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Locally Acquired Dengue --- Key West, Florida, 2009--2010

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Dengue is the most common vector-borne viral disease in the world, causing an estimated 50--100 million infections and 25,000 deaths each year (*1*). During 1946--1980, no cases of dengue acquired in the continental United States were reported. Since 1980, a few locally acquired U.S. cases have been confirmed along the Texas-Mexico border, temporally associated with large outbreaks in neighboring Mexican cities (*2--4*). On September 1, 2009, a New York physician notified the Monroe County (Florida) Health Department (MCHD) and the Florida Department of Health (FDOH) of a suspected dengue case in a New York state resident whose only recent travel was to Key West, Florida. CDC confirmed the diagnosis, and a press release was issued to notify the public and Key West physicians of the potential risk for locally acquired dengue infections. In the next 2 weeks, two dengue infections in Key West residents without recent travel were reported and confirmed. Subsequently, enhanced and active surveillance identified 24 more Key West cases during 2009. On April 13, 2010, another Key West dengue case was reported to FDOH, bringing the total to 28. This report describes the first three dengue cases reported in 2009, briefly summarizes the 2010 case, highlights preliminary findings from the ongoing investigation, and outlines measures used to mitigate and control the outbreak. Clinicians should include dengue in the differential diagnosis of acute febrile illnesses in patients who live in or have recently traveled to subtropical areas of the United States or to the tropics.

Case Reports

Case 1. On August 11, 2009, a previously healthy woman aged 34 years from Rochester, New York, went to her primary-care provider after 1 day of fever, headache, malaise, and chills. A urine analysis revealed bacteruria and hematuria, and she was treated for a presumptive urinary tract infection. Two days later, on August 13, she returned to her primary-care provider with a worsening headache, retro-orbital pain exacerbated by eye movement, and complaints of feeling light-headed, although her fever had resolved. Physical examination determined that she was alert and oriented but had substantial discomfort from her headache; further neurologic evaluation determined that the patient had the Romberg sign. She was referred to a local emergency department for further evaluation and management. At the emergency department, she had a temperature of 98.8ºF (37.1ºC), heart rate of 85 beats per minute, blood pressure of 117/96 mmHg, and respiratory rate of 16 breaths per minute. A complete blood cell (CBC) count revealed a low white blood cell count of 3,900/μL (normal: 4,500--10,500/μL), a normal hematocrit of 43%, and a low platelet count of 115,000/μL (normal: >150,000/μL). Her evaluation included an unremarkable computed tomography scan of the head and lumbar puncture. The patient's light-headedness resolved, and she was discharged to home after a 7.5-hour stay in the emergency department.

On August 17, the woman returned to her primary-care provider, saying, "I don't feel right." On examination she had a temperature of 98.8ºF (37.1ºC), heart rate of 76 beats per minute, blood pressure of 122/60 mmHg, trace pedal edema bilaterally, and petechiae on her lower extremities. During this third visit, a consulting infectious-disease specialist raised the possibility of dengue infection, despite no recent travel by the patient to a known dengue-endemic area. However, on the day of illness onset, she had returned from a 1-week trip to Key West, where she had received multiple mosquito bites.

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Testing of a serum specimen at a private laboratory revealed dengue immunoglobulin M (IgM) antibodies. After her physician notified MCHD of the test result, the patient's serum specimen from August 17, a cerebral spinal fluid (CSF) specimen from August 13, and a repeat serum specimen from September 3 were sent to CDC for confirmatory testing. Both serum specimens were positive for dengue IgM antibodies by IgM-capture enzyme-linked immunosorbent assay (MAC ELISA). Dengue virus serotype 1 (DENV-1) was detected by reverse transcription--polymerase chain reaction (RT-PCR) from the CSF specimen. The patient had improved when she returned to her primary-care provider on August 19, and she had completely recovered when interviewed by MCHD on September 1.

Case 2. On August 31, 2009, a man aged 48 years from Key West who reported no recent travel outside Florida went to a clinic with a febrile illness that began August 25. The fever was accompanied by headache, myalgia, arthralgia, vomiting, and a truncal maculopapular rash. Laboratory results on that visit included a white blood cell count of 4,900/μL (normal: 4,500--10,500/μL), an elevated hematocrit of 51.1% (normal: 39%--50%), a low platelet count of 82,000/μL (normal: >150,000/μL), aspartate aminotransaminase (AST) of 59 U/dL (normal: 15--41 U/dL), and alanine aminotransaminase (ALT) of 78 U/dL (normal: 15--41 U/dL). The patient was diagnosed with a viral syndrome and instructed to return to the clinic in 2 days. He returned on September 2, at which time he requested diagnostic testing for dengue because he had learned of possible dengue transmission in the area. Testing of a serum specimen at a private laboratory identified dengue IgM antibody. Serum from this specimen and a repeat specimen obtained on September 23 were positive at CDC for dengue IgM by MAC ELISA. All of the man's symptoms, except for minor fatigue, resolved and his hemoglobin and platelet counts normalized by September 15.

Case 3. While following up on the second case, a nurse at MCHD learned that the patient's wife, aged 46 years, had a similar febrile illness beginning on September 9. Her symptoms included headache, eye pain, pruritic truncal rash, nausea and vomiting, chills, and abdominal pain. A diagnosis of dengue subsequently was confirmed by CDC with detection of dengue IgM in a serum specimen by MAC ELISA.

Latest reported case. On April 9, 2010, a man aged 41 years from Key West was hospitalized with hematuria, leukopenia, and thrombocytopenia. His symptoms had begun April 5 with onset of myalgia, arthralgia, and fever, followed by development of a petechial rash and gingival bleeding on April 7. The patient previously had traveled to dengue-endemic regions but reported no travel outside the United States in 18 months. Initial testing at FDOH laboratories of a serum specimen collected April 13 detected IgM antibodies against both dengue and West Nile virus. Subsequent testing at CDC confirmed the serologic results and additionally confirmed the diagnosis of a recent dengue infection by detecting the presence of dengue-specific nonstructural protein 1 (NS-1) in the serum specimen.

Control Measures and Investigation

In response to the three cases of locally acquired dengue, the Florida Keys Mosquito Control District (FKMCD) increased the frequency of truck and aerial spraying to control adult mosquito populations and initiated an intense door-to-door campaign to find and eliminate mosquito breeding sites. Larvicide and handheld adulticide foggers were used when mosquitoes and larvae were found, and ovitrapping and collection of adult mosquitoes was enhanced. During September--December 2009, a total of 407 pools of adult female *Aedes aegypti* mosquitoes from throughout Key West were collected and tested for dengue by PCR at FDOH. Two mosquito pools collected in mid-October tested positive for DENV-1. Testing of mosquito pools in Key West for the presence of dengue is ongoing, and FKMCD and CDC also are testing *Ae. aegypti* mosquitoes in Key West for evidence of insecticide resistance. A public education campaign was conducted by MCHD and FKMCD to emphasize the importance of eliminating mosquito breeding sites and to encourage personal prevention measures against mosquito bites. In addition, FDOH and CDC are providing physician education in south Florida regarding the early identification, prevention, and treatment of dengue.

To determine the extent of dengue infection in the Key West community, a serosurvey was conducted by FDOH and CDC, using randomly selected households, during September 23--27, 2009. Of 240 participants tested, 13 (5.4%) had evidence of recent dengue infection. In addition, Key West physicians were contacted by MCHD and asked to send serum specimens to CDC from all patients with signs and symptoms consistent with dengue. Of 21 specimens submitted during September 23--November 27, nine (42.9%) were positive by either dengue RT-PCR (three), NS-1 assay (one), or IgM ELISA (five). For additional case finding, medical records from three acute health-care facilities in Key West were reviewed for patients treated during July 15--September 15 who had symptoms consistent with dengue infection. Of six persons considered to have dengue-like illnesses and contacted for testing, four were positive for recent dengue infection. Because two of the four cases also had been counted in the serosurvey, the total number of dengue cases acquired in Key West in 2009 was 27, including the index case in the traveler from New York and the 26 cases in Key West residents.

Onset dates in the 27 Key West residents ranged from July 22, 2009, to April 5, 2010 (Figure), indicating that transmission began occurring before the August 10, 2009, onset of symptoms in the New York resident and continued for months afterward. The 28 pa-

tients ranged in age from 15 to 73 years (median: 47 years). Fever was reported by all 28; headache, myalgia, arthralgia, eye pain, and rash also were commonly reported (Table). Six patients reported some type of bleeding; four had blood in their urine, two reported gingival bleeding, one reported excessive vaginal bleeding, and one reported epistaxis.

Reported by

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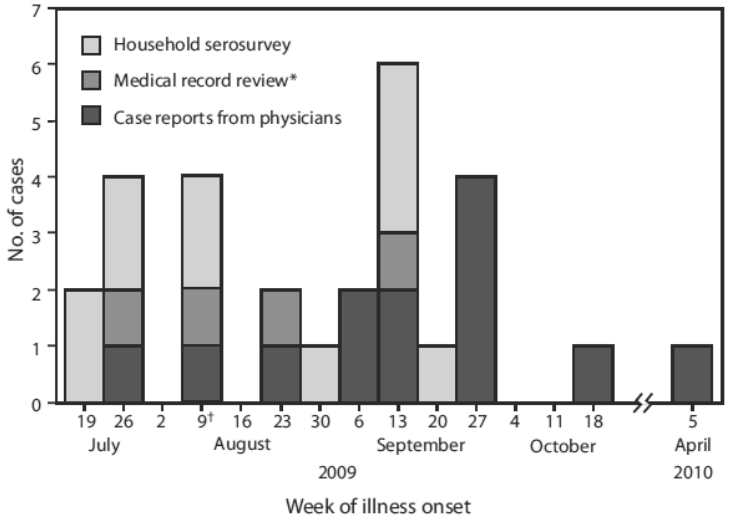
FIGURE. Number of locally acquired dengue cases (N = 28), by week of illness onset and method of identification --- Key West, Florida, 2009--2010



* Two cases identified in both household serosurvey and medical record review are shown as record review cases.

† Week of illness onset in index patient.

TABLE. Characteristics of patients (N = 28) with locally acquired dengue — Key West, Florida, 2009–2010

Characteristic	No.	(%)*
Sex		
Male	19	(68)
Female	9	(32)
Age group (yrs)		
<20	1	(4)
21–40	11	(39)
41–60	11	(39)
>60	5	(18)
Race		
White	24	(86)
Black	3	(11)
Asian/Pacific Islander	1	(4)
Ethnicity		
Non-Hispanic	25	(89)
Hispanic	3	(11)
Symptoms		
Fever	28	(100)
Headache	22	(79)
Myalgia	23	(82)
Arthralgia	18	(64)
Eye pain	14	(50)
Rash	15	(54)
Bleeding	6	(21)

* Percentages might not add to 100% because of rounding.

Editorial Note

The outbreak described in this report represents the first dengue cases acquired in the continental United States outside of the Texas-Mexico border since 1945 and the first locally acquired cases in Florida since 1934. Concern about the potential for emergence of dengue in the continental United States has increased in recent years (*5*). Reported dengue cases in South America, Central America, Mexico, and the Caribbean increased fourfold, from 1,033,417 during 1980--1989 to 4,759,007 during 2000--2007 (*6*). Rapid urbanization with a proliferation of man-made containers able to serve as mosquito-breeding sites, increased international travel, and lack of effective vector-control measures likely have been major factors in the spread of dengue. Since 1980, seven localized outbreaks have occurred along the Texas-Mexico border (*2--4*). The most efficient mosquito vector, *Ae. aegypti*, is found in the southern and southeastern United States. A secondary vector, *Ae. albopictus*, has spread throughout the southeastern United States since its introduction in 1985 and was responsible for a dengue outbreak in Hawaii in 2001, likely after the virus was introduced by a Hawaii resident returning from Tahiti (*7*).

Cases of dengue in returning U.S. travelers have increased steadily during the past 20 years (*8*). Dengue is now the leading cause of acute febrile illness in U.S. travelers returning from the Caribbean, South America, and Asia (*9*). Many of these travelers are still

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Thank You For Your Participation!

The Epidemiology Program would like to thank the Lead School Board Nurse, Eileen McGatlin, RN, BSN, NCSN, all the school board nurses, and all the school clinic assistants for their timely reports during this past school year, and especially for their enhanced surveillance for 2009 H1N1 influenza A.

For more information about Florida's List of Reportable Diseases/Conditions, please contact Gregory Danyluk, PhD at 407-665-3266.

Selected Diseases/Conditions Reported to the Seminole County Health Department	2010 through Week 17	2009 through Week 17	2008 through Week 17	2008–2010 Average
AIDS*	**22**	26	11	**20**
Animal Bite to Humans**	6	14	4	8
Animal Rabies	2	4	1	2
Campylobacteriosis	**3**	3	2	**3**
Chlamydia	407	352	405	388
Cryptosporidiosis	**2**	2	1	**2**
Cyclosporiasis	0	1	0	0
Dengue	0	0	0	0
E. coli O157:H7	0	0	1	0
Giardiasis	**12**	6	7	**8**
Gonorrhea	116	104	136	119
Haemophilus influenzae—Pneumonia	0	0	0	0
Hepatitis A	0	3	1	1
Hepatitis B	26	22	23	24
Hepatitis C	94	82	103	93
Hepatitis B in Pregnant Woman	4	3	6	4
HIV*	19	26	36	27
Lead poisoning	**2**	1	1	**1**
Legionnaire's disease	0	2	3	2
Lyme Disease	0	2	0	1
Meningococcal Disease	0	0	0	0
Pertussis	**1**	0	0	**0**
Salmonellosis	16	17	14	16
Shigellosis	**3**	0	4	**2**
S. pneumoniae – drug resistant	**8**	2	7	**6**
Syphilis	7	25	18	17
Tuberculosis	**4**	3	3	**3**
Varicella	**17**	7	9	**11**

* HIV data includes those cases that have converted to AIDS. These HIV cases cannot be added with AIDS cases to get combined totals since the categories are not mutually exclusive. Current AIDS/HIV data are provisional at the county level.

** Animal bite to humans by a potentially rabid animal resulting in a county health department or state health office recommendation for post-exposure prophylaxis (PEP), or a bite by a non-human primate.

Reported cases of diseases/conditions in **Bold** are >10% higher than the current three year average for the same time period.

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viremic upon return to the United States and potentially capable of introducing dengue virus into a community with competent mosquito vectors. Because of concerns over the increasing number of travel-associated dengue infections, the risk for local transmission upon introduction of the virus, and the risk for potential transmission of the virus by blood transfusion (*10*), the Council of State and Territorial Epidemiologists (CSTE) made dengue a nationally notifiable disease in 2009.

Many dengue infections, particularly in children, cause no symptoms or a nonspecific febrile illness, but dengue infection also can cause classic dengue fever or severe life-threatening disease (e.g., dengue hemorrhagic fever or dengue shock syndrome). Laboratory confirmation of dengue infection can be obtained by viral isolation or identification of dengue virus by dengue-specific PCR in a specimen collected within the first 5 days of illness (an acute phase specimen), or seroconversion demonstrated between a paired acute phase specimen and a convalescent phase specimen (collected within 6--30 days of illness onset). Dengue NS-1 also can be detected within the first 10 days after symptom onset by an assay that is currently not approved by the Food and Drug Administration. Probable recent dengue cases are defined by identification of dengue IgM antibodies in a single specimen. The dengue case definition and additional information regarding dengue diagnosis and reporting are available at http://www.cste.org/ps2009/09-id-19.pdf .

Why dengue has reemerged in Florida at this time is unknown. Dengue might have been present in the community earlier and is only now being detected. The environmental and social conditions for dengue transmission have long been present in south Florida: the potential for introduction of virus from returning travelers and visitors, the abundant presence of a competent mosquito vector, a largely nonimmune population, and sufficient opportunity for mosquitoes to bite humans. The increased volume of international travel has been implicated in the spread of dengue globally, and the popularity of south Florida as a tourist destination enhances the likelihood of virus introduction and subsequent local transmission. The volume of domestic visitors to the area also might increase the risk for localized transmission in other parts of the United States with competent mosquito vectors. The reemergence of dengue in Florida as well as the threat posed to the United States from other emerging mosquito-borne arboviruses (e.g., chikungunya) emphasizes the necessity for strong vector-borne surveillance and mosquito control infrastructure to rapidly identify and control outbreaks of dengue or other mosquito-borne diseases.

The timely reporting of dengue in the index patient from New York illustrates that, despite an absence of compatible travel history, clinicians throughout the United States should consider appropriate laboratory testing based upon clinical presentation. Had the index patient not been evaluated promptly and reported, the cases in Key West residents likely would not have been diagnosed. Dengue should be included in the differential diagnosis of acute febrile illnesses for patients who live in or have recently traveled to subtropical areas in the United States or to the tropics. This is particularly important when signs and symptoms such as thrombocytopenia, leukopenia, hemoconcentration, rash, or eye pain are present. Prompt reporting of suspected dengue cases to public health authorities can facilitate a coordinated response resulting in detection of locally acquired cases or helping to define new areas of transmission. Additional information regarding dengue prevention, diagnosis, and management is available at http://www.cdc.gov/dengue.

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