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A Cluster of Dengue Cases in American Missionaries Returning from Haiti, 2010

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Abstract. Dengue is an acute febrile illness caused by four mosquito-borne dengue viruses (DENV-1 to -4) that are endemic throughout the tropics. After returning from a 1-week missionary trip to Haiti in October of 2010, 5 of 28 (18%) travelers were hospitalized for dengue-like illness. All travelers were invited to submit serum specimens and complete questionnaires on pre-travel preparations, mosquito avoidance practices, and activities during travel. DENV infection was confirmed in seven (25%) travelers, including all travelers that were hospitalized. Viral sequencing revealed closest homology to a 2007 DENV-1 isolate from the Dominican Republic. Although most (88%) travelers had a pre-travel healthcare visit, only one-quarter knew that dengue is a risk in Haiti, and one-quarter regularly used insect repellent. This report confirms recent DENV transmission in Haiti. Travelers to DENV-endemic areas should receive dengue education during pre-travel health consultations, follow mosquito avoidance recommendations, and seek medical care for febrile illness during or after travel.

INTRODUCTION

Dengue, an acute febrile illness characterized by fever, headache, eye pain, myalgia, arthralgia, hemorrhage, and rash,[1] is a leading cause of febrile illness among travelers returning from the Caribbean.[2,3] Dengue is caused by the bite of an *Aedes aegypti* or *Ae. albopictus* mosquito[4,5] infected with one of four dengue viruses (DENV-1, -2, -3 and -4) that belong to the viral family *Flaviviridae*. Because there is currently no effective antiviral drug or vaccine available to treat or prevent dengue,[6,7] minimizing mosquito exposure while traveling is the most effective means of preventing infection.[8,9] Although no consistent surveillance for dengue exists in Haiti, mosquito vectors for dengue are present in Haiti,[10] and dengue has been documented in visitors to Haiti, including travelers,[11,12] military personnel,[13] and relief workers.[14,15] These observations, along with reports of dengue in native Haitians,[16–19] suggest that DENV transmission is endemic in Haiti.

After the 2010 Haiti earthquake, the Centers for Disease Control and Prevention (CDC) issued a briefing on dengue in Haiti as part of the emergency response plan after a volunteer returning from Haiti in January of 2010 with dengue-like symptoms was confirmed to be infected with DENV.[20] The patient worked for a charity organization in Port-au-Prince and reported having slept outside after the earthquake (CDC, unpublished data). CDC also issued a Health Alert Network advisory asking US physicians to be vigilant and report suspected cases of dengue among relief workers returning from Haiti.[21]

The Nebraska Department of Health and Human Services was notified by Nebraska's Central District Health Department in October of 2010 of a cluster of dengue-like illness among members of a missionary group recently returned from Haiti. The goals of this investigation were to (1) describe the clinical and laboratory characteristics of DENV-infected and non-infected travelers to Haiti, (2) describe pre-travel knowledge about dengue risk and methods to prevent disease, and (3) identify risk factors for DENV infection.

MATERIALS AND METHODS

Background. A group of 28 missionaries from Nebraska (n = 22) and Georgia (n = 6) traveled to the Carrefour region of Haiti in October of 2010, where they stayed in a house with non-closing/non-screened windows, no air conditioning, and intermittent electricity. Twenty-two travelers spent 7 days, three travelers spent 9 days, and three travelers spent 11 days in Haiti. The travelers provided humanitarian assistance while in Haiti, which included offering spiritual and community support, prayer walks, and organizing activities such as food drives, medical clinics, religious classes, and soccer games. Most activities were conducted during the daytime within walking distance of the house where the travelers stayed; most morning group meetings were conducted inside a nearby building, and evening group meetings were conducted on a nearby rooftop.

Laboratory methods. All travelers of the returning missionary group were offered laboratory testing for DENV infection by the CDC Dengue Branch diagnostic laboratory. Separate testing algorithms were used for travelers reporting any sign or symptom of illness during travel or within 14 days of returning home (i.e., symptomatic travelers) and travelers not reporting illness (i.e., non-ill travelers). For symptomatic travelers, specimens collected within 5 days of illness onset were considered acute, and specimens collected after 5 days of illness onset were considered convalescent. For non-ill travelers, because the period of viremia and the immune response in asymptomatic infections is not well-understood,[22] paired specimens were requested: first specimens were collected within 8 days of returning home, and second specimens were collected at least 14 days after the first specimen.

Diagnostic testing. Acute and first specimens were tested by real-time reverse transcription polymerase chain reaction (rRT-PCR) using DENV serotype-specific primers.[23] Acute or first specimens testing negative by rRT-PCR were subsequently tested by anti-DENV immunoglobulin M (IgM) antibody capture enzyme-linked immunosorbent assay

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(MAC-ELISA),[24] and a convalescent or second specimen was requested and tested by MAC-ELISA. To identify additional cases, convalescent or second specimens were screened for anti-DENV IgG antibody at a dilution of 1:100.[25,26] Because 50–80% of DENV infections can be asymptomatic,[22,27,28] anti-DENV IgG titers to detect seroconversion were determined on paired specimens positive at the screening dilution for symptomatic and non-ill travelers.

Laboratory definitions. Acute DENV infection was defined as a traveler with (1) any specimen testing positive by rRT-PCR or (2) paired specimens showing a fourfold or greater rise in anti-DENV IgG antibody with a 90% reduction in plaques in the specimen compared with the virus control in a plaque reduction neutralization test ($PRNT_{90}$) that confirmed specificity of antibodies against DENV.[29] No acute DENV infection was defined as a traveler with a convalescent or second specimen that tested negative by MAC-ELISA. Indeterminate DENV infection was defined as a traveler with a negative MAC-ELISA and rRT-PCR in the acute or first specimen with no convalescent or second specimen provided. A recent flavivirus infection was defined as a traveler with any specimen testing positive by MAC-ELISA.

Prior flavivirus exposure was defined as detection of anti-DENV IgG antibodies in an acute or first specimen. Because of known antibody cross-reactivity between flaviviruses,[30] paired specimens from travelers with prior flavivirus exposure were tested by $PRNT_{90}$ against DENV-1 to -4 and West Nile virus (WNV) to confirm prior flavivirus exposure.

Case definitions. A dengue case was defined as a symptomatic traveler with an acute DENV infection. A dengue non-case was defined as a traveler with no acute DENV infection. Dengue fever and severe dengue were defined according to the 2009 World Health Organization (WHO) guidelines.[1]

Epidemiologic investigation. All 28 travelers were invited to answer a 53-item questionnaire that collected information on the following topics: demographics; medical, vaccination (i.e., against yellow fever virus [YFV] or Japanese encephalitis virus [JEV]), and travel history; pre-travel preparation and knowledge of dengue; living arrangements while in Haiti; prevention activities used while in Haiti; and illness during travel or within 14 days of returning home. Travelers were subsequently asked to answer an 18-item supplementary questionnaire regarding participation in specific activities while in Haiti. Dengue case investigation forms (DCIFs; available at http://www.cdc.gov/Dengue/resources/TestpolEng_2.pdf) were completed for each traveler providing a serum specimen, and it recorded demographic, epidemiologic, and clinical information. Additional clinical course data was obtained from hospital discharge summaries. Initial and supplemental questionnaires were completed within 8 weeks of returning home. All travelers who had laboratory evidence of prior flavivirus exposure were asked if they recalled a prior flavivirus diagnosis (i.e., WNV, YFV, JEV, Saint Louis encephalitis virus, Murray Valley encephalitis virus, tick-borne encephalitis virus, or any other flavivirus). If a prior flavivirus diagnosis was reported, information regarding date of diagnosis, hospitalization status secondary to diagnosis, and symptoms associated with diagnosis were also collected.

Sequencing and phylogenetic analysis. Serum specimens were inoculated into cultured C6/36 (*Ae. albopictus*) cells, and the presence of virus was confirmed by rRT-PCR[23] and indirect immunofluorescence. Isolates were further propagated and viral RNA was extracted from culture supernatant using the Universal BioRobot System (Qiagen, Valencia, CA). The envelope glycoprotein (E) gene was amplified and sequenced; sequence data were restricted to the E gene open-reading frame (1,485 base pairs). Multiple sequence alignment was performed using the ClustalW module available in MEGA 5 (www.megasoftware.net). Evolutionary history was inferred using neighbor-joining trees. Evolutionary distances were computed, and several E gene sequences from GenBank were included in the phylogenetic tree to support tree topology by genotype (Supplemental Table 1).

Study design and statistical analyses. A retrospective cohort study was performed to identify differences between dengue cases and non-cases. This study underwent CDC human participants review and was determined to be public health practice and not research; as such, Institutional Review Board approval was not required. All travelers with indeterminate test results or who did not provide a serum specimen for diagnostic testing were excluded from analysis. Data were analyzed using SAS 9.2 (SAS Institute Inc., Cary, NC). Fisher exact test was used to calculate *P* values to test the statistical significance of association ($\alpha = 0.05$) between pre-travel dengue knowledge, mosquito avoidance practices, or participation in specific activities and acute DENV infection.

RESULTS

Identification of acute DENV infections. Of the 28 travelers, clinical information was available for 26 (93%), and 23 (82%) provided at least one serum specimen for diagnostic testing. Eighteen (69%) travelers reported any illness during travel or within 14 days of returning home. Seven (39%) of those travelers had an acute DENV infection, nine (50%) had no acute DENV infection, and one (6%) had indeterminate diagnostic testing; one (6%) symptomatic traveler did not provide a specimen. Of eight non-ill travelers, five (63%) had no acute DENV infection, and one (13%) had indeterminate diagnostic testing; two (25%) non-ill travelers did not provide a specimen. Thus, of 28 travelers, 7 (25%) had an acute DENV infection, 14 (50%) had no acute DENV infection, 2 (7%) had an indeterminate test result, and 5 (18%) did not provide a serum specimen.

Demographic characteristics. Twenty-five (89%) of twenty-eight travelers provided demographic information (Table 1). Fourteen (56%) were male, all were white and non-Hispanic, and the median age was 34 years (range = 11–69 years). All were born in the continental United States. More than one-half had previously traveled outside of the continental United States, including two (8%) with previous travel to Haiti; six (24%) had previously lived in a DENV-endemic country. No travelers reported prior DENV infection. Six (24%) travelers reported having been vaccinated against YFV, and none reported vaccination against JEV.

Prior flavivirus exposure. Seven travelers met the case definition for prior flavivirus exposure (Table 2). Three of these travelers did not have an acute DENV infection, and $PRNT_{90}$ results in paired specimens showed that all three travelers had the highest neutralizing antibody titer against WNV. Among the four travelers with an acute DENV infection and evidence of prior flavivirus exposure, $PRNT_{90}$ results on acute specimens showed the following results: two travelers, including one traveler who reported hospitalization for WNV

TABLE 1

Demographics and travel and vaccination histories of a group of missionary travelers returning from an approximately 1-week trip to Haiti in October of 2010

Characteristic	All travelers* (*N* = 25)	Dengue case† (*N* = 7)	Dengue non-case† (*N* = 14)
Median age in years (range)	34 (11–69)	45 (31–69)	36 (16–68)
Sex (male; *n* [%])	14 (56)	4 (57)	8 (57)
White (non-Hispanic; *n* [%])	25 (100)	7 (100)	14 (100)
United States as country of birth (*n* [%])	25 (100)	7 (100)	14 (100)
Previously lived abroad (*n* [%])	6 (24)	2 (29)	4 (29)
Previously traveled abroad (*n* [%])	16 (64)	5 (71)	9 (64)
History of yellow fever vaccine (*n* [%])	6 (24)	2 (29)	3 (21)
History of Japanese encephalitis vaccine (*n* [%])	0 (0)	0 (0)	0 (0)

* Questionnaires were offered to all 28 travelers; 25 travelers completed the questionnaire.
† All travelers with indeterminate test results or who did not provide a serum specimen for diagnostic testing were excluded.

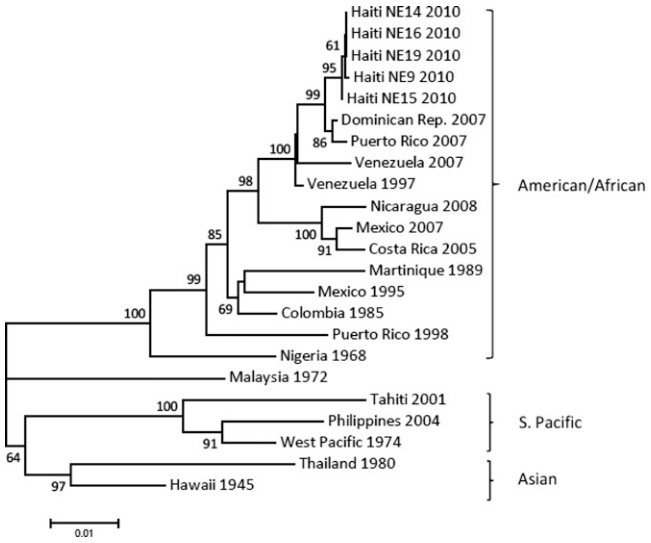

FIGURE 1. Phylogeny of DENV-1 isolated from five missionary travelers that visited Haiti in October of 2010. Each taxon represents a single virus isolate and is labeled with the geographical origin and collection year; an additional specimen identifier is also included in specimens isolated from travelers to Haiti. Eighteen E gene sequences obtained from GenBank were included to support tree topology and identify genotypes. Three major genotypes are marked by brackets: American/African, South Pacific, and Asian. Taxa labels and GenBank accession numbers are available in Supplemental Table 1.

infection in 2003, had the highest neutralizing antibody titer against WNV; one traveler had a low neutralizing antibody titer against DENV-1; and one traveler with a history of YFV vaccination had no detectable neutralizing antibody titer against any DENV or WNV.

Phylogeny of viruses circulating in Haiti. Virus was isolated from five of seven (71%) serum specimens from travelers with acute DENV infection. Sequencing revealed nearly identical (≥ 99.8%) E gene nucleotide (nt) sequence between all five viruses. The closest homologue (≥ 99.3% nt identity) in GenBank was a DENV-1 isolated in 2007 in the Dominican Republic and Puerto Rico. Phylogenetic analysis showed that the isolated viruses share ≥ 96.2% nt identity with the American/African genotype of DENV-1 (Figure 1).

Clinical course. Of the seven travelers with acute DENV infection, all met the 2009 WHO criteria for dengue; none met the criteria for severe dengue.[1] All dengue cases had fever, chills, myalgia/body pain, eye pain, arthralgia/joint pain, anorexia, and weakness. Other signs and symptoms among these seven travelers included headache, rash, nausea/vomiting, lethargy/restlessness, abdominal pain, and hemorrhagic manifestations such as petechiae, purpura, and menorrhagia (Table 3). All had illness onset 3–7 days (median = 4 days) after returning home, and all sought medical care. Five (71%) of seven dengue cases required hospitalization for fluid management and close monitoring of fever, thrombocytopenia, leucopenia, and/or hemorrhagic manifestations. Cases were hospitalized for 3–5 days (median = 3 days) within 3–6 days (median = 5 days) of illness onset; none were admitted to an intensive care

TABLE 2

Diagnostic testing results of 7 missionary travelers who visited Haiti in October of 2010 and had prior flavivirus exposure

Traveler	Prior flavivirus exposure or vaccination reported?	Specimen DPO	rRT-PCR	IgM	IgG titer*	$PRNT_{90}$* DENV-1	DENV-2	DENV-3	DENV-4	WNV
Dengue case										
NE1†	Yes, YFV vaccine	5	DENV-1	ND	640	< 20	< 20	< 20	< 20	< 20
		170	ND	Neg	640	160	160	160	< 20	< 20
NE5†	No	5	DENV-1	ND	640	20	< 20	< 20	< 20	< 20
		163	ND	Neg	10,240	> 640	160	80	40	20
NE16†	No	2	DENV-1	ND	640	< 20	< 20	< 20	< 20	320
		167	ND	Neg	10,240	160	160	160	20	> 640
NE19†	Yes, WNV	4	DENV-1	ND	10,240	< 20	40	< 20	< 20	320
		169	ND	Pos	10,240	160	160	80	40	> 640
Dengue non-case										
NE4	No	4	Neg	Neg	160	< 20	< 20	< 20	< 20	160
		20	ND	Neg	160	< 20	< 20	< 20	< 20	160
NE11	No	NA	Neg	Neg	2,560	< 20	< 20	< 20	< 20	> 640
		NA‡	ND	Neg	2,560	< 20	< 20	< 20	< 20	> 640
NE18	No	NA	Neg	Neg	160	< 20	< 20	< 20	< 20	160
		NA‡	ND	Neg	160	< 20	< 20	< 20	< 20	80

DENV = dengue virus; DPO = day post-onset of symptoms; NA = not applicable because of no report of symptoms of disease; ND = not done; Neg = negative; Pos = positive; $PRNT_{90}$ = 90% plaque reduction neutralization test; rRT-PCR = real-time reverse transcription polymerase chain reaction; WNV = West Nile virus.
* Reciprocal titer.
† Hospitalized.
‡ Second specimen collected ≥ 14 days after first specimen.

TABLE 3

Symptoms reported by 18 missionary travel group members who reported any illness during travel or within 14 days of returning from an approximately 1-week trip to Haiti in October of 2010

Symptom (*n* [%])	Dengue case (*N* = 7)	Dengue non-case (*N* = 9)	Indeterminate or no test result (*N* = 2)
Fever	7 (100)	5 (56)	2 (100)
Chills	7 (100)	2 (22)	1 (50)
Myalgia/body pain	7 (100)	2 (22)	2 (100)
Eye pain	7 (100)	0 (0)	0 (0)
Arthralgia/joint pain	7 (100)	2 (22)	0 (0)
Anorexia	7 (100)	3 (33)	0 (0)
Weakness	7 (100)	4 (44)	1 (50)
Headache	6 (86)	4 (44)	2 (100)
Diarrhea	6 (86)	5 (56)	1 (50)
Rash	5 (71)	0 (0)	0 (0)
Nausea/vomiting	5 (71)	4 (44)	1 (50)
Lethargy/restlessness	4 (57)	2 (22)	0 (0)
Abdominal pain	2 (29)	2 (22)	0 (0)
Petechiae	3 (43)	0 (0)	0 (0)
Purpura	1 (14)	0 (0)	0 (0)
Menorraghia	1 (14)	0 (0)	0 (0)
Epistaxis	0 (0)	0 (0)	1 (50)

unit, and all survived. The five hospitalized cases included the four DENV-infected travelers with evidence of prior flavivirus exposure and one of three DENV-infected travelers without evidence of prior flavivirus exposure.

Behavioral risk factors. An initial questionnaire was completed by 25 (89%) of 28 travelers. Twenty-two (88%) respondents sought pre-travel advice from a healthcare provider, all of whom recalled receiving malaria chemoprophylaxis and/or at least one vaccine (e.g., typhoid; hepatitis A; hepatitis B; poliovirus; tetanus, diphtheria, acellular pertussis; measles, mumps, and rubella; or influenza). Of the 22 travelers, sixteen (73%) recalled receiving information about health risks in Haiti, thirteen (59%) recalled receiving information about mosquito avoidance, and two (9%) recalled receiving information about dengue.

About one-half of travelers who completed the initial questionnaire reported pre-travel knowledge of dengue (Table 4); however, less than one-third of travelers knew about potential dengue exposure while in Haiti. Less than one-half of respondents recalled being bitten by a mosquito while in Haiti, few reportedly used mosquito repellant appropriately, and less than one-half wore long pants on at least one occasion. There was no statistically significant difference between cases and non-cases in pre-travel dengue knowledge or mosquito avoidance practices.

Twenty-three (92%) of twenty-five travelers who completed the initial questionnaire also completed the supplemental questionnaire. All respondents attended at least one of the morning and evening group meetings and participated in at least one of two food drives. Most respondents participated in the twice daily prayer walks on at least one occasion, at least one of the daily religious classes, and at least one of the medical clinic sessions; few participated in one of two soccer tournaments. No statistically significant difference was found in participation in these activities between cases and non-cases.

TABLE 4

Knowledge of dengue and mosquito avoidance practices among a group of missionary travelers* who traveled to Haiti for approximately 1 week in October of 2010

Knowledge and practices	Total† (*N* = 25)	Dengue case (*N* = 7)	Dengue non-case (*N* = 14)	*P* value‡
Pre-travel knowledge (*n* [%])				
Had a pre-travel healthcare visit	22 (88)	7 (100)	12 (86)	0.53
Knew about dengue	14 (56)	3 (43)	7 (50)	> 0.99
Knew dengue is transmitted by mosquitoes	11 (44)	3 (43)	6 (43)	> 0.99
Knew about potential dengue exposure in Haiti	7 (28)	1 (14)	5 (36)	0.61
Mosquito avoidance practices (*n* [%])				
Recalled mosquito bite	11 (44)	2 (29)	8 (57)	0.36
Used repellent multiple times a day	6 (24)	3 (43)	2 (14)	0.28
Wore long pants at least one time	11 (44)	2 (29)	9 (64)	0.18
Wore long sleeves at least one time	3 (12)	2 (29)	1 (7)	0.25
Used mosquito coils	1 (4)	1 (14)	0 (0)	0.33
Used insecticide-treated clothing	0 (0)	0 (0)	0 (0)	–
Used insecticide aerosols	0 (0)	0 (0)	0 (0)	–
Used bed nets	0 (0)	0 (0)	0 (0)	–

*Twenty-five of twenty-eight travelers completed the questionnaire.
†Based on cases, non-cases, and cases with unknown or indeterminate dengue status.
‡*P* values were calculated using Fisher exact test to compare cases and non-cases.

DISCUSSION

This is the third published investigation of a cohort of travelers from the United States returning from the Caribbean with dengue,[31,32] and the first report of dengue in Haiti after the earthquake in January of 2010. Although the group spent only 1 week in Haiti, at least 25% were acutely infected with DENV. This attack rate during short-term travel provides insight into the force of DENV transmission in Haiti and illustrates the need for pre-travel information about dengue and mosquito avoidance strategies for travelers to DENV-endemic areas to include education on dengue risks and prevention strategies.

In addition to living in a house with no window screens and limited use of mosquito avoidance practices, the high attack rate experienced by this group of travelers may be explained by increased dengue activity in the Caribbean in 2010[33] and/or travel to Haiti during peak dengue season[16,34] when vector populations are likely to be high.[35] Moreover, the findings from this report along with documented dengue cases among native Haitians,[16–19] travelers to Haiti,[11–15] and known dengue endemicity in the neighboring Dominican Republic[36–38] indicate that Haitians and travelers to Haiti are at risk for DENV infection.

This report also illustrates recent circulation of DENV-1 in Haiti. All viruses identified by sequencing in this investigation were most closely related to a DENV-1 isolated in 2007 from the Dominican Republic and Puerto Rico, suggesting that the same virus was circulating on Hispaniola between at least 2007 and 2010. Previous studies have shown that DENV disseminates in the region rapidly but not fast enough to avert geographic clustering[39]; therefore, the phylogenetic association between DENV-1 isolates from 2007 and 2010 is highly indicative of local and continuous evolution of this lineage. These observations together contribute to the evidence that suggests

DENV is endemic in Haiti, although consistent surveillance is necessary to definitively make this conclusion.

Although most travelers in this report had a pre-travel healthcare visit, many were unaware of the risk of acquiring dengue in Haiti and similar to previous reports,[31,32] did not use mosquito avoidance practices. Healthcare providers involved in pre-travel consultations should be knowledgeable of dengue risk and prevention communication.[40] Travelers to DENV-endemic areas should be informed that risk of acquiring dengue can be reduced through use of effective mosquito avoidance practices such as the application of repellent and use of repellent-impregnated long-sleeved shirts and pants.[8,9] Additionally, travel coordinators and other persons within the travel industry are in an advantageous position to educate travelers[41] and should remain up to date on destination-specific dengue risks. Information about prevention measures and areas with recent DENV transmission are available in the CDC yellow book (available at wwwnc.cdc.gov/travel/yellowbook/2010) and Dengue Map (available at www.healthmap.org/dengue/index.php).

Persons traveling to or returning from DENV-endemic areas should be advised to seek medical care if they develop a febrile illness during or after travel. Healthcare providers evaluating such travelers should consider dengue in their differential diagnosis and are encouraged to confirm the diagnosis by submitting appropriate specimens for dengue diagnostic testing. Additionally, because dengue is a reportable disease in the United States, suspected and confirmed dengue cases should be promptly reported to public health authorities. Given the existence of competent mosquito vectors within the United States and recent reports of autochthonous DENV transmission in the United States,[4,42] timely public health notifications can facilitate risk assessment for secondary local DENV transmission.

This investigation was subject to at least four limitations. First, because of the timing and in some cases, lack of specimen collection, some dengue cases may have been missed, namely in asymptomatic individuals. Second, one traveler with an acute DENV-1 infection that had a low neutralizing antibody titer against DENV-1 in an acute specimen may have been misclassified as a prior flavivirus exposure; because this individual had no prior travel to a DENV-endemic region, this result may have been due to an early rise in IgG after DENV-1 infection. Third, severity of disease for hospitalized travelers may have been underestimated, because all symptoms of disease may not have been included in hospital discharge summaries used to collect clinical information. Fourth, the time between pre-travel healthcare visits, trip activities, or symptom onset and questionnaire administration may have resulted in recall bias.

This outbreak confirms the risk of dengue among travelers to Haiti, where the disease is likely endemic, and it highlights the need to more effectively educate travelers about dengue. Travelers to DENV-endemic areas should seek pre-travel medical consultation 4–6 weeks before travel and adhere to prevention strategies to avoid mosquito bites while traveling. Healthcare providers, travel coordinators, and pre-travel health information resources should tailor recommendations regarding dengue to travelers using up to date information provided on the aforementioned websites. Healthcare providers caring for febrile travelers returning from DENV-endemic regions should consider dengue in their differential diagnosis, submit specimens for laboratory testing, and report cases to local or state health departments.

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SUPPLEMENTAL TABLE 1
GenBank accession numbers of viruses used in Figure 1

Taxa label	Country	Year	Genotype	Accession number
Haiti NE14 2010	Haiti	2010	American/African	JF969281
Haiti NE16 2010	Haiti	2010	American/African	JF969283
Haiti NE19 2010	Haiti	2010	American/African	JF969284
Haiti NE9 2010	Haiti	2010	American/African	JF969280
Haiti NE15 2010	Haiti	2010	American/African	JF969282
Dominican Rep. 2007	Dominican Republic	2007	American/African	JF804017
Puerto Rico 2007	Puerto Rico	2007	American/African	JF804022
Venezuela 2007	Venezuela	2007	American/African	JF804026
Venezuela 1997	Venezuela	1997	American/African	AF425634
Nicaragua 2008	Nicaragua	2008	American/African	GQ199858
Mexico 2007	Mexico	2007	American/African	JF804019
Costa Rica 2005	Costa Rica	2005	American/African	JF804016
Martinique 1989	Martinique	1989	American/African	JF804018
Mexico 1995	Mexico	1995	American/African	DQ341194
Colombia 1985	Colombia	1985	American/African	AF425616
Puerto Rico 1998	Puerto Rico	1998	American/African	JF804021
Nigeria 1968	Nigeria	1968	American/African	AF425625
Malaysia 1972	Malaysia	1972	Malaysian	AF425622
Tahiti 2001	Tahiti	2001	South Pacific	JF804024
Philippines 2004	Philippines	2004	South Pacific	JF804020
West Pacific 1974	Nauru Island	1974	South Pacific	M23027
Thailand 1980	Thailand	1980	Asian	AF425630
Hawaii 1945	Hawaii, United States	1945	Asian	AF425619