



**Commonwealth of Massachusetts**  
STATE RECLAMATION AND MOSQUITO CONTROL BOARD



**NORTHEAST MASSACHUSETTS MOSQUITO CONTROL  
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## ***2015 Vector Management Plan***

The **2015 Vector Management Plan** will focus almost exclusively on the exotic mosquito-borne virus that appeared in the United States in 2014, Chikungunya. Its potential to spread into Massachusetts and infect residents, as well as how we will respond to this new threat will also be discussed. All other aspects of the 2014 VMP remain in place; the reader is recommended to review this document available at the Northeast Massachusetts Mosquito Control District website ([www.northeastmassmosquito.com](http://www.northeastmassmosquito.com)). For information on arbovirus detections and infections last year in your community and throughout the rest of the Northeast MA Mosquito Control District, the reader is recommended to review the “**Overall Mosquito & Arbovirus Surveillance Summary**” of your municipality’s **2015 Best Management Plan (BMP)** that accompanies this document.

For anyone active in vector-borne public health, the spread of Chikungunya in the western hemisphere in 2014 was not a surprise. District Boards of Health officials have been warned annually of this probability beginning with the 2008 VMP. And while its establishment in Massachusetts seems remote at this time for reasons discussed below, it is worth reviewing from where this virus came, how it spreads, and how infected patients are affected.

Chikungunya virus (abbreviated as **CHIKV**) was discovered in Tanzania in 1952. It is a “human-infecting virus” in the sense that people are the principal hosts of this virus. West Nile and Eastern Equine Encephalitis viruses, on the other hand are “bird viruses” with humans as accidental hosts. CHIKV is transmitted from person-to-person by specific types or “species” of mosquitoes highly attracted to human blood. This virus does not spread directly from person to person. After CHIKV infects a person, the onset of illness occurs usually between 3 and 7 days, but can range from 2 to 12 days. During the infection, the virus is reproducing in the patient, increasing its numbers astronomically in the bloodstream. The blood becomes so abundant with virus particles that when an uninfected mosquito takes a bloodmeal from this person, enough virus particles have been consumed by the next mosquito and it will soon become infected.

The word “Chikungunya” comes from the African Makonde language which means “bent over in pain.” Chikungunya has nothing to do with chickens! Chikungunya causes high fever, severe joint and muscle pain, headache, fatigue, and rash lasting a week or more for most patients. Chikungunya does not often result in death, but the joint pain may last for months or years resulting in a chronic disability. Serious complications are not common, but in older people, children and pregnant women the disease can get worse. There is no specific treatment for chikungunya infection, nor any vaccine to prevent it. Pending

the development of a new vaccine, the only effective means of prevention is to protect against mosquito bites.

Since 2004, Chikungunya virus has caused massive and sustained outbreaks in Asia and Africa, infecting more than 2 million people, with attack rates as high as 68% in some areas. This situation has put a sudden and heavy burden on health services, especially in poorer countries. Then, in December 2013, for reasons totally unknown, locally-acquired infections (i.e., infections in people with no history of travel) by this virus began to appear in several islands of the eastern Caribbean. The virus then spread rapidly, first through the Caribbean then into Central and South America, and eventually into North America. The appearance of CHIKV outside the tropics was not unexpected. The first non-tropic outbreak was in northern Italy in September of 2007, infecting well over 200 people.

As of January 13, 2015, a total of 2,344 Chikungunya virus disease cases have been reported to ArboNET from United States in 2014. 7% of all U.S. cases have been reported from Massachusetts. Massachusetts ranks fourth nationwide with number of cases after New York, Florida, and New Jersey. The large number of Massachusetts cases is a reflection of this state's large Dominican community in which many residents travel to and from the Dominican Republic. This Caribbean nation, with over a half-million infections in 2014 alone, currently has the greatest number by far, of CHIKV cases in the Western Hemisphere. But the most important point here is that all these cases were in people who traveled to the Dominican Republic and got infected while visiting there; none have been infected in Massachusetts.

There have been eleven locally-transmitted cases reported from Florida. These infections occurred in people who did not travel anywhere outside the U.S. This means that these people were infected through bites of local mosquitoes, which also means that the mosquitoes acquired the virus from biting an infected person. Once the virus begins "cycling" from local mosquitoes to residents to mosquitoes, it is a very good chance that the virus will become "established" in the community where the mosquitoes are found. At this point, the virus may be extremely difficult to eliminate from the community and the virus may then work its way through the human population until most people have become infected.

There are only two species of mosquitoes in the United States currently with the capacity to transmit the CHIKV, the "Yellow Fever mosquito" *Aedes aegypti* and the "Asian Tiger mosquito" *Aë. albopictus*. Both species are human biters to the extent that they depend almost exclusively on human blood for their reproduction. Any human-biting mosquito can acquire the virus from an infected individual however, in most mosquito species, the virus cannot complete its development. Therefore, the vast majority of mosquito species can never pass on the virus and cause disease to anyone. Only the two aforementioned species have the ability (i.e., "vector capacity") to allow the virus to develop inside its adults to the extent that virus particles are already in the salivary glands ready to be injected into the next host when that mosquito bites again.

The Yellow Fever mosquito is not found in Massachusetts. Its eggs cannot survive the winter. It has been established in the southeast U.S. since colonial times, but has never been found actively breeding north of Maryland and Delaware. On the other hand, the Asian Tiger mosquito (hereafter, ATM) having first appeared in the U.S. in Houston Texas in 1986, has been spreading northward into New England. It has been repeatedly found in Bristol County in recent years and is a cause of serious concern in Massachusetts. However, it has yet to have become endemic (i.e., permanently "established") in the state.

The regular appearances of the ATM in Massachusetts are due to the constant introduction of its eggs through imported used tires. In areas where this species is abundant, it will lay its eggs in any sort of water-filled containers including used water-filled tires stored outdoors. The tires are then brought into Massachusetts and are stored outdoors and will eventually fill with water after the next rain. The eggs,

plastered onto the inside walls of the tires, survive the prolonged dry spells and of being transported, and hatch when tires fill with water. The Massachusetts winters have so far been too cold for ATM eggs laid in the fall to survive and hatch the following spring. The concern is that sooner or later, there will be eggs that will have adapted to our winters and this will allow this species to rapidly populate and become established in the state.

The ATM is an aggressive daytime-active human-biting mosquito. Not only can it effectively harbor and transmit CHIKV, but it can also transmit another serious human-debilitating illness, Dengue. Dengue, also caused by a series of viruses, is the most widespread mosquito-borne viral illness in the Western Hemisphere!

However, if ATM becomes established in Massachusetts, the probability of it becoming a vector of CHIKV remains remote. This is because the strain of CHIKV currently circulating in the Americas appears to have its origin in Asia rather than in Africa. And the ATM does not transmit the Asian form of CHIKV as effectively as does the Yellow fever mosquito. There is always the possibility of a mutation in the virus that would allow it to become infective to the ATM, which is what happened that resulted in the Northern Italian outbreak in 2007.

So what is currently being done to monitor the spread of ATM and CHIKV? The Massachusetts Department of Public Health has been keeping track of potential ATM in various locations throughout the state. Any ATM collected is tested for virus, including CHIKV. In our District's regular surveillance, the presence of ATM has not been confirmed; specimens collected in Merrimac in 2008 were suspected of being ATM, but no other specimens have been collected even with the use of specialized ATM traps. If the ATM is collected anywhere in the District, surveillance will be intensified in the area where collections were made to determine where they are breeding. Attempts will be made to terminate breeding by a combination of "source reduction" (eliminating containers where ATM larvae are developing), larviciding (applying larval-killing agents to permanent water-holding structures), and if necessary adulticiding (applying chemical to kill active adults before they lay eggs). Any captured ATM adults will be sent to Massachusetts DPH for testing to determine if they are infected with viral agents.

For further information on Chikungunya, please review the web pages below from the U.S. Centers for Disease Control and the Pan American Health Organization, as well as the references listed at the end of the 2014 District VMP.

<http://www.cdc.gov/chikungunya/geo/united-states.html>

[http://www.paho.org/hq/index.php?option=com\\_topics&view=article&id=343&Itemid=40931](http://www.paho.org/hq/index.php?option=com_topics&view=article&id=343&Itemid=40931)

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