# Information about Dengue Virus:
## Causative agent of Dengue Fever and Dengue Hemorrhagic Fever

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**(Lobo, 2010)**

***Aedes aegypti*, the house mosquito, transmits Dengue virus in the V.I.**

Officials at the Virgin Islands Department of Health have announced that a dengue virus outbreak is currently taking place within the defined area they term the "St. Thomas-St. John district" (V.I. Dept. of Health 2010a). We suggest that this outbreak extends throughout the Virgin Islands, although yet unofficially recognized due to lack of disease incidence reporting.

### All residents of the territory are strongly encouraged to seek *immediate* medical care if they suspect they have been infected with dengue virus.

Dr. Julia Sheen, the Virgin Island's Health Commissioner states, "If you don't seek immediate medical care, Dengue Fever can lead to death" (V.I. Dept. of Health 2010a).

However, we would urge readers to not be overly fearful, just vigilant for yourselves and those around you. Incidence of dengue infection remains low even in the face of this current outbreak. By understanding and responsibly sharing information herein with our community *we can protect ourselves from infection* and *we can limit the spread of dengue virus*!

Here's the critical facts everyone should know:

- ✓ Do not be fearful, only vigilant and conscientious
- ✓ Know the symptoms
- ✓ Go to the doctor if you think you have been infected
- ✓ Protect yourself from mosquito bites
- ✓ Eliminate sites where mosquito larvae can grow

**Symptoms of Dengue Virus Infection**

adapted from CDC 2009a

If you experience any of these symptoms please seek medical attention, which can save your life!

The principal symptoms of dengue are:
-High fever and at least two of the following:

- Severe headache
- Severe eye pain (behind eyes)
- Joint pain
- Muscle and/or bone pain
- Rash
- Mild bleeding manifestation (e.g., nose or gum bleed, petechiae, or easy bruising)
- Low white blood cell count

The following symptoms are indicative of dengue hemorrhagic fever and you should *seek care immediately* if you ignored the principal warning signs and develop any of the following symptoms. The mortality rate of untreated dengue hemorrhagic fever can be as high as 50% (Price and Wilson, 2009). However, if treatment is sought appropriately, the mortality of dengue hemorrhagic fever can be less than 1% (CDC 2009b)

- Severe abdominal pain or persistent vomiting
- Red spots or patches on the skin
- Bleeding from nose or gums
- Vomiting blood
- Black, tarry stools (feces, excrement)
- Drowsiness or irritability
- Pale, cold, or clammy skin
- Difficulty breathing

The risk of developing dengue hemorrhagic fever is increased upon re-infection with alternating subtype of the dengue virus (dengue 1-4). However, *any person,* especially children are at risk for developing dengue hemorrhagic fever as a complication of primary (first) infection with dengue virus (Halstead 1970).

**How to Reduce your Risk of Dengue Infection:**

No vaccine is currently available to prevent infection by any of the dengue virus serotypes, nor are specific medications available to treat an infected patient (CDC 2009c). Therefore, the most effective way to protect yourself from the risk of dengue infection is to avoid getting bitten by *Aedes* mosquitoes.

The best way to reduce mosquito numbers is to reduce available places for female mosquitoes to lay their eggs (CDC 2010c). As discussed below, these often include artificial

containers that hold water in and around your household or workplace. If you must keep containers of fresh water outside your home, recall that the life cycle of *Aedes* takes over one week, and therefore clean water containers like pet and animal watering containers, flower planter dishes at least weekly.

Other water sources that can't be cleaned or exchanged regularly should be covered or treated with a safe, biological larvicide containing *Bacillus thuringiensis* or *Bacillus sphaericus* (available at many V.I. hardware/garden supply retailers) . Commercial preparations contain dormant spores of these bacteria that germinate when ingested by larvae and release insecticidal toxins, but are non-toxic to humans when used correctly according to the manufacturer's instructions (Figure 1) (EPA 2010, Ritchie et al. 2010). Also be mindful to likewise treat, clean, or discard completely any indoor water containers, such as flower vases or indoor plants which are kept in standing water.

(Acosta, 2010)

Figure 1. Representative Commercially Available Biological, "Environmentally Friendly" Mosquito Control Products

To protect yourself against bites of adult mosquitoes, use an effective insect repellent whether you are indoors or out. Effective repellent recommended by CDC and EPA should contain active ingredients DEET (N,N-diethyl-m-toluamide), Picaridin (KBR 3023), or the natural, plant-based oil of lemon eucalyptus (p-menthane 3,8-diol) (CDC 2010d). Also wear long sleeves and full length pants as an added safeguard when practical. Secure indoor areas by confirming that window and doors seal completely or that screens are tightly fit and do not contain holes (CDC 2010c).

As discussed above, risk of transmission increases around individuals who are infected as they are reservoirs from which mosquitoes can acquire the virus. Additional precaution should be taken when a member of your household is infected with dengue to prevent mosquitoes from

transmitting the virus to others in the home. CDC guidelines suggest everyone in the household of a dengue-infected individual sleeps under a mosquito bed net and wears repellent at all times (CDC 2010c).

**Additional Prevention Steps** (V.I. Dept. of Health 2010c)

- Store tires in a dry place
- Place plants that are currently in water, into soil
- Empty indoor and outdoor flowerpots/vases at least once a week
- Keep water barrels tightly sealed
- Cover overflow pipe of cisterns with screen
- Repair or replace damaged screens
- Keep windows and doors without screens closed
- Cover infant cribs with mosquito netting
- Use mosquito repellants according to manufacturer's instructions

V.I. Department of Health urges residents to scour their yards after heavy rains and empty out any containers or reservoirs where water has collected. To report large pools of stagnant water, residents should contact the Environmental Health Division on St. Croix at (340) 773-1311, Ext. 3109 and on St. Thomas at (340) 774-9000, Ext. 4641 or dial 715-5111 (V.I. Dept. of Health 2010c).

**Current Information about the 2010 Dengue Season in the Caribbean**

To date, of 19 suspected cases of dengue virus infection, there have been nine laboratory confirmed cases in the health department's "St. Thomas-St. John district" whereas, in the health department's "St. Croix district", there have been four suspected cases, but laboratory confirmation of these cases is still pending (Table 1) (V.I. Dept. of Health 2010b). Human fatalities of V.I. residents have occurred as a result of dengue virus infection during this outbreak (Blackburn 2010a; Blackburn 2010b; King 2010; ProMED 2010a).

Table 1: Reported Cases of Dengue Fever

*As of September 13, 2010*

| | Suspected | Probable | Lab Positive* |
|---|---|---|---|
| **St. Thomas/St. John** | 19 | 7 | 9 |
| **St. Croix** | 4 | 0 | 0 |

**Dengue Fever case confirmed by laboratory analysis at CDC* (V.I. Dept. of Health 2010b)

Dengue fever and dengue hemorrhagic fever can be the outcome of infection with any of four distinct serotypes of dengue virus, termed dengue 1, dengue 2, dengue 3 and dengue 4 (CDC 2010a). The V.I. Department of Health has collaborated with the Dengue Branch of the U.S. Centers for Disease Control and Prevention (CDC) on Puerto Rico to identify the current cause of infections on the islands of St. Thomas and St. John as dengue 2 (V.I. Dept. of Health 2010a). This is positive news for our population, as dengue 2 was also the cause of 2005 major outbreak in the V.I., and infection with a certain serotype confers immunity to re-infection by that same serotype (Blackburn 2010c).

According to Dr. Eugene Tull, epidemiologist at the V.I. Department of Health, "Physicians who are seeing suspected Dengue cases in their offices…are not reporting the information to the Department of Health, as required by law. This has the effect of making it difficult to effectively confirm the level of transmission of the active Dengue virus" (V.I. Dept. of Health 2010a). Therefore, we urge all V.I. residents who test positive for dengue virus infection to remind their physicians that dengue is a reportable disease (CDC 2010a) and encourage them to forward their case information to the V.I. Department of Health.

Other islands of the Caribbean are also experiencing the toll of this historically severe dengue virus season. Within the first week of September, the Dominican Republic reported that 8839 cases with 41 deaths had occurred so far this year (an increase far beyond 3000 cases and 27 deaths reported occur in the same time span the previous year on that island), and the Ministry of Health on Grenada announced the confirmation of 39 cases of dengue infection amongst its residents (ProMED 2010b).

A report from Puerto Rico on September 11 indicated the worst dengue outbreak in over a decade wherein at least 20 fatalities had already occurred on the island, while 28 cases of dengue hemorrhagic fever were confirmed, and at least 12 more fatalities and 11,600 additional suspected cases were being investigated (ProMED 2010c). Of more immediate concern to the V.I., a summary of a recent Pan American Health Organization (PAHO) Epidemiological Alert noted that the circulating serotypes of dengue virus in Puerto Rico included dengue 1, 2 and 4 (ProMed 2010c).

**Transmission of Dengue Virus**

CDC estimates that over one-third of the world's population currently resides geographical locations where dengue virus is a serious health threat, and that as many as 100 million new infections with this virus occur every year (CDC 2010b). Therefore, infection with dengue virus is one of the major causes of human morbidity and mortality in tropical and subtropical regions worldwide.

Dengue virus is transmitted by the mosquitoes *Aedes aegypti* and *Aedes albopictus*. Although monkeys may also be infected, the primary reservoir during endemic or epidemic dengue virus transmission is man (Van den Enden 2004). Moreover, transovarial transmission (the passing of virus an infected female mosquito to her offspring) also occurs for dengue virus in *Aedes* mosquitoes (Guedes et al. 2010). Therefore, since man and mosquito, not other animal reservoirs, are the only places the virus can occur throughout its transmission cycles, effective protection and prevention strategies (discussed below) are simply to prevent mosquito bites and the growth of the mosquito population.

To understand how the mosquitoes reproduce, it's important to note that these insects have a complex life cycle that includes both terrestrial and aquatic (fresh water) phases (Figure 2) (CDC 2010c).

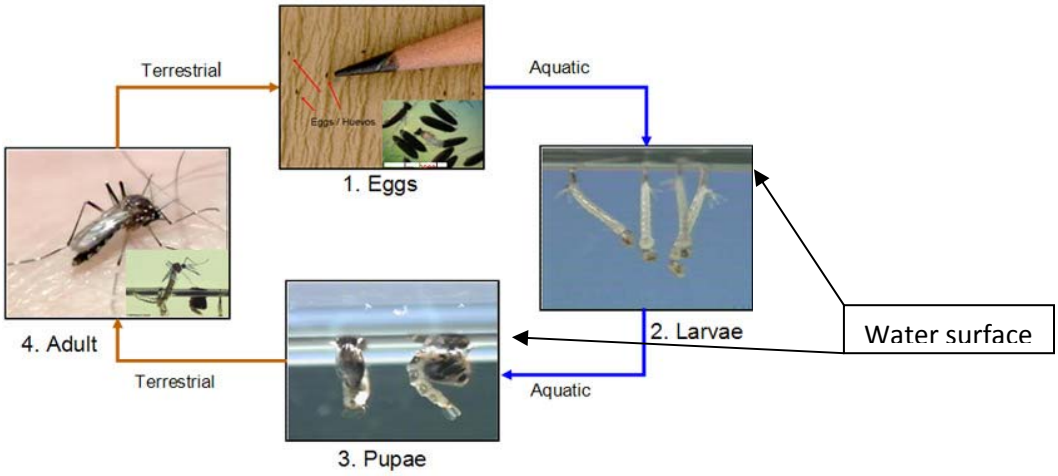


Figure 2. The life cycle of *Aedes* mosquitoes (CDC 2010c)

The adult female mosquito lay up to 200 individual eggs (which may survive desiccated for several months or hatch as quickly as in two days) in man-made containers likely to collect water, such as a discarded tire, flower pot, or unattended pet dish (Blejis 2010, CDC 2010c). When the eggs are rehydrated (following a rainfall, for example) they hatch, releasing the mosquito larvae into the water. The larvae mature, shedding and replacing their skin through four different stages of growth (instars), and remain at the surface of the water to breathe but can also swim below the surface for protection or to seek food such as algae (Blejis 2010, CDC 2010c). Once the larvae have acquired adequate nutrition they halt feeding upon microbes and organic matter, pupate, and undergo metamorphosis, emerging shortly thereafter from the water as fully formed, adult mosquitoes, hungry for a bloodmeal (CDC 2010c). Altogether, it takes just over a week for the entire life cycle of a mosquito (from egg to adult) to be complete (CDC 2010c).

*Aedes aegypti* prefers to feed during the day (WHO 2004). The mosquitoes are most active, seeking bloodmeals, at the cooler parts of the day, from several hours past dawn and again before sunset. During the night and hotter portions of daylight hours, these insects find cool places to rest either indoors in dark confined spaces like closets or under furniture, or outside in well-shaded areas (Blejis 2010). In general, *Aedes* mosquitoes are highly adapted to co-habitating with us in and around our homes. Therefore, be mindful to seek extra protection from repellants or shelter during dawn or dusk, or against mosquitoes in your own home that may be resting below tables/desks waiting for a tasty meal to come along.

To become infected a mosquito must feed on a person during a period of viremia, a stage of the infection wherein large amounts of virions (infectious virus particles) are circulating in the bloodstream, increasing the possibility that they will be ingested by feeding mosquitoes. In a susceptible patient, the onset of symptoms associated with dengue infection usually occurs 4 - 7 days following the bite of an infected mosquito (CDC 2010b). In a characteristic dengue virus infection, this period of viremia often occurs just prior to the onset of symptoms (CDC 2010b). Interestingly, some people who are infected never experience significant symptoms but can act as reservoirs for the virus by being a source for infection of mosquitoes. After being ingested by

the mosquito along with its blood meal, dengue virus has an incubation period ranging from 8-12 days before the mosquito can transmit it to another susceptible human host (CDC 2010b).

Dr. Tull explains this phenomenon clearly, "Dengue is usually contracted inside of the home…If you are ill and the mosquito bites you and that same mosquito bites me several days later, the virus may be transmitted…On average, it takes about a week before an infected mosquito can transmit the virus when it bites another person" (V.I. Dept. of Health, 2010a).

**Treatment**

There are no specific medications for treatment of dengue fever or dengue hemorrhagic fever. CDC suggests that infected persons can use pain reliever containing acetaminophen, but to avoid those containing ibuprofen, Naproxen, or aspirin (CDC 2009a).

Most important is to visit a physician as soon as symptoms appear for a blood cell count that may predict the development of hemorrhagic fever before the onset of severe symptoms. When such a clinical diagnosis is determined early in the infection, dengue hemorrhagic fever can be effectively managed through supportive therapies including fluid replacement and platelet transfusion (CDC 2009a, Thomas 2009)

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