Short Report: Dengue among American Missionaries Returning from Jamaica, 2012

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Abstract. Dengue is an acute febrile illness caused by any of four mosquito-transmitted dengue virus (DENV) types. Dengue is endemic in Jamaica, where an epidemic occurred in 2012. An investigation was conducted by multiple agencies for 66 missionaries traveling from nine US states to Jamaica after 1 missionary from the group was confirmed to have dengue. Travelers were offered diagnostic testing, and a survey was administered to assess knowledge, behaviors, and illness. Of 42 survey respondents, 9 (21%) respondents reported an acute febrile illness during or after travel to Jamaica. Of 15 travelers that provided serum specimens, 4 (27%) travelers had detectable anti-DENV immunoglobulin M antibody, and 1 traveler also had DENV-1 detected by reverse transcriptase polymerase chain reaction. Recent or past infection with a DENV was evident in 93% (13 of 14) missionaries with available sera. No behavioral or demographic factors were significantly associated with DENV infection. This investigation shows that even trips of short duration to endemic areas present a risk of acquiring dengue.

Dengue is an acute febrile illness caused by four mosquito-transmitted dengue virus (DENV) types (1–4) that are endemic throughout the tropics and a leading cause of morbidity among travelers returning from the Caribbean.^{1,2} Dengue is endemic in Jamaica, where an epidemic occurred in 2012.³ The Pan American Health Organization reported DENV-1 to be circulating in Jamaica during this outbreak.³

On August 2, 2012, a woman presented to a Florida emergency department because of an acute febrile illness and was clinically diagnosed with dengue. After being identified by the Electronic Surveillance System for the Early Notification of Community-Based Epidemics–Florida (ESSENCE-FL), a syndromic surveillance system operated by the Florida Department of Health (FDOH), subsequent investigation revealed recent travel to Jamaica.⁴ Dengue diagnostic testing performed at the FDOH detected anti-DENV immunoglobulin M (IgM) antibodies in a serum specimen. After learning that the traveler was part of a larger missionary organization based in Tennessee, the FDOH notified the Centers for Disease Control and Prevention (CDC) and the Tennessee Department of Health (TDH) of the case. With assistance from the CDC, the TDH ascertained that 66 missionaries traveled from nine US states to Old Harbor, Jamaica (49 missionaries from July 13 to 21, 2012 and 17 missionaries from July 21 to 29, 2012) to provide medical services and religious education in the community. The TDH initiated an investigation to describe the clinical and laboratory characteristics of DENV-infected and -uninfected travelers and document travelers' pre-travel knowledge about dengue and mosquito avoidance practices while in Jamaica.

A survey was developed using Survey Monkey (SurveyMonkey Inc., Palo Alto, CA) and distributed to travelers by e-mail from missionary group leaders. Travelers were asked whether they received a pre-travel health consultation and about their pre-travel knowledge of dengue, mosquito avoidance strategies used while in Jamaica, and illness during

or after travel. All travelers were offered diagnostic testing for current or recent DENV infection by reverse transcriptase polymerase chain reaction (RT-PCR)⁵ and anti-DENV IgM enzyme-linked immunosorbent assay (ELISA; InBios International, Inc., Seattle WA), respectively. Serum specimens were tested by multiplex, DENV type-specific, real-time RT-PCR. Microneutralization assays⁶ were performed on all specimens to characterize antibody profiles. Survey data were entered into Microsoft Excel (Microsoft Corp., Redmond, WA) and analyzed using SAS, v.9.3 (SAS Institute, Cary, NC).

Of 66 travelers, 42 (64%) travelers returned the survey, and 15 (23%) travelers submitted a serum specimen for dengue diagnostic testing. All respondents were born in the United States, and most (76%) had previously lived and/or traveled outside of the continental United States. One (2%) respondent reported having been diagnosed with West Nile virus infection before traveling to Jamaica, and another (2%) traveler reported vaccination against yellow fever virus; neither respondent provided a serum specimen.

Nine (21%) respondents reported an acute febrile illness during or after travel to Jamaica. The most frequently reported symptoms were fever and chills (100%) and loss of appetite and weakness (89%). Of 15 travelers who provided serum specimens, 4 (27%) travelers had detectable anti-DENV IgM antibodies (i.e., recent DENV infection), and 1 of those travelers also had DENV-1 detected by RT-PCR (i.e., current DENV infection) (Table 1). All travelers with current or recent DENV infection reported an illness consistent with dengue.⁷ Recent or past infection with DENV was evident in 13 (93%) of 14 missionaries with available sera, including 3 of 7 missionaries with evidence of prior infection with DENV-4 who had only previously traveled to Jamaica.

Ten (24%) of forty-two respondents had a pre-travel health consultation with a healthcare provider. Of these 10 respondents, 1 (10%) respondent reported consultation at a travel clinic, and the other 9 (90%) respondents reported consultation at a private clinic or doctor's office. During the consultation, three (30%) individuals received information about mosquito bite avoidance, and one (10%) individual received information about dengue. While in Jamaica, 17 (40%) of 42 travelers used insect repellent, and 17 (40%) of 42 travelers

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TABLE 1

Diagnostic test results of travelers ($N = 15$) who visited Jamaica in July of 2012 and submitted a serum specimen for dengue diagnostic testing

Traveler no.	Days from return to specimen collection	RT-PCR	IgM ELISA	Microneutralization titers				Overall interpretation	Febrile illness after travel?*	Past travel to dengue-endemic area?
				DENV-1	DENV-2	DENV-3	DENV-4			
1	31	Neg	Neg	< 40	< 40	< 40	160	Past infection with DENV-4	No	Yes
2	6	DENV-1	Neg	> 2,560	> 2,560	> 2,560	1,280	Current infection with DENV-1	Yes	Yes
	19	NP	Pos	> 2,560	320	40	160			
3	25	NP	Pos	> 2,560	640	> 2,560	1,280	Recent DENV infection	Yes	Yes
4	18	Neg	Neg	QNS	QNS	QNS	QNS	UNK	No	Yes
5	UNK	Neg	Neg	160	< 40	160	160	Past DENV infection	UNK	UNK
6	UNK	Neg	Neg	< 40	< 40	1,280	80	Past infection with DENV-3	UNK	UNK
7	UNK	NP	Pos	> 2,560	> 2,560	> 2,560	> 2,560	Recent DENV infection	UNK	UNK
8	UNK	Neg	Neg	< 40	< 40	160	640	Past infection with DENV-4	UNK	UNK
9	37	Neg	Neg	< 40	< 40	160	> 2,560	Past infection with DENV-4	No	Yes
10	37	NP	Neg	< 40	< 40	< 40	160	Past infection with DENV-4	No	Yes
11†	37	Neg	Neg	< 40	< 40	< 40	> 2,560	Past infection with DENV-4	No	No
12	34	Neg	Neg	40	< 40	< 40	> 2,560	Past infection with DENV-4	No	Yes
13	31	Neg	Neg	< 40	< 40	< 40	< 40	None	No	Yes
14	30	NP	Neg	< 40	< 40	< 40	80	Past infection with DENV-4	No	Yes
15	16	Neg	Pos	> 2,560	> 2,560	320	1,280	Recent DENV infection	Yes	Yes

*Fever within 2 weeks of return from travel.

†Traveler likely acquired the infection during the recent trip to Jamaica, because there was no past travel to a dengue-endemic area.

Neg = negative; NP = not performed; Pos = positive; QNS = quantity not sufficient; UNK = missing value.

wore long pants all of the time. Nine (21%) travelers had heard of dengue before the trip. None of these factors were significantly associated with DENV infection.

This is the fourth recent investigation of a cohort of travelers returning from the Caribbean with dengue^{2,8,9} and the first report of travelers returning from Jamaica with dengue. Detection of the initial dengue case was enabled by a syndromic surveillance system that uses statistical modeling and daily downloads from almost 200 statewide emergency and urgent care departments to flag possible cases of diseases with epidemic potential. Subsequent investigation enabled identification of a multistate travel-associated dengue outbreak. Although these travelers spent just 1 week in Jamaica, one-quarter of survey respondents had symptoms consistent with dengue, and more than one-quarter of those respondents who submitted a serum specimen had evidence of acute or recent DENV infection. Several travelers also had evidence of prior DENV infection, likely from previous trips to dengue-endemic areas.

Any travel to dengue-endemic areas presents risk of DENV infection, even trips of short duration. Few respondents in this investigation had a pre-travel healthcare visit or were aware of dengue before the trip, and less than one-half used mosquito repellent while in Jamaica. Less than one-quarter of respondents had heard of dengue, and none acknowledged previous illness caused by dengue. Nonetheless, nearly all travelers that provided a serum specimen had evidence of prior DENV infection, which is a risk factor for severe illness after subsequent infection with DENV.¹⁰ Travelers to dengue-endemic areas, including Jamaica, should be aware of the risk of dengue at their destination, receive dengue education during pre-travel health consultations, follow mosquito avoidance recommendations, and seek medical care for febrile illness during or after travel. Because there is currently no vaccine available to prevent dengue, travelers should be made aware of the importance of reducing mosquito bites as the sole means of dengue prevention during travel to endemic areas. To better prepare for introduction of a dengue vaccine, future studies should identify the types of travelers most at

risk of DENV infection to enable vaccine recommendations based on level of risk.

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