,403	8 (6.7–9.5)	771	10 (7.5–11.7)
Would wash or touch body if family member died of suspected Ebola		**5,512**	**3**	2,437	3 (2.7–4.1)	889	3 (2.0–4.2)	1,406	4 (2.5–4.5)	780	3 (2.0–4.6)
Would accept burial team if family member died of suspected Ebola		**5,344**	**89**	2,346	89 (88.0–90.6)	878	92 (90.6–94.2)	1,371	83 (81.0–85.0)	749	91 (88.8–93.0)
Would accept alternatives to traditional burials that do not involve physical contact with corpse if family member died of any cause		**4,897**	**72**	2,106	76 (74.4–78.0)	800	84 (81.4–86.4)	1,297	65 (61.9–67.1)	694	57 (53.4–60.8)
Observe burial from safe distance	Open-ended, unprompted	**3,509**	**66**	1,605	65 (62.8–67.4)	671	38 (34.3–41.7)	837	83 (80.5–85.5)	396	90 (87.5–93.3)
Have religious leader say a final prayer		**3,509**	**54**	1,605	67 (64.9–69.5)	671	54 (50.0–57.6)	837	34 (30.6–37.0)	396	58 (53.2–63.0)
Know the location of the burial site		**3,509**	**22**	1,605	21 (18.6-22.6)	671	11 (8.4–13.0)	837	18 (15.7–20.9)	396	66 (61.0–70.4)
Provide a name plate at the burial site		**3,509**	**8**	1,605	4 (3.0–5.0)	671	3 (1.6–4.0)	837	11 (8.5–12.7)	396	28 (23.1–31.9)
Self-reported burial practices within past month of interview (for persons dying of any cause)											
Participated in any burial ceremony in the past month:	Yes/No	**5,532**	**20**	2457	18 (16.0–19.0)	897	31 (27.5–33.5)	1,411	17 (14.8–18.8)	767	18 (15.6–21.0)
Washed the corpse	Open-ended, unprompted	**1,082**	**6**	431	1 (0.3–2.5)	274	3 (0.9–4.9)	237	5 (2.3–7.9)	140	16 (9.7–21.7)
Touched the corpse		**1,082**	**4**	431	4 (1.8–5.2)	274	5 (2.5–7.7)	237	5 (2.3–7.9)	140	19 (12.2–25.0)
Touched others at the burial ceremony (e.g., hug, handshake)		**1,082**	**26**	431	13 (9.4–15.6)	274	44 (38.3–50.1)	237	21 (15.5–25.9)	140	33 (25.1–40.7)
Cried over the corpse but did not touch it		**1,082**	**27**	431	17 (13.2–20.2)	274	30 (24.9–35.7)	237	42 (35.9–48.5)	140	22 (15.2–29.0)

Abbreviations: CI = confidence interval; DK = don't know.

* Weighted percentages based on poststratification adjustments with probability proportional to population size of the participant's administrative region.

† As of August 2015, Maritime Guinea reported the total highest number of Ebola cases; all of its prefectures had reported cases, and it was the only natural region with active transmission (in Conakry and Forécariah prefectures) at the time of data collection.

§ As of August 2015, Middle Guinea was the region least affected by Ebola, and six of the 10 prefectures had never reported Ebola cases.

¶ As of August 2015, Upper Guinea had experienced low numbers of Ebola cases, and two of the eight prefectures had never reported Ebola cases.

** As of August 2015, Forest Guinea had no active transmission. However, it reported the first Ebola cases of the epidemic and eventually reported cases in all six prefectures.

†† Proportions of eligible participants who did not respond or replied "don't know" were as high as 51.2% in Middle Guinea, 44.5% in Maritime Guinea, 41.4% in Guinea Upper, and 38.2% in Forest Guinea. These participants were not excluded from denominators when calculating percentages.

§§ Ebola survivors were defined as persons previously infected with Ebola who had been discharged from an Ebola Treatment Center and certified by government health officials to have been cured of the disease.

¶¶ Expressed one or more of the following attitudes about Ebola survivors: 1) survivors certified to be cured of Ebola could infect others through casual contact, 2) would not buy fresh vegetables from survivor certified by government to be cured of Ebola, and 3) would not welcome back into community a survivor declared to be cured of Ebola.

common among respondents in Forest Guinea (57%). Among 1,082 (20%) participants who had recently attended burials of persons who had died from any cause, a minority reported washing (6%), touching (4%), or crying over the corpse without touching it (27%), but 26% reported touching other burial attendees. Participants from Forest Guinea were more likely to report recently washing (16%) or touching (19%) corpses than were participants from other regions (Table 2).

Discussion

Eighteen months after the start of a devastating Ebola epidemic, most participants in this geographically diverse sample understood principal aspects of Ebola transmission and prevention, reported taking actions to reduce their risk for acquiring Ebola, and indicated they would use safer case management and burial practices for relatives with suspected Ebola. However, a substantial percentage of participants harbored misconceptions about Ebola transmission or expressed reticence about close proximity to Ebola survivors, including persons certified by the government to be cured of the disease. Although the World Health Organization declared Guinea to be Ebola-free by late 2015, clusters of Ebola cases occurred in 2016, partly through sexual transmission from survivors with persistence of Ebola virus in semen (*9*). These data underscore the value of ongoing health promotion efforts to prevent sporadic transmission or future outbreaks, including messaging that aims to reverse misconceptions about Ebola transmission and prevention, to clarify duration and modes of transmission from survivors, and to address stigma that survivors might face as they recover, rebuild their lives, and reintegrate into communities. Regional variations in the epidemic and related response activities might have resulted in the regional differences in attitudes and suggest

that targeting health communication by region might be more effective than a uniform, national approach. Underlying differences in customs and traditions across different ethnic populations might have contributed to regional variation in attitudes and behaviors, especially regarding burials.

The assessment was the first national-level quantitative evaluation of Ebola-related burial practices among persons who attended a burial in West Africa during a period of ongoing Ebola transmission. It revealed that most participants would forsake traditional burial preparations involving washing or touching Ebola-affected corpses and would adopt safer practices without corpse contact. Compared with residents of other regions, residents of Forest Guinea were far more likely to indicate a preference for keeping a safe distance from Ebola-affected corpses. However, among the subset of persons who had recently attended burials for deaths from any cause, Forest Guinea residents were substantially more likely to have washed or touched corpses than were residents of other regions. The Forest Guinea region was the first region in the country to report Ebola cases and, unlike other regions, had contained its outbreak several months before the survey. This might explain why Forest participants reported a lower perceived risk for Ebola and might have reverted to traditional, high-contact burial practices for persons dying from causes other than Ebola. These findings underscore the observation that changes in cultural practices to combat highly infectious diseases such as Ebola might be transient, and that in-depth community engagement or new resources, such as cadres of professional body washers, might help prevent future transmission of infectious diseases related to corpse contact (*10*).

The findings in this report are subject to at least four limitations. First, because of the need to conduct the survey during the ongoing epidemic, interviewers did not validate the comprehension of some survey questions in French or other languages. Second, some participants might have provided socially desirable responses aligned to government recommendations rather than their actual opinions. For instance, government messages to encourage social distancing from Ebola-affected persons during the epidemic might have explained the reticence about close contact with Ebola survivors that some interviewers observed. Third, this analysis did not examine the relation between attitudes and exposure to health promotion interventions or messages. Finally, the sample was not nationally representative because of the partial randomization needed to intentionally oversample heavily affected areas, and the need to seek consent from heads of households, who were usually older men.

Despite their limitations, the mobile data collection tools permitted generation of preliminary findings that were shared with several organizations in Guinea within a few days of the interviews; this information was used to guide the ongoing response and health communication efforts, which contributed to eventual control of the epidemic. Such rapid KAP surveys, conducted during an outbreak, can provide important information for health communications efforts that can contribute to controlling an outbreak at its source, and thereby enhance global health security.

Summary

What is already known about this topic?

Assessments of knowledge, attitudes, and practices (KAP) in countries affected by the Ebola virus disease (Ebola) epidemic during 2014–2015 found that although most participants understood many aspects of Ebola transmission and prevention, misconceptions about the disease and transmission modes persisted. In Guinea, health officials suspected that traditional burial preparations and funeral rites involving corpse contact promoted transmission, but they lacked national-level data about these practices.

What is added by this report?

As the Ebola epidemic waned in Guinea, a KAP survey found that most participants understood Ebola causes, transmission, and prevention, but nearly half believed that Ebola could be transmitted by mosquitoes or ambient air. The majority of participants reported more frequent handwashing and avoiding physical contact with persons suspected of having Ebola. Nearly all participants reported they would seek specialized treatment for family members with suspected Ebola and would engage special burial teams if someone died from Ebola in their homes. More than half would observe Ebola-affected corpses from a safe distance that would avoid corpse contact, but there was considerable regional variation in that finding.

What are the implications for public health practice?

KAP information collected during an epidemic can yield data to guide response and recovery efforts, health education, and social mobilization. Future activities should aim to reverse misconceptions about Ebola transmission and prevention, clarify duration and modes of transmission from survivors, prevent stigmatization of Ebola survivors, and foster safer case management and burial practices.

Acknowledgments

From Conakry, Guinea: 75 sampling specialists and interviewers who recruited or interviewed participants; approximately 6,000 Guinean residents and district leaders who participated in some aspect of the survey; Sakoba Kéïta, Ministry of Health; Kadijah Bah, Santé Plus; Barry Ibrahima Kholo, Institute of Nutrition and Health; Paul Sengeh, FOCUS 1000; Mohamed Ag Ayoya, Guy Yogo, Jean-Baptiste Sene, Esther Braud, UNICEF-Guinea. From the United States: Alison Amoroso, Benjamin Dahl, Stephanie I. Davis, Rana Hajjeh, Amy Lang, Judy Lipshutz, Amanda MacGurn, Craig Manning, Sharmila Shetty, Kerri Simone, Frank Strona, Brittany Sunshine, Leigh Willis, Mary Claire Worrell, CDC; Sean Southey, PCI Media Impact, New York, New York.

Conflict of Interest

No conflicts of interest were reported.

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Reporting Deaths Among Children Aged <5 Years After the Ebola Virus Disease Epidemic — Bombali District, Sierra Leone, 2015–2016

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Mortality surveillance and vital registration are limited in Sierra Leone, a country with one of the highest mortality rates among children aged <5 years worldwide, approximately 120 deaths per 1,000 live births (*1*,*2*). To inform efforts to strengthen surveillance, stillbirths and deaths in children aged <5 years from multiple surveillance streams in Bombali Sebora chiefdom were retrospectively reviewed. In total, during January 2015–November 2016, 930 deaths in children aged <5 years were identified, representing 73.3% of the 1,269 deaths that were expected based on modeled estimates. The "117" telephone alert system established during the Ebola virus disease (Ebola) epidemic captured 683 (73.4%) of all reported deaths in children aged <5 years, and was the predominant reporting source for stillbirths (n = 172). In the absence of complete vital events registration, 117 call alerts markedly improved the completeness of reporting of stillbirths and deaths in children aged <5 years.

The 2016 National Civil Registration Act established a new authority in Sierra Leone responsible for recording vital events.* The act is an essential step toward improving national death reporting and registration, which are currently largely paper-based and limited in coverage. Improving death reporting is needed to enhance disease reporting, facilitate more rapid disease control, and enhance global health security. In March 2017, Sierra Leone implemented an electronic reporting system, Integrated Disease Surveillance and Response, which includes facility-based maternal mortality reporting (*3*). Discussions are ongoing regarding adding deaths among children aged <5 years to the reporting. Until further improvements in reporting systems are introduced, decision-makers must rely on modeled national mortality rate estimates for children aged <5 years.

Preparations are underway to implement a Child Health and Mortality Prevention Surveillance (CHAMPS)† site in Bombali Sebora chiefdom, Bombali District, northern Sierra Leone (population approximately 161,000). CHAMPS seeks to generate high-quality cause-of-death data for children aged <5 years through multifaceted postmortem investigations. A baseline assessment of surveillance for stillbirths and deaths among children aged <5 years was conducted during 2015–2016 to guide surveillance strengthening and CHAMPS cause-of-death investigations.

The main objectives of the assessment were to assess the relative contributions of different reporting mechanisms to death ascertainment and to evaluate reporting completeness by comparing the number of documented deaths with national mortality estimates calculated from modeling. Eligible cases were defined as stillbirths and deaths among resident Bombali Sebora children aged <5 years that occurred from January 1, 2015 through November 25, 2016.

Data from three existing reporting streams were used in this analysis. The first was the 117 telephone alert system; the second included records from eight Bombali Sebora health facilities, and the third contained vital records from the Makeni Office of Births and Deaths. The toll-free 117 phone alert system was established in August 2014 to allow rapid notification and investigation of suspected Ebola cases and all deaths from the community (*4*). After the epidemic, the phone alert system remained in place under a policy of mandatory death reporting and Ebola testing, and changed to report all deaths in July 2016. Telephone alert calls peaked in October 2014 at >11,000 per week; by December 2016, calls had decreased to <500 per week.

Data on stillbirths and deaths in children aged <5 years from handwritten health facility and Office of Births and Deaths records were abstracted into prepared excel spreadsheets. Deaths were linked across data sources using the child's name (or the mother's name for stillbirths), date of death or stillbirth, age, sex, residence address, and location of death as identifiers. Because denominators for calculating rates and expected numbers of stillbirths and deaths among children aged <5 years in Bombali Sebora were unavailable, expected numbers of stillbirths and deaths were calculated§ using national mortality rates for all children aged <5 years (approximately 120 of 1,000 live births)(*1*,*2*), infants (death during the first year of life; 87 per 1,000), and neonates (deaths during the first 28 days of life; 35 per 1,000 live births), national stillbirth rate (27 per 1,000 births)(*4*), and crude estimates of the birth rate (34.2 births per 1,000 population) (*5*,*6*).

* http://www.parliament.gov.sl/dnn5/LinkClick.aspx?fileticket=hUAMYdkuwpU%3D&tabid=79&mid=650.

† https://champshealth.org/.

§ Expected deaths in children aged <5 years were calculated using the following formula: deaths = live births x national published mortality rate for children aged <5 years and stillbirth rate (SBR). Expected stillbirths were calculated using the following formula: stillbirths = live births x stillbirth rate (SBR)/(1 – SBR).

After consolidation and deduplication of records identified in the three data sources, 172 unique stillbirths and 930 unique deaths among children aged <5 years were identified, including 249 neonatal deaths (27%), 247 (27%) deaths in infants aged 1–11 months, and 434 (47%) deaths in children aged 1–4 years (Figure) (Table). Death reports from health facilities and vital records were lowest in early 2015, when multiple facilities remained closed because of the Ebola epidemic. There was minimal overlap among the different reporting streams: only 11% of deaths were reported through more than one source (Figure). The majority of deaths (600; 65%) were documented through 117 phone alert only, followed by 20% (187) through health facilities only, and 5% (45) through vital records only. The proportion of deaths reported by phone alert decreased from 81% in 2015 to 65% in 2016. The percentage of expected deaths that were reported declined from 92% in 2015 to 53% in 2016. The number of infant deaths reported varied most from the number expected: reported infant deaths were 70% of expected in 2015 and 37% of expected in 2016.

Among an expected 277 stillbirths, 172 (62%) were reported. A majority of stillbirths were reported through phone alert (107; 62%) or health facility records only (53; 31%), with one stillbirth identified through a death record, and 11 (6%) by more than one source. Stillbirth reporting patterns were inconsistent over time and information on gestational age at delivery was rarely available.

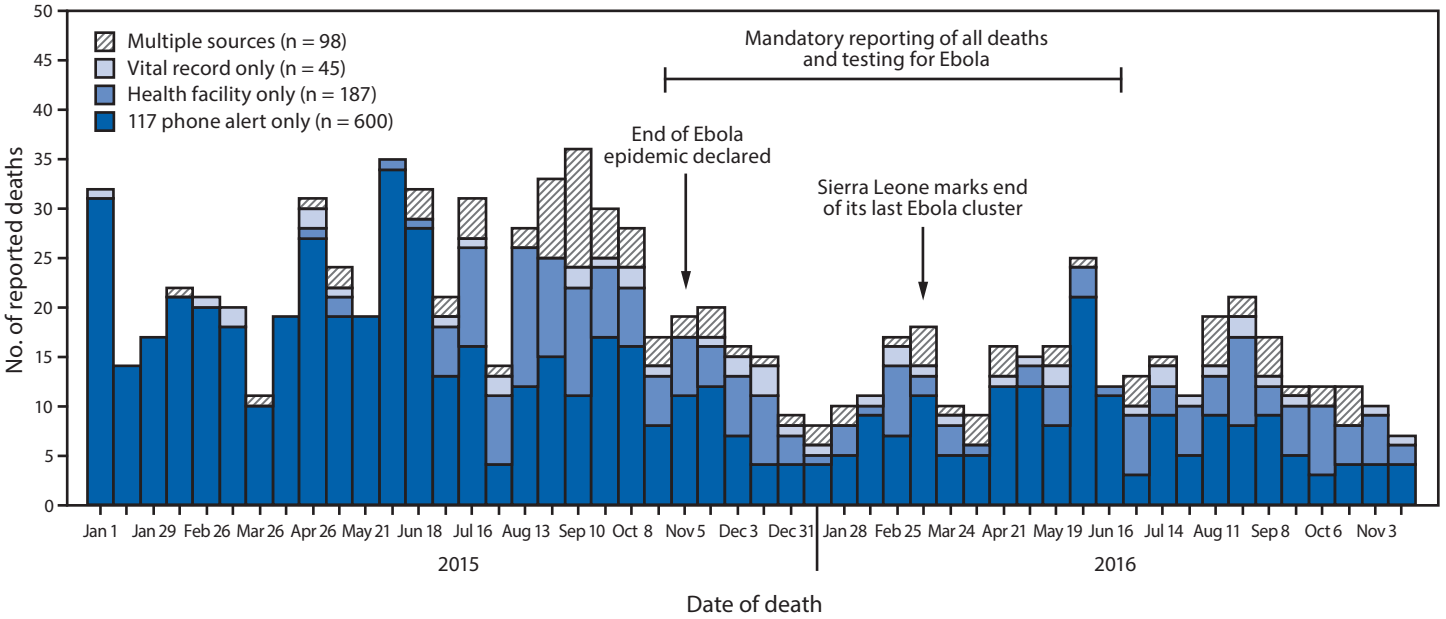
TABLE. Number of expected and reported stillbirths and deaths among children aged <5 years, by year — Bombali Sebora chiefdom, Bombali District, Sierra Leone, January 2015–November 2016

Reported and expected deaths	Stillbirths	Total deaths among children aged <5 years	Infant deaths (0–12 months)	Neonatal deaths (0–27 days)
Jan–Dec 2015				
Reported*	91	**606**	334	161
Expected†	145	**662**	480	193
Ratio (reported/ expected)	0.63	**0.92**	0.70	0.83
Jan–Nov 2016				
Reported*	81	**324**	162	88
Expected†	132	**607**	440	177
Ratio (reported/ expected)	0.61	**0.53**	0.37	0.50
Overall				
Reported*	172	**930**	496	249
Expected†	277	**1,269**	920	370
Ratio (reported/ expected)	0.62	**0.73**	0.54	0.67

* Reported stillbirths and deaths among children aged <5 years were ascertained through one or more of the following reporting streams: 1) the 117 phone alert system established during the Ebola virus disease epidemic; 2) records from eight Bombali Sebora health facilities, and 3) vital records from the Makeni Office of Births and Deaths.

† Expected numbers were estimated using national under-5, infant, and neonatal mortality rates (120, 87, and 35 deaths per 1,000 live births, respectively), stillbirth rate (SBR) (27 stillbirths per 1,000 births), and crude birth rate (34.2 births per 1,000 population). Deaths in children aged <5 years were calculated using the formula: deaths = live births x mortality rate; stillbirths were calculated using the formula: stillbirths = live births x SBR /(1 – SBR).

FIGURE. Number of reported deaths in children aged <5 years (N = 930), by reporting source* — Bombali Sebora chiefdom, Bombali District, Sierra Leone, January 2015–November 2016



Abbreviation: Ebola = Ebola virus disease.

* Reported deaths among children aged <5 years were ascertained through one or more of the following reporting streams: 1) the 117 phone alert system established during the Ebola virus disease epidemic; 2) records from eight Bombali Sebora health facilities, and 3) vital records from the Makeni Office of Births and Deaths.

Discussion

On the basis of the national estimates used for these analyses, stillbirths and deaths in children aged <5 years are underreported in Bombali Sebora chiefdom; use of all available sources is needed to improve death reporting in this chiefdom. The 117 phone alert system captured community-based deaths and stillbirths not recorded through health facility and vital records.

The findings in this report are subject to at least three limitations. First, expected stillbirths and deaths were calculated based on point estimates; therefore, comparisons with reported cases should be interpreted with caution. Second, case misclassification might have occurred because of age estimation errors and inconsistent application of a standard case definition for stillbirths. Stillbirth classification was largely self-defined by reporters, and there is a high likelihood that certain spontaneous miscarriages and early neonatal deaths were included. Finally, when interpreting trends in stillbirth and child mortality over time, it is important to note that separating the effects of the Ebola epidemic on child mortality from changes in reporting and documentation was not possible. For example, the July 2016 change to nonmandatory 117 death reporting would be expected to lead to a decline in death reporting through this source; however, the contribution of this change to the proportion of expected deaths that were reported could not be determined. Despite these limitations, the findings in this report indicate that surveillance in this setting can be strengthened by using multiple data sources, which together capture both community and facility deaths. These findings also demonstrate that community-based reporting strategies, such as phone alerts, can be implemented in countries with incomplete death registration to supplement vital events records.

Sierra Leone continues to use the 117 phone alert system to improve national disease surveillance and plans are in place to include the system for death reporting as part of enhanced child mortality surveillance through CHAMPS in Sierra Leone. Additional strategies are needed to improve overall child morality surveillance and to promote post-Ebola community participation in death reporting using the 117 phone alert system.

Acknowledgments

Ministry of Health and Sanitation, Sierra Leone; eHealth Africa, Sierra Leone; CDC Country Office, Sierra Leone; Robert F. Breiman, MD, Jeffrey P. Koplan, MD, Emory Global Health Institute, Emory University, Atlanta, Georgia.

Conflict of Interest

No conflicts of interest were reported.

Summary

What is already known about this topic?

Inadequate vital events registration is common in low- and middle-income countries, including Sierra Leone. To estimate child mortality in the absence of reliable vital records, additional data sources are needed.

What is added by this report?

Assessing multiple death reporting streams, including the 117 phone alert system established during the Ebola virus disease outbreak, improved ascertainment of deaths among children aged <5 years and stillbirths.

What are the implications for public health practice?

Community-based reporting strategies (e.g. phone alerts) can be implemented in countries with incomplete death registration to supplement vital events records and strengthen child mortality surveillance.

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Notes from the Field

Counterfeit Percocet–Related Overdose Cluster — Georgia, June 2017

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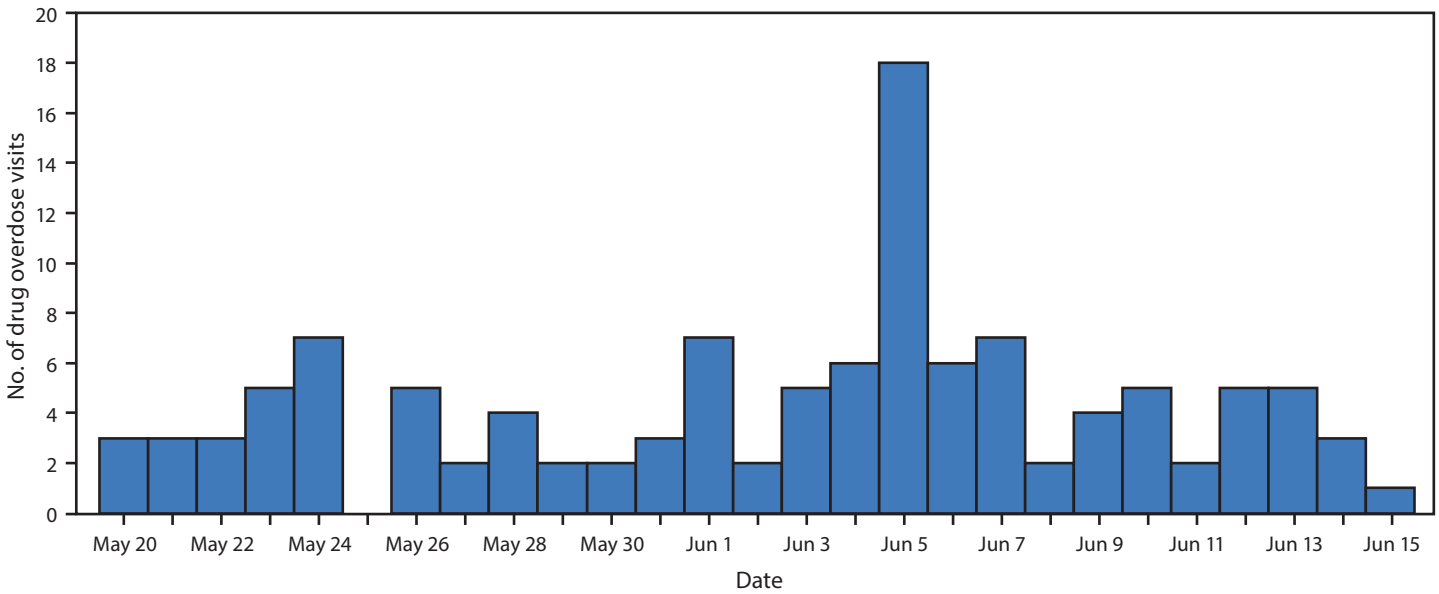
On June 5, 2017, a Georgia North-Central Health District emergency department (ED) notified the Georgia Poison Center of six opioid overdoses and one death during the previous day. All patients had severe respiratory depression, loss of consciousness, or both, and some required high naloxone doses and mechanical ventilation. Two patients reported taking one or two pills that they believed to be Percocet, purchased without a prescription, on the street.

The Georgia Poison Center notified area hospitals and a Georgia Department of Public Health (GDPH) epidemiologist, who informed partners, including 1) health district epidemiologists, who worked with hospitals; 2) the Georgia Bureau of Investigation, which performed drug testing; 3) the High Intensity Drug Trafficking Area office, which notified law enforcement; 4) local coroners, who reported related deaths to GDPH; and 5) the GDPH Office of Emergency Medical Services (EMS), which notified EMS providers and the medical community. A coordinated communication effort led to two multiagency press conferences on June 6 to notify the public about the presence of the dangerous counterfeit pills.

A counterfeit Percocet cluster case was defined as 1) an opioid toxidrome (i.e., with central nervous system depression, respiratory depression, and pupillary miosis) requiring resuscitation, ventilation, naloxone, or all three; 2) a history of purchasing street pills; and 3) ingestion of as few as one or two pills, resulting in disproportionately severe central nervous system, respiratory, or cardiovascular depression occurring in a person evaluated by EMS or at an ED since June 1, 2017 (*1*). During June 6–13, EMS providers and EDs reported possible cases daily, and district epidemiologists reviewed medical records to determine whether patients met the case definition. Concomitant syndromic surveillance was conducted by reviewing Georgia statewide ED admission data received daily, using a text-search for drug overdose syndrome. This surveillance was used to determine whether the cluster extended beyond the initially identified area. Local law enforcement personnel delivered pills obtained from one patient to the Georgia Bureau of Investigation crime laboratory for chemical analysis.

Syndromic surveillance demonstrated a sharp increase in overdoses reported by EDs on June 5 (Figure). Chemical analysis of obtained pills identified cyclopropyl fentanyl and U-47700, two rare and potent illicit synthetic opioids. The source of the pill was not identified.

FIGURE. Drug overdose emergency department visits,* — North-Central Health District, Georgia, May–June, 2017



* The figure depicts all emergency department visits that met the overdose syndrome definition. Syndromic surveillance data cannot be used to determine whether these visits met the counterfeit Percocet cluster case definition, but they can monitor trends in overdoses. The North-Central Health District consists of 13 counties in central Georgia (http://northcentralhealthdistrict.org/).

Among the 37 possible cases reported initially (including five deaths), 27 cases (including one death) that occurred during June 4–13 met the counterfeit Percocet cluster case definition. Of the 27 patients, 16 (59%) were male, and 19 (70%) were black; median age was 34 years (range = 19–69 years). Symptoms included loss of consciousness (25 patients [93%]) and respiratory distress (22 [81%]). Twenty-five (93%) patients received naloxone, and 11 (41%) required intubation and mechanical ventilation. Routine urine drug screens were positive for multiple drugs in 16 (59%) patients; synthetic opioids are not detected by these screens.

E-mail descriptions of the pills and related overdoses were sent from the High Intensity Drug Trafficking Area office to law enforcement personnel and from GDPH to EMS and the medical community to alert all to the danger of these pills and how to prevent occupational exposure (*2*), to note that Georgia law specifies a naloxone standing order allowing anyone to purchase it (*3*), and to share the CDC opioid prescribing guideline with prescribers (*4*). Rapid identification, notification, public messaging, and a coordinated response among members of the health care community, public health agencies, and law enforcement personnel contributed to curtailing this outbreak.

Conflict of Interest

No conflicts of interest were reported.

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Announcement

Community Preventive Services Task Force Recommendation for Comprehensive Telehealth Methods to Deliver Dietary Interventions for Chronic Disease Management

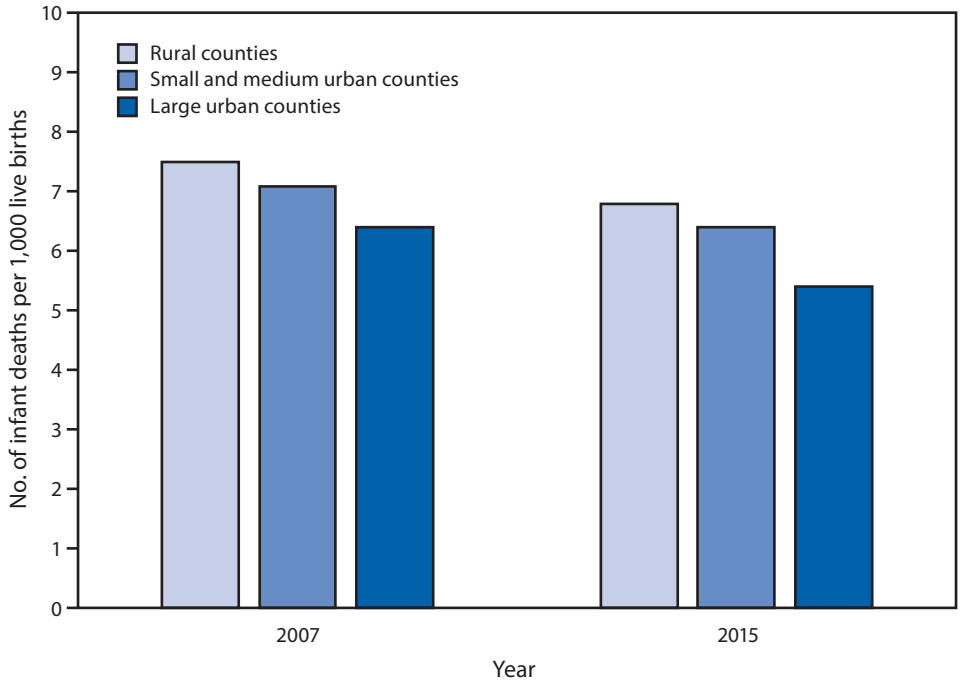
The Community Preventive Services Task Force (CPSTF) recently posted new information on its recommendation regarding telehealth interventions to supplement the care of adults with chronic diseases affected by diet. "Health Information Technology: Comprehensive Telehealth to Deliver Dietary Interventions to Patients with Chronic Diseases" is available at https://www.thecommunityguide.org/findings/health-information-technology-comprehensive-telehealth-deliver-dietary-interventions.

Established in 1996 by the U.S. Department of Health and Human Services, the CPSTF is an independent, nonfederal panel of public health and prevention experts whose members are appointed by the director of CDC. The CPSTF provides information for a wide range of persons who make decisions about programs, services, and other interventions to improve population health. Although CDC provides administrative, scientific, and technical support for the CPSTF, the recommendations developed are those of the task force and do not undergo review or approval by CDC.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Infant Mortality Rate, by Urbanization Level* — National Vital Statistics System, United States, 2007 and 2015



* Urbanization level is based on maternal county of residence. Counties were classified according to their metropolitan status using the National Center for Health Statistics Urban–Rural Classification Scheme. https://www.cdc.gov/nchs/data_access/urban_rural.htm.

In both 2007 and 2015, infant mortality rates were highest in rural counties (7.5 infant deaths per 1,000 live births and 6.8, respectively). Rates were lower in small and medium urban counties (7.1 in 2007 and 6.4 in 2015) and lowest in large urban counties (6.4 in 2007 and 5.4 in 2015). For all three urbanization levels, infant mortality rates were significantly lower in 2015, compared with rates in 2007.

Source: National Vital Statistics System, linked birth/infant death period files, 2007 and 2015. https://www.cdc.gov/nchs/nvss/linked-birth.htm.

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ISSN: 0149-2195 (Print)