Dengue Fever/Dengue Haemorrhagic Fever

Pre-decision Brief for Public Health Action

Haiti ■ Feb 2010

Key recommendations

- Dengue and its primary mosquito vector are present in Haiti. Mosquito breeding is favored by storage of water for consumption and deterioration of infrastructure. Providing access to safe drinking water, covering water containers, eliminating mosquito breeding sites, and large-scale environmental cleanup in destroyed areas of the city all contribute to effective control of mosquito breeding. Standing water facilitates the breeding of other species of mosquitoes (e.g., *Culex* species, the vectors of West Nile virus) as well as the mosquito vector of dengue *(Aedes aegypti)*; thus, appropriate disposal of storm and waste water is important.
- An increased number of cases of febrile illness with laboratory confirmation of dengue should trigger public health action.
- Building Haitian lab capacity and engaging reference labs early are important in order to facilitate and enable laboratory confirmation.
- A vigorous public information campaign should provide recommendations for eliminating mosquito breeding sites to prevent dengue transmission in the community and within civilian/military rescue workers and troops.

1. What was the situation in Haiti prior to the earthquake?

- The primary mosquito vector of dengue *(Aedes aegypti)* is present in Haiti.[1]
- Dengue was first confirmed in Haiti in 1964, but there has not been national surveillance of dengue.
- A 1996 study of 215 children in Port-au-Prince showed that 85% had been previously infected with one or two dengue virus serotypes; the annual rate of infection in this group was estimated to be 30%.[2] IgG antibody seroprevalence of 68% was reported in some parts of Haiti in 2004.[3]
- Investigations during prior foreign military operations found minimal numbers of symptomatic community cases or hospitalizations, while severe cases were reported among foreign military and foreign civilian personnel in Haiti. It is unclear if this difference is due to surveillance artifact or true difference in susceptibility.
- Attack rates in foreign soldiers, including cases of dengue hemorrhagic fever (DHF) were as high as 10–15%. Transmission stopped after aerial and ground spraying, and with the use of larvicides, insect repellents such as N,N-diethyl-meta-toluamide (DEET), and permethrin-impregnated clothing.
- Haiti's diagnostic lab staff members have been ~~are~~ trained for serological testing (by CDC in 2008). However, there is limited intensive care and clinical lab capacity, which limits the ability to manage severe cases effectively.
- A dengue prevention plan was developed with PAHO-WHO last year, with the intent to implement in 2010.

2. What is the likelihood of cases/outbreaks of this disease developing in the near future?

- All four dengue virus serotypes have been documented in recent years in Haiti; only one or two usually circulate at a given time.[2–5] Infection with any one dengue serotype confers lifelong immunity against that serotype only, and can predispose patients to severe disease in subsequent infection by different serotypes. Substantial population susceptibility to infection will exist, and thus outbreaks are likely to occur.
- The population is largely unprotected against mosquito bite. Infrastructure destruction encourages water storage. Further, once the rainy season starts (typically between March and May), every fallen building will harbor mosquito breeding sites. These circumstances will likely sustain transmission.

3. Should an outbreak occur, how would it be detected?

- Surveillance teams should collect daily case counts of acute febrile illness at sentinel sites and camps, and among military and civilian rescue workers.
- Dengue fever should be considered in the differential diagnosis for acute febrile illness. Testing for dengue virus should be undertaken for suspected severe dengue cases (i.e., DHF or dengue shock syndrome [DSS]) and for patients involved in outbreaks of acute febrile illness consistent with dengue fever. Because they may have increased access to care, foreign rescue workers and troops may provide the first indication of an outbreak; if previously infected, they may be at risk for severe dengue.* Fever, retro-orbital pain, joint pain, and rash are common symptoms of dengue fever. Abdominal pain or tenderness, persistent vomiting, change in mental status, hypotension, hemorrhagic signs, evidence of increased vascular permeability, and increasing hematocrit with low platelet count are consistent with DHF and/or DSS.
- Serum samples collected during the first five days of symptoms are likely to allow positive virus detection. Commercial enzyme immunoassay (EIA) and NS1-antigen tests can be performed in the National Public Health Laboratory (LNSP). Serum samples with positive NS1, and negative samples from cases of apparent severe dengue, should be shipped to a reference laboratory (e.g., CDC lab in San Juan) for testing with highly sensitive, real-time polymerase chain reaction (RT-PCR) or EIA in order to document circulating dengue virus serotypes and to exclude other flavivirus infections (e.g., West Nile). If refrigeration is limited, serum samples can be transferred to filter paper for transport. Other regional laboratories can also provide support (e.g., Instituto Evandro Chagas in Brazil or Institut Pasteur in French Guyana).

4. What options for public health action should be considered in the event of an outbreak?

- **Environmental Clean-up and Education:** The most effective action to prevent dengue transmission would be environmental clean-up and removal of potential *mosquito* breeding sites. Attempts to implement large-scale insecticide-based mosquito control measures (including larvicide) may not be very effective because of the destruction and rebuilding of homes, and the large number of temporary living shelters. Education of the local Haitian population, as well as foreign relief workers and military personnel, on dengue transmission and personal protective measures is important. Widespread use of DEET-based mosquito repellent and permethrin to coat clothing or tents may help prevent transmission in areas of suspected outbreaks.
- **Clinical Management:** Response to severe illness will require rapid and meticulous management of intravenous fluids; capacity to monitor hourly vital signs, fluid intake/output, and basic laboratory measures (including hematocrit, white blood cell differential, and platelet counts); and capacity safely to transfuse cases with acute massive hemorrhage.
- **Vector control:** Effective vector control will depend on epidemiological findings and capacity to identify the area of transmission or outbreaks. Control activities may need to be locally targeted. For example, displaced person camps will most likely have unique vector (and dengue virus) population dynamics. After identification of mosquito breeding sites, focal adult and larval vector control should be conducted with backpack and/or mist sprayers using insecticides and appropriate personal protection equipment. Water storage containers should be covered, emptied of water, or removed. Containers that cannot be removed should be treated with a larvicide.

References

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* A case of dengue fever involving a Florida resident who returned from Haiti on January 23, 2010, with dengue symptoms has been laboratory-confirmed. The patient worked for a charity organization in Port-au-Prince and gave a history of having to sleep outside following the earthquake.

Appendix A—Example of Requirements for Dengue Surveillance

Staffing needs:

51– Technicians to collect serum samples and prepare them for delivery to reference laboratory

TBD – Couriers to transport serum samples from the sentinel surveillance sites to the reference laboratory (to be determined by initial assessments)

51– Record Reviewers (reviews charts at sentinel sites and fill out the form, email /fax)

10 – Data Coordinators (track reporting from hospitals, evaluate forms for completeness/quality of data and transmit to the National Public Health Laboratory (*LNSP*) or, if necessary, to CDC in PR/Atlanta from work station at CDC PEPFAR in Port-au-Prince)

1 – Surveillance Coordinator (coordinates all surveillance efforts, writes reports, analyzes data, reports trends to the Ministry of Health (MOH) and other stakeholders from CDC PEPFAR Office in Port-au-Prince).

Appendix B—Example of Laboratory staffing requirements

Staffing needs for this laboratory include:

2 – Serology Support staff

1 – Lead Serologist

Appendix C- Example of Requirements for entomologic response

Staffing needs

100 – Field Staff

10 – Entomology Site Coordinators (supervise field staff, conduct surveillance, organize and lead efforts to eliminate breeding sites and reduce adult mosquitoes, record activities and report to Port-au-Prince)

1 – Senior Entomologist (coordinates all efforts, writes reports, analyzes data, reports trends to MOH and other key stakeholders from office at CDC PEPFAR Office in Port-au-Prince)

Entomology supply needs:

- Mechanical aspirators with collection cups, batteries and chargers
- Pyrethrum insecticide and collection cloths
- Tube aspirators, flash lights and collection cups
- Larval dippers, squeeze bulb syringes, collection vials and alcohol
- Oviposition cups and papers
- Dissection microscopes with lights and keys for regional mosquito vectors
- CDC Bottle resistance assay kit
- Insecticides, application and personal protection equipment